Narrow Water Bridge Project
ENVIRONMENTAL IMPACT STATEMENT



VOLUME 2 - TEXT

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NARROW WATER BRIDGE PROJECT

ENVIRONMENTAL IMPACT STATEMENT / ENVIRONMENTAL STATEMENT

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Acknowledgements

Detailed reports from specialists are available for review in the offices of Louth County Council, County Hall, Millennium Centre, Dundalk as are the Constraints Study Report, the Route Selection Report, the Bridge Feasibility Report and the Preliminary Design Report which were prepared during the design process.

This Environmental Statement has been prepared by a team consisting of the following members:

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Environmental Impact Statement Authors, Scheme Design and Team Leaders.

Biosphere Environmental Services

Impacts on Terrestrial Ecology and Ornithology

Archaeological Development Services Ltd

Impact on Architectural, Archaeological and Cultural Heritage

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Landscape and Visual Impact

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Air Quality

AOS Planning Ltd

Socio-economic impacts

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Agronomy Study

Aquafact International

Hydrodynamic Modelling and Aquatic Ecology

TABLE OF CONTENTS – VOLUME 1

Non Technical Summary of the Environmental Statement

Part I
Background Information and General Description

Part II
Significant Environmental Effects & Proposed Ameliorative Measures

Non-Technical Summary

Narrow Water Bridge

Non-Technical Summary of the Environmental Impact Statement / Environmental Statement

TABLE OF CONTENTS

Part I
Background Information and General Description

1.0 INTRODUCTION

This Environmental Impact Statement/ Environmental Statement (EIS/ES) is for the proposed Narrow Water Bridge Project and has been prepared by Roughan & O'Donovan Consulting Engineers, on the instruction of Louth County Council in association with Newry and Mourne District Council (NMDC).

At present there is no direct link between the Cooley Peninsula in County Louth and the "Kingdom of Mourne" in County Down and no connection between the northern and southern shores of Carlingford Lough. Instead, to gain access around the Lough all vehicular traffic must cross the Newry River in Newry City. This involves a considerable journey away from the Lough and its environs and diverts traffic from the Carlingford area and toward the motorway system connecting Dublin and Belfast.

2.0 BACKGROUND TO THE PROPOSED DEVELOPMENT

Louth County Council, in the Louth County Development Plan 2009 – 2015, identified that linking the Cooley Peninsula and the Mourne District would unlock the tourist and leisure potential of the Carlingford Lough area.

The Development Plan supports the Narrow Water Bridge under Tourism policy TOU 6: "*To co-operate with the authorities in Northern Ireland in the provision of a road bridge between Cooley and south County Down."*

The following further explanation is provided:

"The provision of a road link through the construction of a bridge between the Cooley Peninsula in County Louth and the southern portion of the Mourne Mountains in County Down at Narrow Water would make a valuable contribution to the development of tourism in Louth and the Mournes."

The proposed Narrow Water Bridge aims to create a new cross border connection between the Republic of Ireland and Northern Ireland across the Newry River to the north of Carlingford Lough. It is intended that the proposed bridge will link the R173 Omeath to Newry Road in Co. Louth with the A2 Newry to Warrenpoint Road in Co. Down. The primary objectives of providing the Narrow Water Bridge are:

- Assist the social and economic development of the area;
- Facilitate access to the scenic beauty of Carlingford Lough;
- Enhance the tourist potential of the region;
- Improve the leisure potential of the region;
- Promote interaction between communities north and south of the border;
- Encourage pedestrian and cyclist activity.

3.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT

3.1 Location

The proposed Narrow Water Bridge will cross the Newry River approximately 400m south of the Narrow Water Keep (**see Figure 3.1** in Volume 3). The bridge, which will connect the R173 Omeath Road south of Ferry Hill and the A2 dual carriageway at the existing roundabout, is situated approximately 1km and 2km northwest of Warrenpoint and Omeath, respectively. The bridge will pass close to the beacon near the southern shoreline.

The site is situated between the steep Cooley Mountains to the south and the drumlins of Down to the north. The Newry River flows through this valley before widening to form Carlingford Lough. The shoreline is flanked by roads on both sides and a former rail line occurs along the southern shore. In the immediate vicinity of Narrow Water the countryside pattern is of small fields bounded by hedgerows.

3.2 Proposed Scheme

Overview

The scheme will provide a new single carriageway link between Omeath and Warrenpoint. The proposed 6m wide carriageway will connect the R173 and the A2 dual carriageway across the Newry River at Narrow Water. A new roundabout will be constructed at the junction with the R173 Omeath Road and the existing A2 roundabout will be upgraded to accommodate the required additional arm. The total length of the scheme, including the required bridge crossing, is approximately 660m.

Cable-Stayed Bridge with Opening Span

The proposed structure is illustrated on **Figures 3.4 – 3.10** in Volume 3 and will comprise a cable-stayed bridge with a rolling bascule opening span. The structure is supported by asymmetric back-ward inclined towers, with the higher (86m) tower located on the southern side of the crossing. The lower (33m) twin towers on the northern side operate the rolling bascule opening span. The cable-stayed span is supported by a double plane of cable-stays which are anchored to an inclined vertical tower.

Plate 3.1 Photomontage of Proposed Narrow Water Bridge

The superstructure is primarily constructed from stiffened steel plates whereas the abutments at either end consist of reinforced concrete. The tower will be constructed from structural steel, consisting of an outer and inner steel skin which will be infilled with concrete. The cable-stays are small diameter stays comprised of parallel wires with multiple layers of corrosion protection.

The bridge design was influenced by the requirement to allow continued navigation along the Newry River and the need to minimise the impacts on this sensitive receiving environment. The construction methodology of the cable-stayed bridge allows minimal interference with the in-river environment with slim supporting piers required at only one location and the bridge can completed in component sections from the foreshore embankments (**see Figures 11.2 – 11.7** in Volume 3).

Navigation Beacon

The proposed bridge will interfere with the navigational beacon situated near Ferry Hill and therefore, the operation of the leading lights. Therefore, it is proposed to construct a new navigational beacon on the downstream of the proposed bridge as shown in **Figure 3.15** in Volume 3. The new navigational beacon shall mimic the existing masonry navigational beacons in shape, dimension, colour and surface finish however the requirements of Warrenpoint Harbour authority and Carlingford Loughs Commission will be adhered to in the construction and finishing of the proposed beacon.

Control Building

A control building is required to facilitate the opening of the bridge. It is preferable that the operators in the control building shall have a clear unobstructed view to the bridge and along the river. Therefore, the proposed control building is located at the edge of the river on the north side approximately 200m from the bridge as shown in **Figures 3.16 to 3.20** in Volume 3.

The proposed control building is approximately 9.7m long and 7.4m wide single storey rectangular structure with a pitched roof. The wall nearest the river will be curved and contain a large bay window that will permit the bridge operators a clear unobstructed view of the river.

Pedestrian and Cyclist Facilities

The proposed Narrow Water Bridge includes for the provision of a combined cycle / footway between the proposed Cornamucklagh Roundabout on the R173 and the A2 roundabout. Both the Cooley Peninsula and the Mourne Mountains are popular among hill walkers and cyclists, therefore, it is important that the Narrow Water Bridge should cater for pedestrians and cyclists.

4.0 ALTERNATIVES CONSIDERED

As part of the development of the Narrow Bridge Project the scheme has gone through a number of development stages:

- Identification of Study Area;
- Identification of Constraints;
- Route Selection;
- Hydrodynamic Modelling;
- Bridge Design Options Appraisal and;
- Bridge Preliminary Design Report.

4.1 Identification of Study Area

In the recent past three studies have been carried out to determine whether a bridge or car ferry link between the Cooley Peninsula and the Mourne District was feasible. These studies are:

- 'Omeath to Warrenpoint, Feasibility Study', 1979, Nicolas O'Dwyer and Partners;
- 'Carlingford Lough-Ferry Feasibility Study', 1993, Jonathan Blackwell and Associates; and
- 'Omeath – Warrenpoint Road Link, Feasibility Study', 2001, M C O'Sullivan and Co. Ltd (now RPS Consulting Engineers).

The 1979 and 2001 studies determined that a bridge crossing located within the vicinity of the A2 roundabout was viable. The study area for the current project was subsequently developed based on the environmental, engineering and economic constraints previously identified and incorporating the crossing point already identified by previous studies as being viable.

The study area for the proposed bridge is indicated on **Figure 2.1** in Volume 3.

4.2 Route Selection

Three initial routes (**Figure 4.1** in Volume 3) were developed based on site visits and information recorded in the constraints study. The route options examined were as follows:

- Route Option A: Southern Corridor (connects to A2 roundabout);

- Route Option B: Central Corridor (connects to A2 50m north of Narrow Water Keep);
- Route Option C: Northern Corridor (connects to A2 600m and 1km north of the Narrow Water Keep and the existing A2 roundabout, respectively.

Each of these three route options was assessed on the basis of environmental impacts, engineering requirements and economic grounds. Route Option A was subsequently ranked highest and most favourable of the three options (detailed information available in the Route Selection Report).

4.3 Bridge Design Options

Three design options were considered:

- Design Option 1 – Multi-span Bridge with Bascule Opening Span
- Design Option 2 – Multi-span Bridge with Twin Swing Opening Span
- Design Option 3 – Cable-stayed Bridge with Rolling Bascule Opening Span

Hydrodynamics and Marine Modelling

Early consultations with the Loughs Agency and Warrenpoint Harbour Authority highlighted the importance of minimising the release of sediment during both the construction and operation of the bridge.

As a consequence of these significant concerns, AQUAFACT International Services Ltd. were commissioned to develop a computer model to assess the hydrodynamics of Newry River Estuary and to assess the effects of a proposed bridge on the water circulation patterns of the estuary. This detailed hydrodynamic assessment concluded that cable-stayed option would have minimal impact on water circulation patterns and therefore sediment release.

Bridge Design Option Selection

In addition to undertaking the hydrodynamic modelling exercise, the three feasible bridge design options were evaluated against the various engineering, environmental and economic issues. The Bridge Feasibility Report was completed in November 2008 and reviews each option against all environmental, engineering and economic issues identified. The parameters which were identified as the key environmental factors influencing the design choice were:

- Archaeology and cultural heritage;
- Aquatic Environment;
- Terrestrial Ecology;
- Socio-economic impact; and
- Landscape and visual amenity.

Each parameter was weighted and the bridge designs were subsequently assessed and scored in an assessment matrix. This process identified the preferred bridge option when weighed against the above factors as being Option 3 – the Cable-Stayed Option with Bascule Opening Span. The factors which weighted the decision in favour of Option 3 were the minimal impact this option will have on the aquatic environment and the archaeological and cultural heritage.

5.0 TRAFFIC AND TRANSPORT IMPACTS

The proposed Narrow Water Bridge will significantly improve connectivity between the Cooley peninsula and the Mourne District, thus enhancing the tourist potential of the region. The primary finding of the traffic assessment concludes that the bridge and link road will be able to accommodate the predicted traffic levels. Other highlighted findings include:

- The proposed bypass is forecast to carry a design year traffic flow of between 1,036 and 3,767 AADT in 2033.
- The provision of a link results in an 18 minute journey time saving for traffic travelling between Omeath and Warrenpoint.
- It is expected that the road geometry will discourage HGVs from crossing the Narrow Water Bridge. The HGV traffic, which is likely to use the crossing, will result in a minimal increase of HGV traffic on the A2 dual carriageway.
- A 6.0m wide carriageway is the most suitable road type for the Narrow Water Bridge.
- The opening operation is estimated to take 20 minutes to complete.
- On the south side, queues can be accommodated between the wig wag signals and the Cornamucklagh Roundabout.
- On the north side, queues can be accommodated on the approaches to the A2 roundabout without blocking any accesses with the appropriate traffic management.
- On the north side, queues can be accommodated on the approaches to the A2 roundabout without blocking any accesses with a slight modification to the A2 roundabout southern approach and the appropriate traffic management
- In the unlikely event of a RORO ship arriving when the bridge is opening during the morning peak hour, the bridge shall not be opened until the ship is unloaded or peak hour traffic has dissipated. This procedure should be included in the Environmental Operating Plan.
- The segregated and combined pedestrian and cyclist facilities along the bridge and approaches provide a safe environment pedestrians and cyclists to utilise.
- The Narrow Water Bridge is beneficial as it improves road safety in the vicinity of the crossing;
- The peak truck traffic during the construction period is estimated to amount to 20 truck movements per day during the first 4 months of the construction period, and to then drop to 10 truck movements per day for the following 20 months.
- Construction near or adjacent the navigational channel shall be highlighted to approaching vessels.
- The navigational channel shall be closed during the installation of this opening span.
- An Environmental Operating Plan, which will include a Traffic Management Plan, will be put in place by the contractor during the construction phase of the scheme with regard to the NRA Guidelines for the Creation and Maintenance of an Environmental Operating Plan (2007). This EOP will include a Traffic Management Plan.

Part II
Significant Environmental Effects and Proposed Ameliorative Measures

6.0 SOCIO-ECONOMIC IMPACTS

This section examines the effects of the proposed development on human beings that are adjacent to, and are affected by, the proposed project; in particular focusing on socio-economic issues including land-use, population, economic activity, agriculture, tourism and residential amenity.

It is considered that the bridge will have a positive impact on tourism and economic activity, with the proposed signature structure having the potential to become an attraction and a landmark in its own right. The provision of footpaths and cycle lanes will enhance this experience for bridge users.

The project is also considered as having no negative community impacts. During the construction phase there will be a low level of nuisance and disruption, but due to the bridge design and construction method this will be minimal and temporary. In fact the enhanced community connectivity delivered by the project, through vehicular, bicycle and pedestrian access, will have a significant positive impact and will strengthen local community identity.

7.0 THE NATURAL ENVIRONMENT

7.1 General

The issues that are assessed in this chapter of the Environmental Statement are as follows:

- Terrestrial Ecology;
- Marine Modelling and Aquatic Ecology;
- Noise and Vibration;
- Air Quality and Climate; and
- Soils, Geology and Hydrogeology.

7.2 Terrestrial Ecology

The ecological impact assessment identified that the proposed road and bridge at Narrow Water is in an area of high nature conservation value. The area of foreshore is a candidate Special Area of Conservation in County Louth and an Area of Special Scientific Interest in County Down (refer **Figure 7.1** in EIS Volume 3). Carlingford Lough Special Protection Area, which is designated specifically for birds, also occurs further up the lough. A Natura Impact Statement completed for the project finds that there is no impact on the features or integrity of these designated sites.

A number of detailed surveys were undertaken to record the habitats, bird usage and mammal presence. The primary potential impacts highlighted by the study include minor loss of poor quality saltmarsh habitat on the Omeath foreshore the temporary loss of a high tide waterbird roost site on the Omeath foreshore and the potential for avian collision against the bridge cables.

A comprehensive range of measures to avoid or reduce these potential impacts are proposed. These include measures to protect and re-establish salt-marsh vegetation, creation of a high tide bird roost slightly downstream from the development and up-lighting the bridge at night to prevent bird strike. Mitigation measures are also proposed to minimise any potential impact on badgers and bats which use the area. In addition, a project ecologist will be appointed to manage the implementation of all mitigation measures and there will be ongoing monitoring of bird numbers using the site.

7.3 Aquatic Ecology and Marine Modelling

The issues of concern in terms of aquatic ecology were identified as water quality / aquaculture and fish migration.

Water Quality and Aquaculture

Carlingford Lough is a designated shellfish production site and as such contains licenced shellfish beds. The quality of the water is thus protected by the EC (Quality of Shellfish Waters) Regulations 2006, the essence of which makes it imperative that the construction and operation of the bridge does not result in significant sediment release which could impair water quality.

The chosen cable-stayed bridge requires only one series of slim in-river piers and therefore has minimal impact on water velocity and sediment transport. In addition, the construction methodology allows the bridge to be built in segments from the embankments. This construction methodology and slim in-river piers combine to direct that there is no requirement for specific mitigation measures in this instance.

Fish Migration

The issue in this instance is the requirement to avoid preventing salmonids, eels or lamprey species migrating upstream. The sheet piling which is necessary in coffer dam construction could prevent this migratory movement. These operations will only be undertaken during normal working hours and as such will allow fish movement during at least half of the 24 hour tidal cycle. However in order to minimise any impact on fish movements, the construction and removal of the coffer dam and necessary in-river piling shall be undertaken outside of the main migratory periods. With respect to this, the contractor shall be required to submit their methodology and timing to and receive the agreement of the Loughs Agency.

7.4 Noise and Vibration

The Noise and Vibration Impact assessment identified that two properties in County Louth (location 1 and location 4) and one (currently vacant – location 11) property in County Down would suffer minor increases in noise levels as a result of traffic using the road and bridge.

The use of 'low noise road surface' will reduce the noise impact by between 3 and 5 decibels which in each case brings the noise levels to within the recommended limits.

It is recognised that during construction there is the potential for temporary noise impact. This will be controlled and limited through the adherence to a number of mitigation measures including the use of well maintained and serviced plant; noise monitoring and screening where necessary.

7.5 Air Quality and Climate

Neither the construction nor operation of the scheme will have a significant impact on the existing air quality or climate.

7.6 Soils, Geology and Hydrogeology

The assessment has been completed using a desk study of published information and field investigations of terrestrial and marine environments. Soils encountered are generally at least firm or medium dense with frequent cobbles and boulders along the river. Bedrock consists of sedimentary limestone, siltstone and sandstone which is often fractured. Modest height embankments and cuttings as well as piled foundations and construction methods are proposed. Overall, the road and bridge foundation construction requirements result in minimal impacts on soils, geology and hydrogeology receptors.

8.0 LANDSCAPE AND VISUAL IMPACT

The effects of the proposed development on the receiving landscape and visual environment are assessed and described. In order to do so all relevant planning policy documentation from both jurisdictions has been reviewed.

The assessment highlights that the proposal sits within an area of high scenic quality and within the vicinity of a number of protected and familiar monuments such as Narrow Water Castle.

While it is acknowledged that the issue of bridge design and bridge impact is influenced by highly subjective considerations and personal experiences, it is considered that the proposed development will not adversely or directly alter the inherent quality of the landscape, its significance or value. Indeed it is considered that this unique structure (refer **Figures 8.4 – 8.7** in Volume 3) has the potential to add to the significance of its setting and to present focus and momentum towards realising local landscape and tourist related objectives.

Given the nature of the project, consideration of mitigation has been a significant aspect of the project design and as such the proposal incorporates a number of design elements to minimise the landscape and visual impact of the project. These elements include:

- An alignment that is near perpendicular to the river centerline, which is thereby shorter and a more visually natural bridging
- A tie-in to an existing roundabout on the A2 on the northern side of the river, thereby reducing impact on shore and surrounding area;
- Siting the bridge adjacent to and avoiding impact on the wooded promontory of Ferry Hill. In this way the wooded hill provides a visual foreground/background anchor for the main tower on the southern side of the bridge. This effect is clearly illustrated in the Photomontages;
- Minimising and down-sizing the number of piers and apparent mass of the structural components, thereby decreasing adverse visual impacts on views along the river/lough; and
- Incorporation of a signature bridge design with inclined towers and a unique opening mechanism.

As such cognisance was taken of the significance of the landscape setting and it was considered that the landmark bridge best:

- acknowledges and reflects the recognised scenic and visual qualities of its wider setting;
- provides an iconic structure that will assist in the development and realisation of co-ordinated and focused amenity, landscape and recreation objectives and policies for the significant landscape resource of the Cooley Peninsula and the South Down landscapes;
- marks a location of a clear transition between inland river valley and open coastal inlet;
- defines a boundary to westward extension of visually detracting port, port-related and mixed-use development along the shore towards Narrow Water Castle at Warrenpoint;

9.0 MATERIAL ASSETS

Agriculture

Four agricultural holdings will be affected by the proposed Narrow Water Bridge Project. However, there are no farms on which the agricultural impact will be severe or major. The impacts on the farm holdings are considered moderate to minor. **Figure 9.1, Volume 3** illustrates the land to be acquired for construction of the proposed scheme.

Measures to compensate farmers/landowners due to land acquisition, drainage works and loss of facilities will be agreed by the valuer as the project progresses.

Commercial

Warrenpoint Harbour and Carlingford Lough Commission

Access to Warrenpoint Harbour is provided by a series of buoys and leading lights which are the property of Warrenpoint Harbour Authority (WHA). The link road and southern tower in County Louth will have a significant impact on the operation of this leading light navigation system by interrupting and partly blocking the view of one of a pair of stone navigation beacons (see **Figure 3.2 and 3.15** in Volume 3). To remedy this situation Carlingford Lough Commission and Warrenpoint Harbour Authority have been consulted with respect to the acceptability of replacing this leading light and on the proposed location and design of the new structure. Louth County Council proposes to construct a new structure and leading light to the satisfaction of WHA and CLC prior to the construction of the southern tower. This structure will be constructed immediately east of the bridge and in line with the two existing leading lights. See **Figure 3.2 and 3.15** in Volume 3.

Carneyhaugh Properties Ltd.

Carneyhaugh Properties Ltd control received outline planning permission for a mixed use development on a site adjacent to the bridge on the northern shore. The proposed development as described within the outline application includes for provision of a hotel and restaurant, residential units and office and retail units. The property group have stated their full support of the project and have cooperated in the design of the Control Building and access as the proposed scheme will enhance their development. The design and location of the Control Building and the access has been agreed with Carneyhaugh Properties Ltd. The design and location of the

Control Building and the access has been agreed with Carneyhaugh Properties Ltd. Finishes will be as per **Figure 3.16 to 3.19** in Volume 3 and will be sympathetic to the proposed development.

10.0 CULTURAL HERITAGE

The location of the proposed scheme is in an archaeologically sensitive area with 14 recorded sites within a 1.5km radius. Recorded archaeological features within the area shows activity from the Prehistoric through the Early Christian, Medieval and Post Medieval periods.

Narrow Water is, as its name suggests, the narrowest point on the Newry River which would have been a major route into Ulster from Carlingford. Therefore, the area would have been naturally used as a crossing point throughout history.

Prominent local features include Narrow Water Castle and the associated Keep, the motte to the north of the A2 roundabout and the existing stone tower navigation beacons.

Given the archaeological sensitivity of the environs of the line of the proposed bridge, non-invasive pre-development testing has been carried out in accordance with mitigation measures as stipulated by the Heritage authorities in NI and ROI. This pre-development testing took the form of geophysical, non-invasive surveys within the riverine line of the proposed route and within the terrestrial line of the project. These surveys have been carried out by appropriate specialists who have made further recommendations including archaeological investigation of geo-physical anomalies and pre-construction top soil stripping to allow for the identification and preservation of undiscovered remains and artefacts.

11.0 CONSTRUCTION PHASE

The construction of the proposed road and bridge is estimated as taking 18 to 21 months.

During construction, measures will be put in place to minimise any temporary nuisance that may occur. This will include a dust management plan, traffic management at the tie-ins to the existing road network (the R173 and the A2), maintaining roads clear of mud and where necessary using screening to minimise noise levels.

A number of mitigation measures will be included in the contract to ensure that there is no contamination of the Newry River estuary or related drains or watercourses.

The contractor will be required to prepare a Waste Management Plan and an Environmental Operating Plan prior to construction commencing. In addition the appointed contractor will be required to prevent, as far as is possible dirt being released onto public roads. In the event that site traffic leaves dirt on the road the Contractor will be required to clean the road.

All of the above mitigation measures will be tied into all contract documents and it will be a requirement of the Main Contractor to adhere to all of these mitigation measures and any further measures required as part of the planning conditions.

12.0 INTERRELATIONSHIPS

Chapters 5 – 11 inclusive discuss the impacts of the proposed scheme on the various elements of the environment and highlight the measures necessary to mitigate these impacts. The mitigation measures could potentially impact on other elements of the environment, and the inter-relationships of the various measures proposed to mitigate the impact of the scheme have been assessed. In this instance traffic has been shown to interact with air quality and noise and vibration; and landscape and visual impact has been influenced by aquatic ecology and cultural heritage.

13.0 MITIGATION MEASURES

The principal mitigation measures proposed in the scheme are as follows:

- Pre-construction archaeological investigations and monitoring of topsoil stripping will be undertaken to ensure that any undiscovered archaeological remains are discovered and protected;
- A new high tide bird roost will be constructed;
- The bridge will be lit at night to prevent bird strike;
- All necessary vegetation clearance will be undertaken outside of the bird breeding season;
- Mammal fencing and underpasses shall be provided to avoid unnecessary road casualties;
- A bat fly-over shall be developed to ensure the continuation of bat foraging and commuting routes;
- To minimise any impact on fish movements, the construction and removal of the coffer dam and necessary in-river piling shall be undertaken outside of the main fishery migration periods.
- During construction, stringent restrictions will be imposed on the contractor to prevent pollution of the Newry River estuary;
- The completed scheme will be landscaped, where appropriate, with trees and shrubs to soften the impact of the engineered features;
- All suitable material excavated within the cut sections shall be used to the greatest possible degree as fill material on the development;
- Embankment and cut slopes which are considered at risk from erosion are to be topsoiled and seeded as soon as possible to prevent the deterioration due to weathering effects;
- Low noise road surface will be used to reduce the operational noise impact to within the recommended limits; and
- Boundary treatment / secure fencing shall be provided at the site to protect the public.

14.0 FURTHER INFORMATION

The full Environmental Statement will be on display and available for inspection and purchase for not less than 6 weeks from the date of publication at Louth County Council Offices and in the offices of Newry and Mourne District Council.

Please contact:

The Senior Engineer
Roads Department
Louth County Council
County Hall
Millennium Centre
Dundalk

Phone: 00353 (0)42 9335457

The following additional reports will also be available for inspection upon request:

- Constraints Report
- Route Selection Report
- Bridge Feasibility Report
- Bridge Preliminary Design Report

15.0 WHAT HAPPENS NEXT?

Construction of the scheme is dependent on approval from An Bord Pleanála in the Republic of Ireland and The Planning Service in Northern Ireland. The planning application will be advertised locally and written submissions relating to the environmental effects can then be made to the planning authorities. These advertisements will indicate where the planning application, Environmental Impact Statement and other supporting documents can be viewed. Any written submissions will be considered by the planning authorities in making their decision on whether or not to approve the scheme with or without modifications.

Part I

Background Information
General Description

Chapter 1

Introduction

Chapter 1 Introduction

1.1 General

This Environmental Impact Statement (EIS) / Environmental Statement (ES) is for the proposed Narrow Water Bridge Project and has been prepared by Roughan & O'Donovan Consulting Engineers, on the instruction of Louth County Council (in conjunction with Newry and Mourne District Council). The Statement is a compilation of the inputs provided by the various bodies listed in the acknowledgements on the previous pages.

This document will be submitted as the required Environmental Impact Statement in support of the planning application in the Republic of Ireland and the Environmental Statement in support of the planning application in Northern Ireland.

For presentation purposes, this EIS/ES is set out in three Volumes:

Volume 1 Non Technical Summary

Volume 2 Main Text

Volume 3 Figures

This document, Volume 2 contains the following elements:

Non - Technical Summary

Part I “Background Information and General Description”

There are five chapters to this part of the document.

Chapter	1:	Introduction
Chapter	2:	Background to the Proposed Development
Chapter	3:	Description of the Proposed Development
Chapter	4:	Alternatives Considered
Chapter	5:	Traffic and Transport Impacts

Part II “Significant Environmental Effects and Proposed Ameliorative Measures”

This part of the document sets out the likely significant environmental effects of the scheme under the headings:

Chapter	6:	Human Beings
Chapter	7:	The Natural Environment
Chapter	8:	Landscape and Visual Impact
Chapter	9:	Material Assets
Chapter	10:	Cultural Heritage
Chapter	11:	Construction Phase
Chapter	12:	Interrelationships
Chapter	13:	Mitigation Measures

1.2 Context to the Proposed Development

At present there is no direct link between the Cooley Peninsula in County Louth and the "Kingdom of Mourne" in County Down and no connection between the northern and southern shores of Carlingford Lough. Instead, to gain access around the Lough all traffic must cross the Newry River in Newry City. This involves a considerable journey away from the Lough and its environs and diverts traffic from the Carlingford area and toward the motorway system connecting Dublin and Belfast.

The Narrow Water Bridge project arises directly from an identified priority in Chapter 5 'All Island Co-operation' of the Republic of Ireland's National Development Plan 2007 - 2013 to "improved access for tourism and other opportunities along the eastern corridor, including better links between County Louth and County Down in Northern Ireland." The Good Friday Agreement in Northern Ireland supports this stance and has designated tourism as an area for co-operation under the auspices of the North-South Ministerial Council.

Louth County Council, in the Louth County Development Plan 2003 – 2009 (as amended, July 2006) has also identified that linking the Cooley Peninsula and the Mourne District would unlock the tourist and leisure potential of the Carlingford Lough area. At Section 8.8, the Development Plan makes the construction of a bridge at Narrow Water an objective of Louth County Council. The Council have now embraced this policy and are proposing this bridge as the element of tourism infrastructure needed to open up the Carlingford Lough area.

1.3 Legal Requirements

1.3.1 Legislative Requirement for an Environmental Impact Assessment (EIA)

The proposed bridge at Narrow Water crosses an international border, providing a road and pedestrian/cycle link connecting the Republic of Ireland and Northern Ireland across the Newry River. As a consequence, it is essential that the development of this Environmental Impact Assessment adequately addresses the requirements of legislation in both jurisdictions.

Despite the differing legislation used in each jurisdiction, it is in both cases an interpretation of the E.C. Directives – 85/337/EC of 27th June 1985 "The assessment of certain public and private projects on the environment" as amended by Directive 97/11/EC and Directive 03/35/EC).

Republic of Ireland

In the Republic of Ireland, The Roads Act, 1993, together with the Roads (Amendment) Act 1998 and the Roads Regulations, 1994 (S.I. No. 119 of 1994) give effect to the E.C. Directive 85/337/EC as amended. The amendment, E.C. Directive 97/11/EC, was incorporated into amending regulations and published as Section 14 of the European Communities (Environmental Impact Assessment) (Amendment) Regulations 1999 (SI No. 93 of 1999).

Section 50 of the Roads Act, 1993 as amended by, *inter alia,* the European Communities (EIA) (Amendment) Regulations, 1999, the Planning and Development Act, 2000, the Planning and Development (Strategic Infrastructure) Act 2006, the Roads Act 2007 and the Planning and Development Act 2010 sets out provisions for the preparation of an Environmental Impact Statement (EIS) / Environmental Statement (ES) by a Road Authority, such as Louth County Council.

Northern Ireland

In Northern Ireland the application will be made as a planning application under the Planning (Northern Ireland) Order 1991 (SI 1991 No. 1220 (N.I. 110). Planning Service have advised that the application will be treated as an Article 31 application "Special Procedure for Major Planning Applications". The relevant EIA legislation is the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 1999 (Statutory Rules of Northern Ireland 1999 No. 73).

Schedules 1 – 4 of the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 1999 identify those projects which will require environmental impact assessment, how this is determined and what must be included in the report.

1.3.2 Determination of the requirement for an EIA

Republic of Ireland

The legal requirements for Environmental Impact Assessment of a road development are defined in the Roads Act (1993) as amended by the Planning and Development Acts (2000 - 2010), the Roads Act (2007), and by Regulations made under the Roads Acts, The European Communities (Environmental Impact Assessment) (Amendment) Regulations 1989 – 2001 and the EC Directives 85/337/EC and 97/11/EC. Section 50 of the Roads Act (1993), as amended by Section 9 of the Roads Act (2007), sets out provisions for the preparation of an Environmental Impact Statement (EIS) by a Road Authority.

Environmental Impact Statement (EIS) Section 50 of the Roads Act, 1993 as amended by Section 9 (1) (d) (i) of the Roads Act 2007 states:

"A road authority or the Authority shall prepare a statement of the likely effects on the environment ('environmental impact statement') of any proposed road development consisting of:

(i.) *the construction of a motorway,*

(ii.) *the construction of a bus way,*

(iii.) *the construction of a service area, or*

(iv.) *any prescribed type of proposed road development consisting of the construction of a proposed public road or the improvement of an existing public road."*

The prescribed type of proposed road development, as defined by paragraph 8 of the Roads Regulations (S.I. No.119 of 1994), for the purpose of subsection (1) (a) (iii) of section 50 of the Act is as follows:

"(a) the construction of a new road of four or more lanes, or the realignment or widening of an existing road so as to provide four or more lanes, where such new, realigned or widened road would be eight kilometres or more in length in a rural area, or 500 metres or more in length in an urban area;

(b) ***the construction of a new bridge or tunnel which would be 100m or more in length****."*

Northern Ireland

The Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 1999 and the Planning (Environmental Impact Assessment) (Amendment) Regulations (Northern Ireland) 2008 give effect to the E.C. Directive 85/337/EC of 27th June 1985, as amended by Directive 97/11/EC, "on the assessment of the effects of certain public and private projects on the environment."

Schedule 2 of The Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 1999 states that road projects for which the area of works exceeds one hectare require Environmental Impact Assessment.

Schedule 3 defines the selection criteria for sub threshold development. Section 2 'Location of Development' references the need to consider the environmental sensitivity of the area likely to be affected by the development and specifies areas protected by member states legislation and by the Habitats and the Birds Directives. In Northern Ireland the bridge abutment will be constructed within Carlingford Lough Area of Special Scientific Interest (ASSI).

Louth County Council were therefore obligated to have an Environmental Impact Assessment undertaken, in both jurisdictions, to examine the likely significant effects of the proposed scheme at Narrow Water and to identify, where appropriate, relevant mitigation measures.

1.3.3 Required Contents of the Environmental Impact Statement

Despite the differing legislation used in each jurisdiction, it is in both cases an interpretation of the E.C. Directives – 85/337/EC of 27th June 1985 "The assessment of certain public and private projects on the environment" and the amendment Directives 03/35/EC 97/11/EC and 03/35/EC.

In the Republic of Ireland it is Sections 50(2) and 50(3) of the Road Acts, 1993 (as amended), which define the information to be contained in the Environmental Impact Statement. In Northern Ireland it is Schedule 4 of the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 1999 (as amended).

For the purposes of this document, the required content of an Environmental Impact Statement / Environmental Statement is considered as:

- "A description of the proposed road development (project) comprising information about the site, design and size of the proposed road development.
- A description of the measures envisaged in order to avoid, reduce and, if possible, remedy significant adverse effects.
- The data required to identify and assess the main effects which the proposed road development is likely to have on the environment.
- An outline of the main alternatives studied and an indication of the main reasons for its choice, taking into account the environmental effects.
- A summary in non-technical language of the above information.

Further explanation and clarification is given in both jurisdictions – by Section 50(3) of the Roads Act in the Republic of Ireland and by reference to Part 1 of Schedule 4 of the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 1999 (as amended). The following is taken directly from Section 50(3) of the Roads Act, but for the purposes of this EIS it is considered a pertinent interpretation of the relevant elements of Part 1 of Schedule 4.

An environmental impact statement shall, in addition to and by way of explanation or amplification of the specified information referred to (above), contain further information on the following matters: -

(a) (i) a description of the physical characteristics of the whole proposed road development and the land use requirements during the construction and operational phases;

(ii) an estimate, by type and quantity, of expected residues and emissions (including water, air and soil pollution, noise, vibration, light, heat and radiation) resulting from the operation of the proposed road development;

(b) a description of the aspects of the environment likely to be significantly affected by the proposed road development, including in particular: -

- human beings, fauna and flora,
- soil, water, air, climatic factors and the landscape,
- material assets, including the architectural and archaeological heritage, and the cultural heritage,
- the inter-relationship between the above factors;

(c) a description of the likely significant effects (including direct, indirect, secondary, cumulative, short, medium and long term, permanent and temporary, positive and negative) of the proposed road development on the environment resulting from: -

- the existence of the proposed road development,
- the use of natural resources,
- the emission of pollutants, the creation of nuisances and the elimination of waste,
- and a description of the forecasting methods used to assess the effects on the environment."

(d) an indication of any difficulties (technical deficiencies or lack of know-how) encountered by the road authority concerned in compiling the required information;

(e) a summary in non-technical language of the above information.

(As the above is an unqualified interpretation of the legislation in both jurisdictions, the reader is advised to consult the Acts and the Statutory Instruments for the full text).

1.4 Public Consultation

1.4.1 Informal Scoping

Roughan & O'Donovan Consulting Engineers in conjunction with Louth County Council undertook an informal scoping exercise during April and May 2008. This consisted of written consultation with a number of both Statutory and Non-Statutory bodies who were deemed to have an interest in the scheme. As the scheme will provide an international link between the Republic of Ireland and Northern Ireland it was necessary to consult the relevant bodies in both jurisdictions. Tables 1.1 and 1.2 list the Consultees in the Republic of Ireland and Northern Ireland respectively.

The purpose of the Scoping Document was to provide consultees with information on the scheme and on the proposed scope of the Environmental Impact Assessment. This scoping exercise was relatively successful with a significant number of responses received. **Appendix 1.1** provides a summary of all responses received. In general, the responses are in support of the proposed scheme and confirm satisfaction with the studies being undertaken as part of the Environmental Impact Assessment.

Table 1.1 List of Consultees – Republic of Ireland

Ordnance Survey Ireland
Land Registry Dublin
Louth County Council – Planning Department
Louth County Council – Roads and Marine
Eastern Regional Fisheries Board
The Marine Institute
Commissioner of Irish Lights
Department of Communications, Energy and Natural Resources
Department of Environment, Heritage and Local Government
An Taisce
Failte Ireland
The Arts Council
Iarnrod Eireann
National Roads Authority
The Heritage Council
National Parks and Wildlife Service
Department of Agriculture Fisheries and Food – Foreshore Section
Geological Survey Of Ireland
Environmental Protection Agency
Tourism Ireland
County Louth Archaeological and Historical Society
Bord Gais
Eircom

Table 1.2 List of Consultees – Northern Ireland

Ordnance Survey Northern Ireland
Warrenpoint Harbour Authority
Northern Ireland Water
Environment and Heritage Service (now Northern Ireland Environment Agency): - Built Heritage; - Natural Heritage; - Water Management Unit; and - Land and Resource Management
The Crown Estates
Armagh and Down Tourism Partnership
Geological Survey of Northern Ireland
The Planning Service
The Mournes Heritage Trust
The Royal Society for the Protection of Birds

Council for Nature Conservation and the Countryside
Centre for Environmental Data and Recording
Fisheries Conservancy Board
SusTrans
Newry and Mourne District Council
The Woodland Trust
The Wildfowl and Wetlands Trust
Council for Nature Conservation and the Countryside
Warrenpoint Chamber of Commerce
Newry Chamber of Commerce and Trade
Police Service Northern Ireland
Invest NI
Inland Waterways Association
Translink
Department of Agriculture and Rural Development
Department of Culture Arts and Leisure – Inland Waterways and Inland Fisheries
Department of Enterprise Trade and Industry
Foyle Carlingford and Irish Lights Commission
The Rivers Agency
The Loughs Agency
The National Trust
Land Registers of Northern Ireland
Carlingford Lough Yacht Club
Warrenpoint Boating Club

1.4.2 Further Consultations

In addition to the above consultation exercise, a series of ongoing meetings have been held with the key relevant statutory stakeholders.

In Northern Ireland this has been supported through the Pre-Application Discussions process arranged by the Planning Service Northern Ireland. A number of meetings have taken place and representatives of the following bodies have attended:

- Northern Ireland Environment Agency (Built and Natural Heritage Directorates);
- Landscape Architects Branch of Planning Service;
- Newry and Mourne District Council;
- Rivers Agency;
- Roads Service Northern Ireland;
- The Planning Service;
- Warrenpoint Harbour Authority;
- Carlingford Loughs Commission; and
- Loughs Agency.

A number of separate meetings have also been held with following bodies:

- The Centre for Maritime Archaeology;

- The Loughs Agency;
- Newry and Mourne District Council;
- Roads Service Northern Ireland;
- Police Service Northern Ireland and Ambulance Service;
- Warrenpoint Harbour Authority; and
- All affected landowners.

In the Republic of Ireland, meetings and discussions have been held with the National Parks and Wildlife Service, the Archaeology, Architecture and Underwater Archaeology Unit of DoAHG and with the Foreshore Section of the Department of the Environment, Community and Local Government (DoECLG).

1.4.3 Public Consultation Events

Public Consultation No. 1

A first public consultation event was held on 19th May 2008 in Omeath, at the Granvue House Hotel, and on 20th May 2008 in Warrenpoint, at the Warrenpoint Town Hall. A series of posters and leaflets were prepared for both events.

Members from Roughan & O'Donovan's project design team were also on hand to answer queries and comment sheets were made available. The events were advertised locally and both events were very well attended.

The purpose of the first public consultation was to aid in the identification of constraints or issues which members of the public may have. The overwhelming public opinion recorded was one of strong support for the scheme. Statements were made about the need to upgrade the R173 on the County Louth side and the wish to prevent HGVs from using the link.

Public Consultation No. 2

A second public consultation event was held on the 20th and 21st October 2008 again in the Granvue House Hotel in Omeath and Warrenpoint Town Hall. These events were used to present the Preferred Route and the selected bridge design to the communities on both sides of the Newry River and Carlingford Lough.

The two unsuccessful bridge design options and a route selection matrix were also presented to the public on fourteen A1 boards on display at both venues. Both events were exceedingly well attended and the response was overwhelmingly positive and supportive, indicating the level of local public support which exists for the proposed scheme and proposed bridge structure. The events created significant interest within both the local and national media with coverage on both the RTE and UTV evening news.

Plate 1.1 Public and UTV cameras during a presentation on the Preferred Route and chosen bridge design at PC2

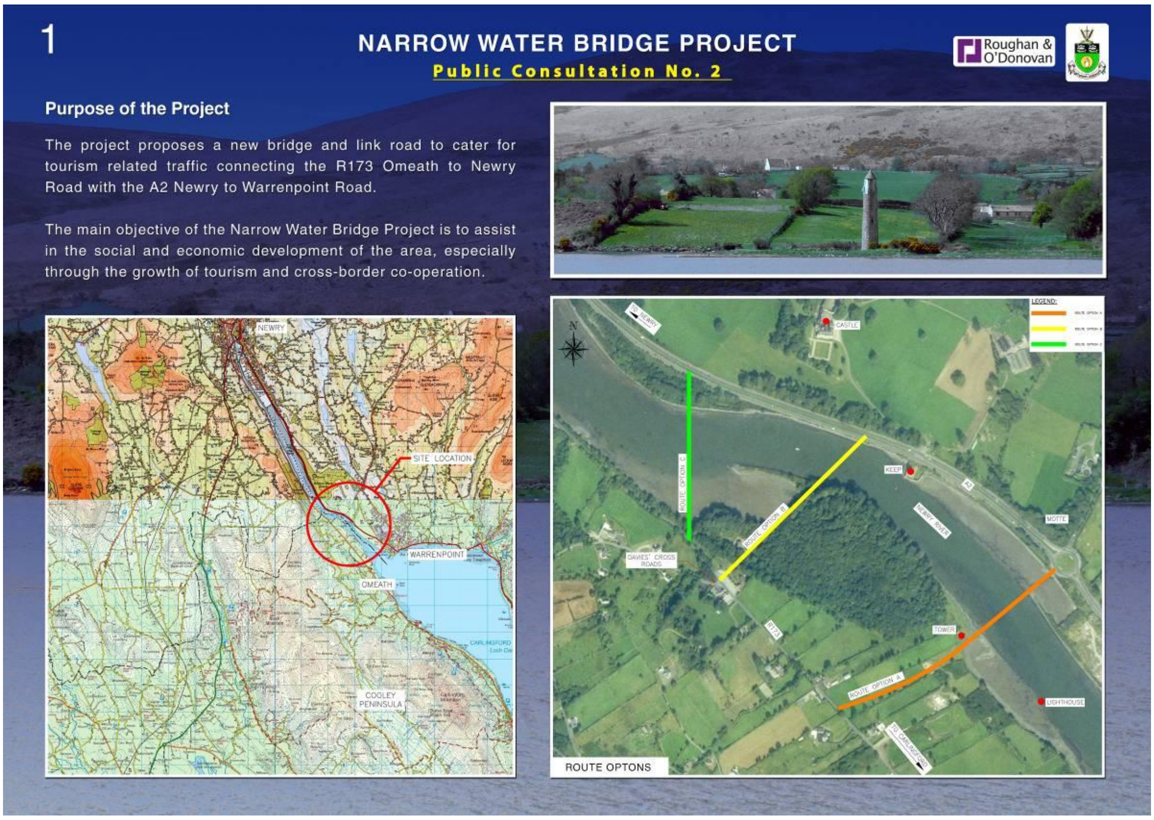

Plate 1.2 Display Board No. 1 – Route Options at PC2

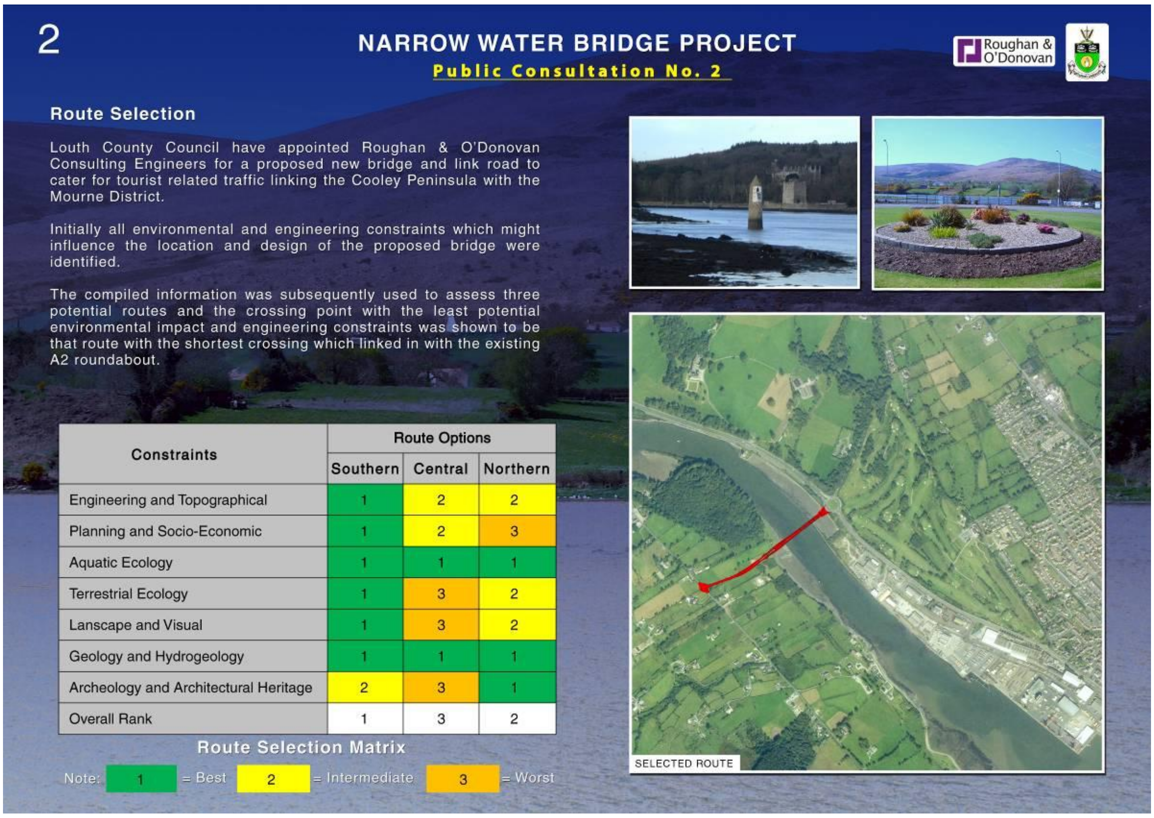

Plate 1.3 Display Board No. 2 – Preferred Route at PC2

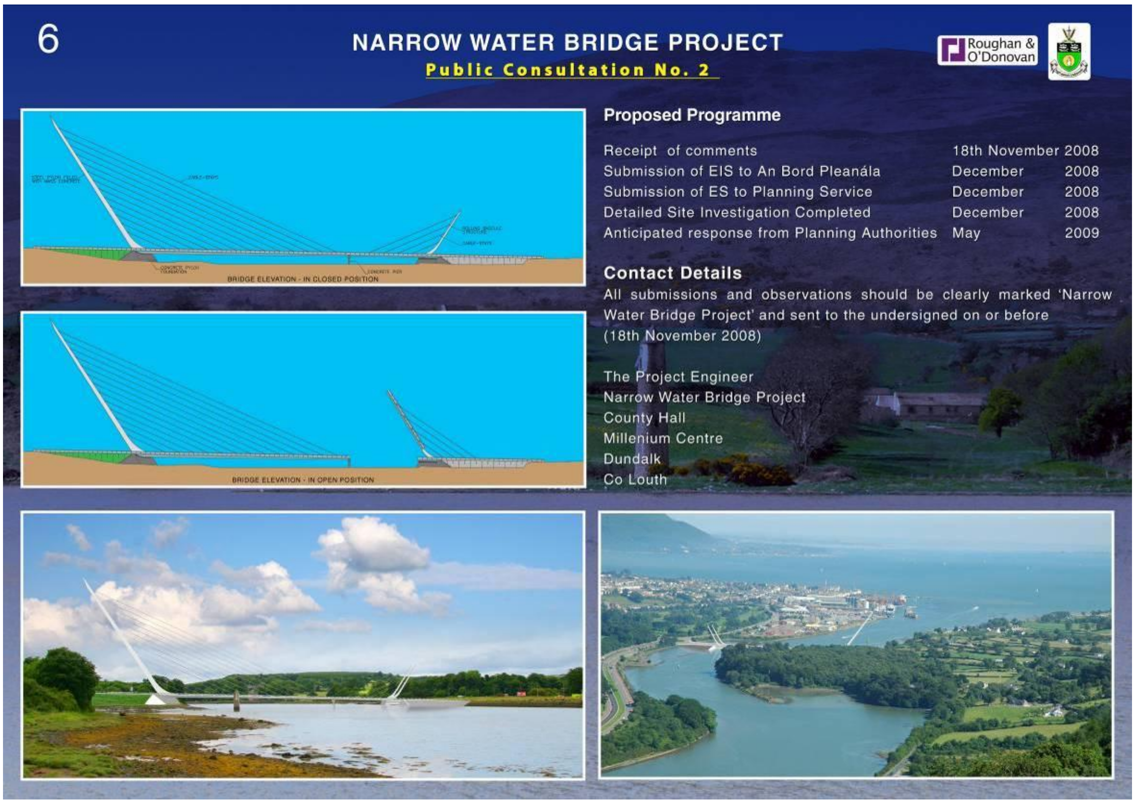

Plate 1.4 Display Board No. 6 – Images of Preferred Bridge Design at PC2

1.4.4 Statutory Consultation Requirement

Republic of Ireland

Section 51 of the Roads Act, 1993, as amended, requires that public notice should be issued stating:

(i) that such application has been made to An Bord Pleanála for approval;

(ii) that an environmental statement has been prepared in respect of the proposed road scheme;

(iii) that copies of the statement be available for inspection for a specified period not less than six weeks;

(iv) that copies are available for sale at a cost not exceeding the reasonable cost of making a copy;

(v) that submissions may be made in writing to An Bord Pleanála in relation to the likely effects on the environment of the proposed road development before a specified date (which shall be not less than two weeks after the end of the period for inspection).

Northern Ireland

Regulations 12 and 13 of the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 1999, as amended, identify the statutory public consultation requirements when a planning application is lodged with an Environmental Statement.

Regulation 12 requires the Department (The Planning Service) to publish notice of the planning application and the associated environmental statement. This notice must state where the environmental statement can be viewed. Regulation 12 states that at least 4 weeks must be allowed for responses to be made to the application from the date on which the notice was first published. Regulation 12 further requires that any person or group affected, or with a likely interest in the application, who are unlikely to become aware of it through public advertisement, must be directly notified.

Regulation 13 requires the applicant to ensure that sufficient copies are made available at the specified address and that sufficient copies are supplied to the Department.

In addition, in Northern Ireland all planning applications are subject to neighbour notification, whereby the applicant must supply the Department with a list of addresses of immediate neighbours. These neighbours are subsequently given direct notice of the application by the Department.

1.5 Difficulties Encountered

It is considered that the only particular difficulty encountered was in the availability of funding to progress to the planning stage resulting in some delays throughout the development of the project.

Name	Title / Division	Company	Date	Comments	Actions
Terence P Johnston	Geological Survey of Northern Ireland	Department of Enterprise, Trade and Investment	04/05/2008	**Comments:** - Ensure the geological context of the site and surrounding area has been described in appropriate detail.	GSNI is good starting point for geological and hydrogeological research for EA/ES. Large archive.
Orla Jackson	Chief Executive	Newry Chamber of Commerce	07/05/2008	In favour of bridge under following conditions: - bridge allows for navigation into Newry City. - bridge does not allow for access of HGV vehicles and buses. - bridge must be in keeping with surrounds. - feasibility study must take into account recommendations of consultants undertaking feasibility study on the Southern Relief Road.	Would welcome opportunity to discuss in further detail in near future.
Karen Simpson	Chief Executive	Fisheries Conservation Board for Northern Ireland	21/04/2008	Lies within the jurisdiction of the Loughs Agency of Foyle, Carlingford and Irish Lights Commission.	
Nicola O'Neill		BT Northern Ireland	08/05/2008	Copy of BT mark up plan.	
P.A. Hoben	Honary Secretary	The John Donnelly, Newry and Portadown Canal Branch (of Inland Waterways Association of Ireland)	04/05/2008	**Comments:** - Bridge must be a minimum of 100ft at a high spring tide to enable high masted ships.	
J White	Acting Director of Strategic Programmes	Roads Service	01/05/2008	**Suggests:** - Expanding paragraph 3.5 to include: i) Land Use ii) Pedestrians, Cyclists, and Community Effects iii) Vehicle Travellers iv) Plans and Policies and v) Disruption due to Construction (may be in Chapter 11) - Soils and Geology Section - include comments on significance of soils and geology of locality and impact of proposal / mitigation. - Will be forwarding recent traffic surveys.	Suggests traffic assessment is sent in as a Traffic Impact Statement.
Helen Hossack	Senior Conservation Architect	Environment and Heritage Service	30/04/2008	**Suggests:** - using their website or visit their office to gain information (Monuments and Building Record). - any research or impact assessment would need to take into consideration the potential for new remains being uncovered and included and record in proposed programme of works.	

Name	Title / Division	Company	Date	Comments	Actions
Martin Carey	Chief Executive	Mourne Heritage Trust	02/05/2008	**Following points:** - take into account impacts on wider area eg. Kilkeel. - take into account impact of Southern Relief Road. - impact on character of the Mourne area. - design issues and measures to mitigate a diverse visual and biodiversity impact are particularly important. - good impact on tourism. - will compliment European Geopark.	
Fraser McConnell	Brown McConnell, Clark, McKee	(The Crown Estate Agents)	01/05/2008	**Comments:** - Crown Estate's consent would be required for foreshore, riverbed works. - Foreshore currently leased by The Crown Estate to Newry & Mourne District Council. - Only other interest in area is a lease to Carneyhaugh Properties Limited. - They have no record of an outfall to adjoining sewerage works.	
Jonathan McGilly	Enterprise Development Officer	Newry and Mourne District Council	24/04/2008	They have previously supplied us with all relevant information. Happy with EIA approach but stress the need to consult locally with environmental groups and with the council directly.	Strongly recommend consulting with Mr Gareth Coughlin in Scott Wilson in relation to Southern Relief Road.
Hilary Heslip	Divisional Planning Manager	The Planning Service	22/05/2008	Tom Clarke in headquarters will take the lead on this project. Contact him in future.	
Colin Hedderly	Assistant Divisional Engineer	Iarnród Éireann	26/04/2008	Not affected. He has forwarded EIA scoping doc to C.I.E. Group Property Manager.	
E McAuley	Countryside and Coast	Environment and Heritage Service	24/04/2008	Acknowledgment of receipt of EIA.	
J Aaron McCormick	Admin Section	Rivers Agency	23/04/2008	Acknowledgment of receipt of EIA.	
Helen Kirk	Land Use Planning Adviser for NI	The National Trust	22/04/2008	Not affected by proposed development. Still wish to be kept in informed and comment on EIA.	
Claire Ferry	Conservation Officer (Planning)	RSPB Northern Ireland	22/04/2008	**Comments:** - RSPB do not hold any data for the area. Greencastle is a SPA. - Refer to letter and details of contact information for other bodies and Orders.	Contact the British Trust for Ornithology - WEBS count data.

Name	Title / Division	Company	Date	Comments	Actions
Brian Forrest	Land and Resource management	Environment and Heritage Service	26/05/2208	EHS Database identifies three possible sources of contamination - petrol station, railway lands and sewage works. Recommends investigation of information websites - see letter	
Damien Mulligan	Planning Service - Strategic Projects Team	Planning Service	16/05/2008	PADS info	
Patrick Casement		Stautory Advisory Councils (CNCC, HBC, HMC)	19/05/2008	No comment - look forward to reading EIA	
Kevin Scullion	Assistant Direcotr - Environmental Health	Newry and Mourne District Council	21/05/2008	Happy with scope of EIA and supports the methodology for the Air and Noise and Vibration assessments	

Chapter 2

Background to the Proposed Development

Chapter 2 Background to the Proposed Development

2.1 Need for the Scheme

Carlingford Lough and the upper reaches of the Newry River estuary are bounded by Counties Louth, Armagh and Down. In times past, up to the 19th Century, ferry services were provided between Greenore in County Louth and Greencastle in County Down. Similarly, ferry services existed across the Newry River Estuary at Narrow Water Keep.

At present, there is no direct link between the Cooley Peninsula and coastal area of Co. Down. Instead, access is provided by crossing the Newry River in the city of Newry. Since the termination of the ferry services between Greenore and Greencastle, there has been a locally recognised need for a link across Carlingford Lough. At present all traffic travelling along the southern or northern shores of Carlingford Lough is directed away from the Lough through Newry and toward the motorway linking Dublin and Belfast. Consequently the majority of tourist traffic does not continue around the Lough, to the detriment of the tourist economy in both areas.

The need for the scheme is outlined in numerous Planning and Policy documents

- National Development Plan 2007 – 2013;
- National Spatial Strategy 2002 – 2020;
- Regional Development Strategy for Northern Ireland;
- Infrastructure Investment Priorities 2010 – 2016;
- Louth County Development Plan 2009 – 2015;
- Banbridge / Newry and Mourne Area Plan 2015 (Draft Plan).

Strategic Planning Policy

Since the Good Friday Agreement (1998), there has been a transformation in Northern Ireland and in North/South co-operation. In the National Development Plan 2007-2013, the Irish Government sets out proposals for investment in North/South projects and initiatives of mutual benefit. The Narrow Water Bridge project arises from a commitment in the National Development Plan 2007-2013 for “improved access for tourism and other opportunities along the eastern corridor, including better links between Co. Louth and Co. Down in Northern Ireland”. The Good Friday Agreement in Northern Ireland supports this stance and has designated tourism as an area for co-operation under the auspices of the North-South Ministerial Council.

National Development Plan 2007 – 2013

The National Development Plan (NDP) 2007 – 2013 entitled ‘Transforming Ireland – A Better Quality of Life for All’ is an ambitious investment plan designed to link Regional and Local Planning to continued economic investment and expansion.

The Narrow Water Bridge project arises directly from an identified priority in Chapter 5 ‘All Island Co-operation’ of the NDP to “improved access for tourism and other opportunities along the eastern corridor, including better links between County Louth and County Down in Northern Ireland.”

National Spatial Strategy 2002 – 2020

The National Spatial Strategy (NSS) is the national planning framework for Ireland whose primary aim is to achieve a better balance of social, economic and physical development across the country. One of the policies of the NSS is to maximise the potential of the tourism sector. Section 5 clearly stresses the need to address 'infrastructural bottlenecks' and to provide coastal infrastructure, commensurate with the needs of the seafood and marine leisure sectors, at strategic locations of particular importance for local economies.

Regional Development Strategy for Northern Ireland

The Regional Development Strategy (RDS) for Northern Ireland 2025, entitled "Shaping our Future" establishes a strategic planning framework for Northern Ireland that will guide physical development within the Region until 2025. The overall aim of the RDS for rural Northern Ireland is to develop an attractive and prosperous rural area. This is to be achieved by action on a series of Strategic Objectives and Supporting Planning Guidelines.

Of significance is the recognition by the RDS of the need to support the growth of tourism as a major economic development theme. In particular is the identification (within policy ECON 8.3) of the need to facilitate the development of infrastructure to meet the needs of visitors.

Infrastructure Investment Priorities 2010-2016 – A Financial Framework

Although stating that spending will shift more towards public transport this document highlights the need to further develop the tourism product.

"Ireland has witnessed a significant drop in the number of overseas visitors coming to our shores. Recent data shows a fall in the number of trips to Ireland by overseas residents. The number of visits to Ireland in 2009 was 17 percent lower than the corresponding period in 2007…….Tourism remains a valuable internationally traded service however and can again deliver significant value added and employment to the economy. Nonetheless, steps must be taken to reinvigorate this sector. While the opening of the National Conference Centre (to be known as Convention Centre Dublin) later this year will provide a major addition to Ireland's tourism infrastructure, further development of the tourism product is required. The Exchequer Capital Programme therefore provides for a high level of investment in this area into the medium term."

Local Planning Policy

Louth County Development Plan 2009-2015, under Section 7.4 Tourism within Chapter 7 'Economic Development, Employment and Tourism' has identified the need for the link as outlined below:

Policy

TOU 6 To co-operate with the authorities in Northern Ireland in the provision of a road bridge between Cooley and south County Down."

The specific requirements, which relate to the Narrow Water Bridge, are outlined in the various policy statements below.

> ***"7.5.4 Narrow Water Bridge***
> *The provision of a road link through the construction of a bridge between the Cooley Peninsula in County Louth and the southern portion of the Mourne Mountains in County Down at Narrow Water would make a valuable contribution to the development of tourism in Louth and the Mournes. Initial funding for the project*

has been provided in the National Development Plan 2007-2013 and preliminary design work commenced."

Banbridge / Newry and Mourne Area Plan 2015 (Draft Plan)

The primary objective of the plan for this region of Northern Ireland is to deliver a sustainable pattern of growth in the area. It recognises as one of its goals the need to promote Warrenpoint as a local hub of development and to strengthen its role as both a port and a tourist destination.

2.2 Identification of the Study Area

In the recent past three studies have been carried out to determine whether a bridge or car ferry link between the Cooley Peninsula and the Mourne District was feasible. These studies are:

- 'Omeath to Warrenpoint, Feasibility Study', 1979, Nicholas O'Dwyer and Partners;
- 'Carlingford Lough-Ferry Feasibility Study', 1993, Jonathan Blackwell and Associates; and
- 'Omeath – Warrenpoint Road Link, Feasibility Study', 2001, M C O'Sullivan and Co. Ltd (now RPS Consulting Engineers).

The 'Omeath to Warrenpoint, Feasibility Study' published in 1979 recommended a bridge crossing at the A2 Roundabout west of Warrenpoint. The 'Carlingford Lough-Ferry Feasibility Study' undertaken in 1993 only considered a ferry crossing and did conclude with some uncertainty that the operation of a ferry was economically viable. The 'Omeath – Warrenpoint Road Link, Feasibility Study' completed in 2001 compared bridge and road ferry options. It concluded that a bridge would be preferential to a ferry crossing and that this crossing should be located at the same crossing point identified in the 1979 study.

The 1979 and 2001 studies determined that a bridge crossing located within the vicinity of the A2 roundabout was viable. The study area for the current project was subsequently developed based on the environmental, engineering and economic constraints previously identified and incorporating the crossing point already identified by previous studies as being viable.

The study area for the proposed bridge is indicated on **Figure 2.1** in Volume 3 of this EIS/ES.

2.3 Objectives of the Scheme

The proposed Narrow Water Bridge aims to create a new crossing over the Newry River to the north of Carlingford Lough. It is intended that the proposed bridge will link the R173 Omeath to Newry Road in Co. Louth with the A2 Newry to Warrenpoint Road in Co. Down. The primary objectives of providing the Narrow Water Bridge are:

- Assist the social and economic development of the area;
- Facilitate access to the scenic beauty of Carlingford Lough;
- Enhance the tourist potential of the region;
- Improve the leisure potential of the region;
- Promote interaction between communities north and south of the border; and
- Encourage pedestrian and cyclist activity.

2.4 Development of the Proposed Scheme

In April 2008, Louth County Council engaged the services of Roughan & O'Donovan Consulting Engineers (ROD) to progress the planning, design and environmental assessment of a proposed bridge link in the vicinity of Narrow Water. This process has so far been undertaken in a number of clear stages with input from the public at all stages in the selection of the proposed scheme being developed for the purpose of this assessment (See Section 1.4.3 of this document).

Initially a study area was identified so as to limit the area within which potential constraints would be identified. Within the Study area the identified constraints aided in the identification of a preferred route and the selection of a preferred bridge design (refer to Chapter 4, Sections 4.3 and 4.4). This current stage in the development of the scheme is the preparation of an Environmental Impact Statement / Environmental Statement for the preferred preliminary bridge design, road alignment and associated features.

Chapter 4 of this EIS/ES provides detailed information about the development of the proposed Route Selection Process and scheme design.

Chapter 3

Description of the Proposed Development

Chapter 3 Description of the Proposed Development

3.1 Site Location

The proposed Narrow Water Bridge will cross the Newry River approximately 400m south of the Narrow Water Keep (see **Figure 3.1** in Volume 3). The bridge, which will connect the R173 Omeath Road south of Ferry Hill and the A2 dual carriageway at the existing roundabout, is situated approximately 1km and 2km northwest of Warrenpoint and Omeath, respectively. The bridge will pass close to the stone tower navigational beacon near the southern shoreline.

3.2 Site Description

The site is situated between the steep Cooley Mountains to the south and the drumlins of Down to the north. The Newry River flows through this valley before widening to form Carlingford Lough (see Plate 3.1 below). The shoreline is flanked by roads on both sides and a former rail line occurs along the southern shore. In the immediate vicinity of Narrow Water in the south the countryside pattern is of small fields bounded by hedgerows, whereas to the north the immediate countryside is dominated by Warrenpoint Golf Course and the demesne surrounding Narrow Water House. A site on the northern shoreline, south-east of the A2 roundabout, has been granted planning permission for a mixed use development. It is proposed that the site will accommodate a 60 bed hotel, 40-50 residential units, offices and tourist retail/restaurant/information area. This development was taken into consideration during the design of this development and in particular the siting of the proposed control building.

The Newry River, which is a tidal river leading into Carlingford Lough, can be in excess of 280m wide at high tide. At low tide, the main channel is relatively narrow, approximately 40m wide, exposing mudflats and foreshore on either side.

The site lies within an ecologically sensitive area with deciduous woodland and the foreshore in the south and the inter-tidal mudflats in the north all possessing nature conservation designations. A bird roost has been identified has been identified on the southern foreshore approximately 70m southeast of the navigational beacon near Ferry Hill.

There are a number of important monuments in close proximity to the site including the Narrow Water Castle, which was built in 1837 in a Tudor Revival style, and the associated Keep, which is believed to have been built in 1560. In addition, there is a medieval motte located directly adjacent to the A2 roundabout. This is thought to be the location where King John crossed Carlingford Lough in 1210.

The site is also situated in an area of high landscape quality and high visual amenity, the status of which is confirmed by the protective landscape designations in the Development Plans of both jurisdictions.

3.3 Topography

In the south, the topography is dominated by the steep mountains of the Cooley Peninsula. In proximity of the study area, the land slopes from Anglesey Mountain (422 mOD Malin Head/Belfast) down to the Newry River at sea level. The level of the R173 Omeath Road ranges between 15 mOD and 19 mOD (Malin Head/Belfast).

The highest local point is Ferry Hill (23 mOD Malin Head/Belfast), although it is obscured by the surrounding forest.

The topography on the north side of the study area gradually slopes towards the river as it is located within the foothills of the Mourne Mountains. The A2 dual carriageway roundabout, which is situated directly adjacent the Newry River, is at an approximate level of 3.5 mOD (Malin Head/Belfast).

Plate 3.1 Landscape Quality (view from Flag Staff)

3.4 Narrow Water Bridge Link and Approaches

3.4.1 General Route Alignment

The proposed Narrow Water Bridge will provide a new single carriageway link road, which will connect Omeath and Warrenpoint in counties Louth and Down, respectively (see **Figure 3.1** in Volume 3). It is intended that the proposed link would intersect the existing R173 south of Ferry Hill in the townland of Cornamucklagh. The total length of the scheme is approximately 660m.

A new roundabout will be required, where the link road connects to the R173 Omeath Road. The route, which commences at the proposed Cornamucklagh Roundabout, heads towards the Newry River following the existing field boundaries. The vertical alignment generally reflects the existing terrain, which descends from 19m OD along the R173 Omeath Road to sea level, on the southside, however, some “cut and fill” will be necessary to ensure a smooth flowing alignment.

The route straightens and gently rises as it approaches the river avoiding the stone tower to the north. Upon reaching the river’s navigational channel, the alignment descends to tie into the A2 dual carriageway at the existing roundabout, which is situated directly adjacent the Newry River at 3.5m OD above sea level (Malin and Belfast). The existing A2 roundabout will be modified to accommodate this additional link.

The geometric standards used in the design of the road generally follow the requirements of the National Road Authority's Design Manual for Roads and Bridges (NRA DMRB) and the Highway's Agency Design Manual for Roads and Bridges (UK DMRB). A 60kph Design Speed is deemed appropriate for this road link as it is a short length of carriageway (620m) between two roundabouts. The link roads horizontal and vertical alignments, which are shown in **Figures 3.2 and 3.3** in Volume 3, have been designed in accordance with TD 9 of the National Roads Authority Design Manual for Roads and Bridges (NRA DMRB) and TD 9 of the UK DMRB and comply with the following design criteria as outlined in Table 3.1 below.

Table 3.1 Design Standards for Horizontal and Vertical Alignment

Stopping Sight Distance	**Distance**
Desirable Minimum Stopping Sight Distance	90
One step below Stopping Sight Distance	70
Two steps below Stopping Sight Distance	50
Horizontal Curvature for 60kph Design Speed	**Radius**
Minimum R without elimination of adverse camber and transitions	720
Minimum R with Superelevation of 2.5%	510
Minimum R with Superelevation of 3.5%	360
Desirable Minimum R with Superelevation of 5%	255
Vertical Curvature for 60kph Design Speed	**'K' Value**
Desirable Minimum Crest Curve	17
One step below Desirable Minimum Crest Curve	10
Desirable Minimum Sag Curve	13
One Step below Desirable Minimum Sag Curve	9

3.4.2 Facilities for Pedestrians and Cyclists along the Narrow Water Bridge

The proposed Narrow Water Bridge includes the provision of pedestrian and cyclist facilities between the proposed Cornamucklagh Roundabout on the R173 and the A2 roundabout. Both the Cooley Peninsula and the Mourne Mountains are popular among hill walkers and cyclists, therefore, it is important that the Narrow Water Bridge should cater for pedestrians and cyclists, particularly given that it is being promoted as a tourist bridge.

On the northern approach to the structure a 3.0m combined cycle / footway is provided on either side of the carriageway. This combined cycle / footway will tie into the existing footpath on the A2 roundabout. The cyclists will be able to access this combined cycle / footway via the dished kerbs that are to be provided at crossing points. The 3.0m combined cycle / footway is continued across the opening span. The rolling bascule pylons and cables act to segregate pedestrians and cyclists from traffic. The footway and cycleway diverge around the cable anchors on the main span providing a dedicated 2.0m footway and 1.5m cycle track on each side of the bridge (refer **Figure 3.9** in Volume 3). After approximately 100m the footway and cycleway merge once more to give a 3.0m combined cycle / footway (refer **Figure 3.4** in Volume 3).

On the southern approach, the western combined cycle / footway terminates shortly after leaving the structure while the eastern cycle / footway gradually reduces from 3.0m to 1.75m wide. This 1.75m combined cycle / footway, which is separated from the roadway by 0.75m grass segregation continues up the hill to the proposed Cornamucklagh Roundabout (refer **Figure 3.4** in Volume 3).

Presently, there are no pedestrian or cyclist facilities on the R173 Omeath Road, hence the termination at the proposed Cornamucklagh Roundabout. Furthermore, the population centres are Omeath, Warrenpoint and Newry. Therefore, it is considered appropriate that pedestrian and cyclist facilities should be provided on both sides across the bridge but only on the eastern side on the southern approach to the structure.

Dedicated uncontrolled pedestrian and cyclist crossing points at 60m to 100m intervals are to be provided on the bridge.

3.4.3 Road Cross-section

The following minimum road cross-sections are proposed for the Narrow Water Bridge project (refer **Figures 3.4** and **3.7** in Volume 3**)**:

Bridge Cross-section:

• 2 x 3.00m carriageway	6.00m
• 2 x 0.30m setback	0.60m
• 2 x 0.30m barrier / separator	0.60m
• 2 x 0.30m working width	0.60m
• 2 x 0.90m cable anchor	1.80m
• 2 x 3.00m combined cycle / footway	6.00m
Total width	**15.60m**

Bridge Approach Road Cross-section:

• 2 x 3.00m carriageway	6.00m
• 2 x 0.50m hard strip	1.00m
• 1 x 0.75m segregation	1.50m
• 1 x 1.75m combined cycle / footway	3.50m
• 1 x 0.50m verge	0.50m
• 1 x 3.0m verge	3.00m
Total width	**15.50m**

This is consistent with NRA TD27/00 Annex A, which suggests that the cross-sections for non-national roads should be between 5.5m and 7.5m wide. This is considered to be the narrowest cross-section that could be adopted to accommodate the movement of vehicular traffic and cyclists and pedestrians along the link.

This cross-section is considered to be appropriate given the main objective of the scheme is to assist the social economic development of the area through enhancing the tourist amenity of the area and promoting interaction between the communities on either side of the border. In order to achieve this objective, the Narrow Water Bridge should be attractive to tourists including pedestrians and cyclists. It is desirable that traffic is calmed across the bridge. Research has shown that carriageway width is an important factor in limiting vehicular speeds and therefore, a 6.00m carriageway has been selected.

Furthermore, the Narrow Water Bridge connects the R173 Omeath Road with A2 roundabout, which is situated north of Warrenpoint. Although the A2 is a dual carriageway north of Warrenpoint, the R173 Omeath Road is a narrow single carriageway, which is only 6.00m wide.

The Narrow Water Bridge will act as a tourist link between the Cooley Peninsula and the Mourne District and therefore, must accommodate tourist coaches and buses. A 6.00m wide carriageway can accommodate two coaches passing alongside each other. The maximum width of a coach neglecting wing mirrors is 2.5m.

The road markings delineating the carriageway cross-section shall be in accordance with the Department of Transport Traffic Signs Manual in the Republic of Ireland and the Department of Regional Development (Northern Ireland) Traffic Signs Manual in Northern Ireland. Similarly, the road signage shall be in accordance with the Department of Transport Traffic Signs Manual in the Republic of Ireland and the Department of Regional Development (Northern Ireland) Traffic Signs Manual in Northern Ireland. The movement joint between the fixed cable-stayed span and the rolling bascule opening span shall define the boundary between the different signage and road markings schemes applied in the various jurisdictions. The Department of Transport Traffic Signs Manual shall apply south of this boundary while the Department of Regional Development (Northern Ireland) Traffic Signs Manual shall apply north of this boundary.

3.4.4 Junctions

A new roundabout is proposed where the Narrow Water Bridge link intersects the R173 south of Ferry Hill in Cornamucklagh. Although the primary objective is to allow traffic to safely negotiate the link with the R173, this roundabout has the added benefit of calming traffic locally.

The roundabout design utilises the TD16/07 design standard and has been designed as a ‘Large’ sized roundabout as it is considered safer in road safety terms than a smaller roundabout on the R173 at this location.

The Roundabout geometry is in accordance with TD16/07, with an Inscribed Circle Diameter (ICD) of 50m. Entry widths are 6m minimum, effective flare lengths are 30m approx and an entry radius of 20m and exit radius of 60m minimum has been generally adopted throughout.

Access from the north will be provided from the existing A2 roundabout. The existing 3-arm roundabout will be upgraded to accommodate an additional link. The modifications to the roundabout will be in accordance with the same standard as above.

Pedestrian and cyclist movements have been considered in the design, such that pedestrians and cyclists will be easily guided around these junctions.

The Transport Research Laboratory software programme ARCADY assesses capacities, queues and delays at roundabouts. Both the Cornamucklagh and A2 roundabouts were assessed using the heaviest estimated traffic flows and were shown to operate satisfactorily during the Design Year (2033). A more detailed discussion on the operational capacity of these roundabouts can be found in Chapter 5 Traffic and Transport Impacts.

3.4.5 Queuing Facilities

The bridge is required to open to accommodate marine traffic. It is predicted that the entire opening operation of the bridge will take approximately 20 minutes to complete. This is based on the following assumptions:

• Bridge section to fully open	5 minutes
• Passage of marine vessel through bridge	10 minutes
• Bridge section to close	5 minutes
	20 minutes

While the opening operation is taking place traffic on either side of the Newry River will queue. Therefore, sufficient length of carriageway is required to accommodate these subsequent queues. It is conceivable that queue lengths could extend back to the A2 Roundabout and impact on its operational capacity. Should this occur alternative mitigating measures would need to be provided to ensure the safety of all road users and that the operational capacity of the adjacent junctions remains unaffected. Therefore, traffic management proposals, include road markings, VMS signage and gantries are required to ensure the roundabout continues to flow freely. These proposals are being developed in conjunction with Roads Service in Northern Ireland and Louth County Council and will be finalised at detailed design stage.

In addition, it is proposed that a closed circuit television (CCTV) system be installed on the bridge structure. The CCTV system would be linked with the Louth County Council offices in Dundalk to enable activities on the bridge to be monitored at all times. In conjunction with this, it is proposed that there will be a facility to over-ride the messages on the VMS gantries and signage. Therefore, in the case of an road traffic incident occurring on the bridge, this facility would allow the emergency services to re-direct traffic away from the accident zone if required.

3.4.6 Parking

There is an existing lay-by on the northbound carriageway of the A2 dual carriageway situated between the A2 roundabout and the Narrow Water Keep (see Plate 3.2 below). The lay-by, which has recently refurbished by the Loughs Agency, has been provided to provide parking for visitors to the Narrow Water Park. It is 6m wide and approximately 110m in length excluding entry and exit tapers. The parking layout is informal with the exception of the two mobility impaired parking spaces at either end of the lay-by. It is considered that the lay-by can accommodate 18 vehicles parallel to the kerb including 2 mobility impaired vehicles. Based on visitor information between 21st April 2011 and 31st August 2011, it is estimated that between 3 and 4 vehicles utilise this lay-by at peak times. It is only during exceptional circumstances that the parking provision of the lay-by is exceeded.

It is possible that the parking demand at this location will increase due to the provision of the Narrow Water Bridge. However, it is not anticipated that the increase in the parking will compromise the safe operation of the existing lay-by. In the worst case, it is estimated that an additional 9 vehicles will utilise the lay-by at peak times. Even though this is a two- or three-fold increase in parking demand, the lay-by can easily accommodate these additional vehicles. Therefore, it is not proposed to provide any additional parking spaces as part of the Narrow Water bridge scheme. It is difficult to accurately predict tourist traffic, and therefore, it is recommended that the parking demand at this lay-by monitored by local authorities following completion of the bridge.

Plate 3.2 Existing parking adjacent to Narrow Water Keep

3.5 Proposed Structure

3.5.1 Consultants Brief

Roughan & O'Donovan Consulting Engineers were engaged by Louth County Council to undertake engineering consultancy services for a proposed bridge and associated road works at Narrow Water on the Newry River.

The brief included the delivery of the following objectives:

(i) *"The bridge design must reflect its assistance to the social economic development of the area, especially through the growth of tourism and cross-border community co-operation;*

(ii) *The design must take account of its sensitive location in an environmentally protected area (candidate Special Area of Conservation, Area of Special Scientific Interest and Area of Outstanding Natural Beauty);*

(iii) *The design will cater for tourist traffic; and*

(iv) *The bridge is required to open to accommodate marine traffic. This opening must be able to accommodate tall ships and other leisure craft. A separate Navigational Report has been compiled and will be supplied with the planning application."*

3.5.2 General Description

Cable-Stayed Bridge with Rolling Bascule Opening Span

The structure is a two span cable stayed bridge with an asymmetric arrangement. The south span is 138.35m and the north span is 56.8m giving a total length of 195m.

All towers are located at the edge of the bridge over the abutment foundation and are leaning back 56 degrees towards the outside of the main crossing. Neither tower has back stays.

The asymmetry of the span is reflected in the tower heights, while the south tower is approximately 84m high and the north tower is only 32m high. Additionally, the south tower is located transversally on the centre line of the bridge while the north tower consists of twin cantilever towers located on each side of the structure.

The deck has a linear variable depth along the south span from 2.0m at the south abutment to 1.5m over the central pier, keeping a constant depth of 1.5m along the north span. The bridge shows no skew at any of its three supports.

The south abutment will be integral, connecting monolithically the abutment, the south tower and the deck. The bridge will have a construction joint at the intermediate pier and at the end of the north abutment, as required to allow the opening of the north span.

Plate 3.2 Photomontage of Proposed Narrow Water Bridge from southern side

Plate 3.3 Photomontage of Proposed Narrow Water Bridge in open position

The deck will be an orthotropic steel deck supported from the steel-concrete composite towers.

This bridge design is illustrated on Figures 3.5 – 3.12 in Volume 3 and on Plates 3.2 and 3.3 above.

3.5.3 Detailed Description of Proposed Scheme

Span Arrangement

The span arrangement is a two span structure over the Newry River, the south span has 138.5m and the north span has 56.8m. The structure shows articulations at both the central pier and the north abutment.

Approaches Including Run on Arrangement

The proposed link road is constructed on embankments of side slope 1 (V) in 2 (H) at the approaches to the bridge. This slope has been adopted to ensure that the toe of the embankments do not impede on to the river tidal zone.

The embankments will be constructed in suitable fill material in accordance with the specification. The backfill to the abutment will consist of well compacted granular material.

Substructures

The end supports consist of reinforced concrete piled abutments.

The north abutment is a hollow structure to accommodate a counter weight which is part of the north span when the bridge opens. The abutment also includes the machinery required to open the bridge and it will have appropriate access for inspection and maintenance.

The piers consist of steel driven piles of small diameter with a concrete cross head where both cable stayed decks will be supported.

The pier location has been chosen so that the piers have a minimum dimension and provide a navigational channel of at least 25m width.

See **Figures 3.6** to **3.8** in Volume 3.

Superstructure

Deck

The cable-stayed deck cross section consists of two strengthened steel orthotropic boxes with orthotropic top slabs to carry the traffic loads. The twin deck boxes will be connected with a transversal rib every 5.0m. Two cantilevers of 3.00m on each side, made of steel orthotropic slabs are provided to accommodate the footpaths and cycleways along the bridge.

The steel deck will have a depth varying linearly along the south span from approximately 2.0m at the south abutment to 1.5m at the central support keeping a constant depth of 1.5m along the north span. The deck will be supported by cables with a 10m longitudinal spacing on both spans.

Towers

The south tower, which is 86m high will have a dimensions of 4.00 x 3.00 metres at the top to 4.50 x 3.50 metres at the bottom (dimensions are given longitudinally and transversally), the tower will be a steel composite structure with an outer steel plate connected to a concrete hollow section that provides both additional counterweight and structural capacity. Additionally, there will be provision for prestressing cables running along the back face of the tower and anchored at different heights and at foundation level. These cables will be accessible on both ends for inspection and maintenance.

The two northern towers, which are 33m high will have a constant dimension of 2.10 x 1.0m and will consist of a steel section filled with non structural concrete. The concrete will act purely as counterweight.

Cable-stays

The cable-stays are small diameter stays, which allows for greater redundancy, improved aesthetics and ease of replacement with minimal effect on service during possible replacement scenarios. The cable-stays will be parallel wires or equivalent with multiple layers of corrosion protection and will be designed in accordance with the latest international recommendations. The cable-stays will be anchored to both the deck and the pylon.

Foundation Type

Due to the heavy loads expected in both abutments and the geotechnical conditions determined by site investigations, all of the foundations will be piled to some extent. Based on the available site investigation information it is expected that all of the piles supporting the structure are to be concrete bored piles of 900mm diameter. Based on the distribution of the rock cores' unconfined strength and point load test results, and the frequency of discontinuities in the rock, it is assessed that on a preliminary basis, the design of the 900mm diameter bored piles with 5m long rock sockets should be adequate to support the structure.

South Abutment

It is expected that the quantity of the piles will be 10 No. with an average length of approximately 15m. A coffer dam is required to facilitate reinforced concrete construction of the pilecap in the dry.

North Abutment

To accommodate the opening mechanism discussed below, the north abutment will be constructed in a secant piled coffer dam extending down through boulders and into the sandstone rock below. Approximately 10m depth is to be constructed, requiring a deep dry coffer dam.

Central Pier

The central pier is to be piled as it is located within the river and as already stated, its dimensions have to be minimized to avoid any affecting the water regime during tidal flows. Based on the preliminary design, the quantity of the piles at each pier location will be 3 No. rotary bored piles with an approximated length of 10m to 15m.

Navigation Beacon

The supports to the navigation beacon are to be piled, with a wider pilecap base to be constructed to allow for temporary works. A dry coffer dam may be required, but alternatives may be possible.

Opening Mechanism

It is a navigational requirement of this crossing to provide a 20m wide navigational channel to water traffic and for this reason the north span will have a rolling bascule configuration.

The rolling bascule and opening mechanism is housed in the hollow northern abutment and the control mechanism shall be manually operated from the associated control building (refer to **Figure 3.13 in Volume 3**). The control building is located to afford good visibility of the navigation channel, the roadway and all pedestrian and cycle lanes.

Proposed Mode of Operation

The span will roll back away from the channel through an angle of approximately 56 degrees. The span will be operated using two hydraulic cylinders pinned to the lower portion of the counterweight pit at their lower end and to the bottom of the counterweight at their upper end. The span shall be balanced and the cylinders so arranged such that the horizontal load will not exceed 10% of the vertical load at the rolling tread interfaces for any position of span opening under all operational wind load cases. The corresponding percentage for any holding wind load case shall not exceed 17%. For design purposes the maximum horizontal operational wind load shall be assumed to be 0.5 kN/m^2 acting upon any vertical projection of the rolling span under any position of opening and the maximum assumed vertical operating wind shall be assumed to be 12 kN/m^2 acting vertically upon the horizontally projected surface of the span in the closed position only. For holding the span in any fixed position of opening the wind shall be assumed to be 1 kN/m^2 acting horizontally upon any vertical projection of the span.

The hydraulic cylinders shall be designed such that under all operating and holding conditions the maximum static design pressure shall not exceed 125 BAR when two cylinders are operating or 250 BAR with only one cylinder operating. The cylinder manufacturer shall verify that the cylinders are rated for service throughout their full range of motion for all operating and holding load cases. The entire hydraulic system shall be rated at 250 BAR minimum. The hydraulic system shall meet the requirements of “The American Association of State and Highway Transportation Officials” (AASHTO) for movable bridges in addition to any local or national codes having jurisdiction over this project. The hydraulic power unit (HPU) pump capacity shall be sized such that the span can be opened or closed in no more than 150 seconds including acceleration and deceleration periods at the beginning and end of travel. The HPU shall normally run using a minimum of two motor and pump units to provide the necessary flow with provisions to run the system from one pump unit only if necessary for maintenance purposes. A reservoir shall be provided with sufficient volume to equal at least twice the total rated pump flow in litters per minute or sufficient volume to store the complete volume of oil contained in the two cylinders whichever is greater.

Span locks shall be required to lock the tip of the span to the adjoining span at the rest pier. The locks shall be designed to resist all applied live loads and to prevent opening of the span inadvertently using the hydraulic cylinders. A minimum of two span locks shall be required consisting of guided lock bars driven into receiver sockets on the adjoining span. The lock bars can be actuated using either electro-mechanical devices or hydraulic cylinders. In either case the actuators themselves shall not resist any live load once the lock bars are engaged and vehicle traffic is allowed on the bridge.

Tail locks may be required to resist live loads on the counterweight for that portion of the counterweight located behind the centre of rotation and exposed to vehicle traffic. If tail locks are required they shall be designed to resist all live load when the span is open to vehicle traffic then swing out of the way to allow the span to open when necessary. Tail locks can be operated using either electro-mechanical or hydraulic actuators. In either case the tail locks if necessary shall be designed such that when engaged they are in firm contact with the mating surface prior to live load being imposed. The actuators themselves shall not resist any live load once the tail locks are engaged and vehicle traffic is allowed on the bridge.

The control system shall be designed to interlock all the various components such that it will not be possible for the operator to open or close the bridge out of proper sequence. The hydraulic cylinders shall have the capability of being controlled using an open or closed loop system with position feedback. This system shall work with either cylinder operating or both. During operation the system shall monitor position and pressure as well as temperature at all times and incorporate sufficient alarms and shut-downs to prevent damage to the hydraulic system in the event of a malfunction.

Location of Operating and Control Mechanisms

The operator house has been designed and so located to offer good visibility of both, the navigation channel and roadway as well as all pedestrian and cyclist lanes. The use of CCTV cameras may be required to allow proper visibility of all these areas for proper safety. The operator consul shall incorporate a simple ergonomic design that allows the operator to pay attention to what is going on at the site while operating the bridge.

Electricity Power Supply and Distribution

The span operating machinery and pumps will be powered by three phase industrial duty electric motors. A substation will be required if ordinary industrial three phase power is not available close to the bridge in order to step the high transmission voltage down to medium and low voltage for use with electric motors. The stepped down industrial voltage power will be used to directly power the hydraulic pump motors and any electro-mechanical devices such as span locks or tail locks through motor starters and/or electronic controllers. The voltage will further be stepped down using additional transformers to provide single phase power used for lighting, control and for other uses.

Communications Systems

Typically the bridge operator will have a normal phone line available for communication as well as an intercom system to communicate between the operator control room and other areas where maintenance personnel may be located such as the electrical control room or the pier area where the hydraulic power unit is located. The regular phone line can be used to communicate with emergency personnel as well as marine personnel who can call in to request a bridge opening. In some cases a loud speaker is provided allowing the operator to give instructions to pedestrians, cyclists, motorists or marine personnel. CCTV cameras are also used on many bridges to allow the operator to see all areas of access to the moveable span. It is intended that the control room may also have direct connection with the Police Service Northern Ireland Control Room in Newry for emergency incidents.

Plant Room

The span operating machinery will be located within the confines of the bascule pier. This machinery will primarily consist of two large hydraulic cylinders piped to a hydraulic power unit (HPU) located nearby. The electric pump motors and valves for the HPU will be controlled from the electrical control room and operated from the operator station. Maintenance provisions must include a method to replace the hydraulic cylinders and HPU valves, motors and pumps without excessive effort or expense. Typically this is done by incorporating hatchways in the bridge deck or walkway areas or large openings in the pier walls. Sometimes electric cranes are included in the plant room for this purpose.

All equipment should be protected from excessive moisture or direct water contact. Sump pumps shall be provided to remove any water that may enter the counterweight pit area. The HPU should preferably be located inside a protected room within or next to the bascule pier. The HPU shall be manufactured using corrosion resistant components and properly protected from corrosion for long life in the anticipated environment. The electrical controls shall be located inside a room protected from the outside environment which includes proper ventilation and heat if necessary.

3.5.4 Aesthetic Consideration

The bridge has a dramatic profile giving a spectacular appearance to the crossing. This fact is enhanced by the opening system of the north abutment where the deck of the north span rolls back with a bascule movement towards the abutment to achieve an opening position where the deck follows a line parallel to the south tower. This effect can be appreciated in the photomontages shown in Plates 3.4 and 3.5 below.

Plate 3.4 View from A2 on Newry side of Narrow Water Castle (Closed Position)

Plate 3.5 View from A2 on Newry side of Narrow Water Castle (Open Position)

The bridge has been designed as a Signature Structure to mark this historic, international link between the Republic of Ireland and Northern Ireland. It was considered that the substantial natural and cultural heritage warranted a 'signature structure' and that the dramatic landscape possessed the ability to accommodate such a structure.

The bridge aesthetics were thus chosen to reflect the unique character and nature of the bridge setting. The southern side at the intersection of the Newry River and Carlingford Lough is dominated by rugged mountains, predominantly, Anglesey Mountain. The northern side is dominated by low lying rolling parkland associated with Hall's Estate and Warrenpoint golf club. On examination of the site at a closer viewpoint, the southern side is dominated by the high trees of Ferry Hill Wood whilst the northern side consists of low-lying urban roads and parks. This examination of the global and local topography revealed an asymmetric nature to the crossing, which led the design team away from the initial thought process that the most suitable bridge structure at this location would be symmetrical in nature. Continuing on the asymmetrical nature of the crossing, when the detailed bathymetric survey of the river was examined, this also revealed that due to the sweeping bend of the river at the location of the bridge, the navigable river channel is also asymmetric with the centre of the river channel being located towards the northern side of the channel.

This overwhelming asymmetry of the bridge site combined with the challenging aspect of trying to ensure that the bridge design in the closed position will be viewed as one continuous structure led to the development of this option, an inclined cable-stayed bridge visually connected to a rolling bascule opening bridge. When viewed from a distance, the tall inclined tower on the southern side reflects the inclined slopes of the mountain in the background and the smaller yet still distinctive rolling bascule tower counterweights reflect the more low-lying topography on the northern side. The continuous nature of the flowing steel structure flowing from the tip to the bottom of the inclined tower and continuing in the deck across the river and returning to a modest height at the tip of the tower, results in the entrance to Newry River from Carlingford Lough being framed like a distinctive cradle, yet almost surprisingly, when the bridge opens, this physical and visually horizontal dominant element is broken to reveal a welcoming and most interesting nature to the entrance to the Newry River.

A further important consideration of this bridge design option, was to ensure that whilst the a structure with significant vertical elements could be accommodated in the topography, they could not interfere with views up and down the river towards Narrow Water Castle and Carlingford Mountain in the distance. As such the ability of the proposed bridge to frame and thus maintain these existing views was considered of significant aesthetic relevance.

These effects are clearly illustrated on the photomontages and are discussed in more depth in Chapter 8.

3.5.5 Proposed Lighting

At night, the bridge will be illuminated with an architectural lighting scheme. The lighting is considered important from a number of standpoints:

- To enhance the architectural significance of the structure;
- As a signature structure enhancing the importance of the setting;
- To provide a recognisable distance feature; and
- To allow birds in flight at night to avoid the structure and cable-stays.

The main concept of the lighting design is to ensure that the towers and cable stays are the strongest visual features at night.

Narrow beam luminaries mounted on the deck and anchorage abutments will be directed up at the cables and towers, picking out the structure and cable stays in coloured lighting. As the beams converge they will have the effect of strongly highlighting and framing the bridge structure. Light emitting fibre optics may be used to enhance this vision and define the cable stays.

The lighting scheme will reinforce the high quality aesthetic nature of the bridge. The narrow luminaries will wash the towers and cable stays in pale light, providing immediate recognition of the bridge’s setting.

The directed nature of the luminaries and the low level of luminescence provided will ensure that the neighbouring residents will not suffer from any glare, that there will be no impact on the fish movements within the Newry River and will ensure that any birds moving at night can see and avoid the bridge structure.

3.5.6 Navigation Beacon

The proposed bridge will interfere with the navigational beacon situated near Ferry Hill and therefore, the operation of the leading lights. Therefore, it is proposed to construct a new navigational beacon on the downstream of the proposed bridge. The new navigational beacon shall be installed in a reinforced concrete tower as shown in **Figure 3.15** in Volume 3. The new navigational beacon shall mimic the existing masonry navigational beacons in shape, dimension, colour and surface finish however the requirements of Warrenpoint Harbour authority and Carlingford Loughs Commission will be adhered to in the construction and finishing of the proposed beacon.

3.5.7 Control Building

A control building is required to facilitate the opening of the bridge. It is preferable that the operators in the control building shall have a clear unobstructed view to the bridge and along the river. Therefore, the proposed control building is located at the edge of the river on the north side approximately 200m from the bridge as shown in **Figures 3.16 to 3.20** in Volume 3.

The proposed control building is approximately 9.7m long and 7.4m wide single storey rectangular structure with a pitched roof. The wall nearest the river will be curved and contain a large bay window that will permit the bridge operators a clear unobstructed view of the river. The floor levels within the control building will be set 0.50m above the 1 in 100 year flood event.

The proposed control building, which is located a short distance upstream from Warrenpoint Harbour, is situated at edge of a derelict industrial site that contains dilapidated buildings, masonry rubble and other rubbish including furniture. However, as mentioned previously, planning permission has been granted on the site for a 60 bed hotel and 40-50 residential units. Therefore, the external appearance of the control building has been chosen to integrate into a residential environment rather than an industrial zone. Therefore, the external walls shall have a grey rendered finish while the roof tiles will be slate giving the control building the appearance of a residential dwelling.

A vehicular access is to be provided off the A2 approximately 100mm south of the A2 roundabout. It is anticipated that the access road is only lightly trafficked as it is only to be utilised when the bridge is to be opened. Therefore, the access will be a permeable gravel access roadway of similar construction to NRA Road Construction Detail RCD/700/6. It is proposed that the access road is partially constructed prior to commencing the construction of the control building. Therefore, it can be used as a haul road for the transportation of materials during construction of the control building.

A mains water connection is proposed. It is proposed to pump foul effluent to a stand-off manhole near the northern boundary and discharge by gravity to the existing sewer at the edge of the A2. The control building roof is proposed to drain to a soakaway.

It is proposed that the standby generator situated within the control building shall be powered by natural gas via a connection of the gas main located along the A2.

3.6 Earthworks

On the south side, the ground conditions along the mainline typically consist of dense sands / gravels and stiff clay overlying 5-10m rock. On the north side, the soil consists of made ground, gravels, alluvial mud and shingle on fractured rock. The river consists of alluvial mud, clays, gravels and boulders over fractured rock.

In the preliminary design, both cuttings and embankments are assessed at side slopes of 2 horizontal to 1 vertical. Local steepening of slopes may be required to maximum 1.7 horizontal to 1 vertical due to site constraints. Geosynthetic reinforcement or selected frictional fill may be required to achieve this.

Due to topography and alignment, cuttings of up to 4m depth through overburden soils and fill embankments up to 4m height will be required on the south side of the bridge, resulting in a net earthworks balance on that side of the bridge. Extraction of soils is likely to be carried out by mechanical methods such as digging with average plant and machinery. Based on the frequency of gravels and stiff clay soils observed during ground investigation, it is considered that the percentage reuse will be high, in the range of 80-90%. Part of the quantity will be topsoil suitable for spreading on landscape areas. Minor quantities of imported materials will be required to make up the difference.

On the north side it is mainly fill up to a height of 4m that will be required. In carrying out these works on-site, an earthworks volume deficit of approximately 8,250 cubic metres (assumed to be equivalent to 20,000 tonnes) will need to be imported to site as shown in Table 3.2 below. The soft ground present will need to be excavated and replaced with granular fill and possibly rock armour. Depths affected range up to 1.3m. Class 6A will be used if it is to be placed under water. This volume may alter slightly when allowance is made for pavement materials and proposed landscaping.

Table 3.2 Earthworks Quantities

Quantities	Area	**Cut**	**Fill**	**Soft**	**Balance**
		m^3	**m^3**	**m^3**	**m^3**
	South of Bridge	8,700	8,700	-	-
	North of Bridge	-	8,250	-	-8,250
	Totals	8,700	16,950	-	-8,250

Unacceptable material may be transported for disposal to a licensed facility. Any such exported earthworks material that requires to be disposed of off site will be subject to the Waste Management Acts, 1996 to 2008, the NRA *Guidelines for the Management of Waste from National Road Construction Projects* (2008) and all other relevant legislation as well as any conditions imposed by the Planning Authority.

3.7 Drainage System

The proposed road will be constructed within the catchment of the Newry River. The drainage system serving the new road discharges to the Newry River and other local watercourses. The section of catchment traversed by the proposed road is predominantly rural and is characterised by steep gradients falling towards the Newry River. The proposed drainage system for the Narrow Water Bridge is indicated on **Figure 3.13** in **Volume 3**.

3.7.1 Mainline Road Drainage

The proposed mainline road drainage system shall be designed in accordance with the NRA DMRB and the current best practice guidance for drainage i.e. “Sustainable Urban Drainage Systems” or SUDS.

Drainage of the mainline will generally consist of over the edge drainage into ditches or swales. The typical details of the mainline drainage will be similar to those shown in Plate 3.6 below. These drainage channels will seed naturally thereby fitting into the surrounding landscape. They will also operate as attenuation and treatment in the proposed drainage system by slowing the velocity of the runoff thereby facilitating settlement.

Appropriate planting along the proposed swales will be carried out to improve the effectiveness in retaining suspended solids. If required, baffles will be used to further attenuate the flows in order to facilitate treatment of the road runoff pollutants.

A kerb and gully drainage system will be provided at the proposed Cornamucklagh Roundabout and A2 Roundabout. In addition, a petrol interceptor shall be provided at the A2 Roundabout prior to connecting with the existing system. On the south side, the gullies will connect into the swales and interceptor ditches while on the north side the drainage system will be connected via a carrier drain into the existing drainage system.

Plate 3.6 Typical Detail of Drain at Toe of Embankment

In accordance with HD 33/06 of the DMRB, the road drainage will be designed to accommodate a 1 in 1 year rainfall event without surcharge and a 1 in 5 year rainfall event, with surcharge levels below finished road level. This approach will enable the road drainage system to accommodate higher rainfall intensities for short storms. Rainfall intensities will be increased by 20% in order to take into account the future possible effects of climate change.

The proposed drainage system will be effective in the removal of suspended solids and associated heavy metals through the physical processes of settlement, filtration and adsorption. The swales and ditches will be planted with appropriate vegetation such as reeds, pond weeds and grasses however the final details of the wetlands will be confirmed at detailed design stage of this project and will be accordance with the 'HA 103/06 Vegetated Drainage Systems for Highway Runoff'. These pollution control measures will ensure that all runoff undergoes a high level of treatment prior to discharge to the sensitive receiving waters of the Newry River.

The control building roof is proposed to drain to a soakaway. It is proposed to pump foul effluent to a stand-off manhole near the northern boundary and discharge by gravity to the existing sewer at the edge of the A2.

3.7.2 Bridge Drainage

It is proposed to collect the surface water off the bridge deck using kerb drains which will outfall to the mainline road drainage system. Deck and carriageway falls are provided to ensure that no ponding on or beneath the deck surfacing occurs, this has led to a requirement for a minimum 0.5% fall in the vertical alignment. As described above attenuation, pollution control and spillage containment will be provided in the interceptor ditches to the prior to outfall. On the north side, mainline road drainage will connect into the existing drainage system via a petrol interceptor.

Runoff which collects in the base of the northern abutment will be conveyed into the mainline road drainage system on the north side via a pumped system.

3.8 Utilities

Enquires were sent to all known service providers identified within the Study Area, requesting details of both existing and planned installations within or adjacent to the study area. A Utilities Services Plans can be seen, as shown in **Figure 3.14** in Volume 3, outlining all services found at the site.

3.8.1 Electricity

On the southside, the Electricity Supply Board (ESB) has identified that the local distribution network consists of low to medium voltage overhead lines. There are no underground cables located within the constraints study area.

On the northside, the information Northern Ireland Electricity (NIE) provided indicates that there are no overhead lines or underground cables located within the area of interest. There are road lighting columns surrounding the A2 roundabout, which the Department of the Environment in Northern Ireland maintain.

There are no known high voltage lines or cables within the constraints study area.

A three-phase electrical supply will be required to power the mechanical and electrical equipment used in the opening of the bridge. A connection is required to the electricity supply network in Northern Ireland.

In addition, the control building will require electricity and therefore, shall be connected into the electricity network in Northern Ireland. It is proposed that the connection be provided along the access road to facilitate ease of construction and maintenance.

3.8.2 Telecommunications

Eircom is the only communication service provider with equipment within the constraints study area on the south side. The Eircom overhead cables typically follow the R173 Omeath Road and the surrounding local roads.

Similarly, British Telecom (BT) is the only communications provider on the north side of the Newry River. The BT underground cables follow the existing road infrastructure with cables on both sides of the A2 dual carriageway.

3.8.3 Gas

Firmus Energy have confirmed that a medium pressure (4 bar) distribution gas pipeline was laid along the A2 in 2010. This 180mm diameter PE100 pipeline passes beneath the north eastern portion of the A2 Roundabout. Although considerable care must be exercised at all time and particularly, when working near a gas main, it is not anticipated that this gas main conflicts directly with the works associated with the proposed Narrow Water Bridge Project.

The exact position of this underground service must be determined and verified on site in advance of undertaking any works in the vicinity of the gas main. Consultations shall be held and the appropriate mitigation measures shall be agreed with Firmus Energy, should a conflict between the works associated with the bridge and the gas main become apparent. Any works near gas plant should be undertaken in accordance with the Health & Safety Executive guidance HSG47 – Avoiding Danger from Underground Services and no mechanical excavators or power tools should be used within 500mm of any gas apparatus.

3.8.4 Water and Drainage Services

There are no known watermains or foul sewers located within the constraints study area on the southside of the Newry River.

On the northside, there is a watermain and foul sewer, which pass through the A2 roundabout, between the Burren Road and the A2 heading into Warrenpoint.

The provision of welfare facilities in the control building demands potable water. It is proposed, therefore, to connect into the existing waterman on the A2.

The Rivers Agency has also confirmed that there are two 1500mm diameter culverts under the A2 roundabout.

Chapter 4

Alternatives Considered

Chapter 4 Alternatives Considered

This chapter describes the route selection process which was undertaken and the bridge design options that were considered. The main reasons for selecting the preferred route and bridge design are subsequently outlined.

4.1 Legislative Requirement

The Statutory Environmental Impact Assessment Regulations in both the Republic of Ireland and Northern Ireland directly interpret the EIA Directive in requiring that the Environmental Impact Statement (EIS) / Environmental Statement (ES) contain the following information:

"an outline of the main alternatives studied by the road authority concerned and an indication of the main reasons for its choice, taking into account the environmental effects;"

4.2 Identification of Study Area

In the recent past three studies have been carried out to determine whether a bridge or car ferry link between the Cooley Peninsula and the Mourne District was feasible. These studies are:

- 'Omeath to Warrenpoint, Feasibility Study', 1979, Nicolas O'Dwyer and Partners;
- 'Carlingford Lough-Ferry Feasibility Study', 1993, Jonathan Blackwell and Associates; and
- 'Omeath – Warrenpoint Road Link, Feasibility Study', 2001, M C O'Sullivan and Co. Ltd (now RPS Consulting Engineers).

The 'Omeath to Warrenpoint, Feasibility Study' published in 1979 recommended a bridge crossing at the A2 Roundabout west of Warrenpoint. The 'Carlingford Lough-Ferry Feasibility Study' undertaken in 1993 only considered a ferry crossing and did conclude with some uncertainty that the operation of a ferry was economically viable. The 'Omeath – Warrenpoint Road Link, Feasibility Study' completed in 2001 compared bridge and road ferry options. It concluded that a bridge would be preferential to a ferry crossing and that this crossing should be located at the same crossing point identified in the 1979 study.

The 1979 and 2001 studies determined that a bridge crossing located within the vicinity of the A2 roundabout was viable. The study area for the current project was subsequently developed based on the environmental, engineering and economic constraints previously identified and incorporating the crossing point already identified by previous studies as being viable.

The study area for the proposed bridge is indicated on **Figure 2.1** in Volume 3 of this EIS/ES.

4.3 Identification of Potential Constraints

A data collection exercise was undertaken which focussed on determining the physical, environmental and engineering constraints which exist and which could affect the location and design of the scheme within the proposed study area. The Constraints Report identified the sensitivity of the natural and cultural environment and examined the existing topography, geology, road network and land-use in the immediate locality (Refer to Roughan and O'Donovan (2008) '*Narrow Water Bridge Constraints Study Report'*). This study gathered considerable information which was subsequently used to inform the route selection report.

4.3.1 Constraints Identified

The Constraints Study was carried out at an early stage of the project with the objective of gathering as much background information relating to the study area as possible. This data collection exercise focused on determining the physical, environmental and engineering constraints which exist and which could affect the location, design and progress of the scheme. The main constraints arising from the 'Narrow Water Bridge Constraints Study Report' by Roughan & O'Donovan dated June 2008 are listed below:

(i) The southern shoreline of Carlingford Lough is designated as Carlingford Shore candidate SAC and proposed Natural Heritage Area. As a consequence of its cSAC status it is imperative that there is no impact on the Annex 1 habitats for which the site is selected (refer to Natura Impact Statement, Appendix 7.2.3);

(ii) Carlingford Lough also contains two Special Protection Area designations, one in Northern Ireland and one in the Republic of Ireland. These are opposite each other, occur significantly to the east of the proposed development (from the harbour at Carlingford to Greenore Point on the southern shore; and from Killowen Point to Soldier's Point on the northern shore) and cover the intertidal areas therein. As a consequence of these designations it is important that there is no impact on the bird populations which form the Special Conservation Interests of these sites (refer Natura Impact Statement);

(iii) Carlingford Lough Area of Special Scientific Interest extends from the inner part of the Newry River to Cranfield Point - the entire northern shore of Carlingford Lough. This is a site of national nature conservation interest which is designated under the Environment (NI) Order 2002 (refer to Chapter 7, Section 7.2).

(iv) The water quality in Carlingford Lough is strictly monitored and controlled as it is a designated shellfish production site (S.I. 268 of 2006 (EC (Quality of Shellfish Waters) Regulations 2006)

(v) The tidal zone in the vicinity of Narrow Water is also regularly dredged for mussel seed and therefore, access to these grounds by fishing vessels must be maintained;

(vi) The study area lies within an area of high archaeological sensitivity. A number of listed monuments, including Narrow Water Keep and a motte, located just to the north of the A2 roundabout, occur in the immediate vicinity and the area possesses significant cultural history. It is crucial that the development does not physically impact or visually detract from these monuments. In addition, the archaeological studies indicate that the possibility of archaeological remains being discovered along the selected route is relatively high;

(vii) The landscape quality and visual amenity in the study area is very high. Planning policy, in both jurisdictions, protects the landscape quality and visual amenity from adverse development. The Narrow Water Castle is of particular importance in Northern Ireland as it's setting is specifically protected;

(viii) A previous flood study, commissioned by the Northern Ireland Rivers Agency, has shown that the 1:200 year flood event is 4.05m OD (Malin Head) (4.02 OD Belfast). Under these circumstances the A2 roundabout and approach roads, which are on the northern side, would flood.

4.4 Route Selection

Following the compilation of the Constraints Report, a Route Selection Study (refer Roughan & O'Donovan 2008 '*Narrow Water Bridge Route Selection Report*') was undertaken based on the above study area. This study consists of an assessment of the various potential route options on environmental, engineering and economic grounds such that a complete investigation and thorough analysis of the most feasible route corridors is undertaken.

4.4.1 Route Options

A number of initial routes were developed based on site visits and information recorded in the Constraints Study. The route options examined were as follows:

- Route Option A: Southern Corridor;
- Route Option B: Central Corridor;
- Route Option C: Northern Corridor;

These Route Options are illustrated on **Figure 4.1** in Volume 3.

Route Option A: Southern Corridor

This corridor commences south of Ferry Hill in the townland of Cornamucklagh. It departs from the R173 following the field boundaries as it heads towards the Newry River. It crosses the river south of the stone tower and connects with the A2 dual carriageway at the existing roundabout.

Route Option B: Central Corridor

The central corridor begins at Davies' Crossroads. It continues through the forest to the north of Ferry Hill and crosses over the dismantled railway line. The corridor follows the alignment of the existing road, traversing the Newry River 30m north of the slipway before connecting with the A2 dual carriageway 150m north of Narrow Water Keep.

Route Option C: Northern Corridor

This is the northernmost option. Its beginning is located between Davies' Crossroads and the County Bridge. The corridor heads north crossing a wide section of the Newry River. It ties into the A2 dual carriageway 600m and 1km north of the Narrow Water Keep and the existing A2 roundabout, respectively.

4.4.2 Assessment of Route Options

A Route Selection Exercise, and associated report, was completed in November 2008. The study consisted of an assessment of the various options on environmental, engineering and economic grounds.

Each of the three route options was specifically scored against:

- Engineering and Topographical Impacts;
- Planning and Socio-Economic Impacts;
- Aquatic Ecology an Sedimentation;
- Terrestrial Ecology;
- Landscape and Visual Impact;
- Geology and Hydrogeology; and

- Impacts on the Archaeological and Cultural Heritage.

These are detailed below and the findings are summarized in Table 4.1

Engineering and Topography

In the south, the topography is dominated by the steep mountains of the Cooley Peninsula, while on the north side the ground gradually slopes towards the river as it is located within the foothills of the Mourne Mountains. The main topographical constraint, which impacts on all route options, is the proximity of the A2 dual carriageway to the northern bank of the Newry River as this limits the vertical alignment over the navigational channel.

All three route options connect the R173 (B79) Omeath Road and A2 dual carriageway and therefore, would satisfy the traffic demand between the Cooley Peninsula and the Mourne District. However, Davies' Crossroads would appear to be particularly hazardous junction and therefore, it is preferable to avoid locating the bridge crossing nearby. Furthermore, the Roads Service Northern Ireland (RSNI) has indicated its preference for the Narrow Water Bridge to tie into the existing A2 roundabout as a second roundabout is undesirable to road users travelling along the A2 dual carriageway to Newry. On this basis, Route Option A has the least impact on the existing road network and is the preferred route option.

Existing utilities and services were identified within the Constraints Study. All three route options impact on electricity and communication cables, which can be easily diverted. The Rivers Agency (Northern Ireland) have confirmed the existence of two 1500mm diameter culverts, which impact on Route Option A, under the A2 roundabout. These culverts can be diverted and this is not considered a significant constraint.

Planning and Socio-economics

The proposed bridge will link Omeath and Warrenpoint. Omeath possesses a small population with commercial activity being based upon summer tourism and fishing and agriculture. Warrenpoint, on the other hand, is the second largest town in the Newry and Mourne district after Newry with a population of 7000. Warrenpoint's status as a service centre for the surrounding area is secured by the presence of its modern port and associated industrial area. However, similar to Omeath, Warrenpoint also has a strong history of tourism and continues to attract tourists for beach and specialist activity holidays.

In terms of the receiving environment the Constraints Study Report has shown that from both a social and economic viewpoint the existence of a bridge at any one of the route options would have a beneficial impact. However, in terms of physical usage of the bridge Route Option A provides the closest link to both Warrenpoint and Omeath and as such provides the better facility for cyclists and pedestrians.

Aquatic Environment

In terms of aquatic ecology the potential impacts of the three route options are very similar. In relation to the marine environment the Constraints Study Report identifies the most significant issues as being the release of sediments and contaminants into the water body. This issue is more likely to vary in respect of bridge design, than in respect of the suite of route options, and as such is addressed under Section 4.5 Bridge Design Options.

Terrestrial Ecology

The Constraints Study Report highlights that the area is of high nature conservation value and is covered by a number of nature conservation designations (refer to Section 7.2 for detail).

Each of the Route Options will have a similar impact on the mudflats of Carlingford Lough Area of Special Scientific Interest (ASSI) on the northern shore.

Route Option A will have a direct impact on a high tide roost used by the ASSI bird features mentioned. This roost is the Habitats Directive Annex 1 Habitat – salt marsh, although this is not a selection feature of Carlingford Shore candidate Special Area of Conservation (cSAC), which covers the southern shoreline. Route Option B will directly impact the mature deciduous woodland which forms an integral part of the candidate SAC. Route Option C will be a significantly larger span than the other two options and will result in direct impact on mudflats on both sides of the proposal and an area of woodland on the northern shore.

It is not possible to prevent the loss of deciduous woodland as per Route Option B. This is thus the least appropriate site in ecology terms – a decision which is supported by the fact that the woodland is included within the candidate SAC.

It is likely that Route Option A will result in the high tide roost being abandoned during the construction phase. However it is proposed to construct an additional and alternative high tide roost a short distance downstream and this is considered as likely to result in a negligible impact.

Route Option C will impact mudflats on both sides of the Newry River. These mudflats are potentially used as feeding grounds by some of the bird species. This option will also result in the loss of some un-designated woodland on the northern side.

On the basis of this information Route Option A was identified as having the least impact on habitats and species and from an ecological view point is the preferred option.

Landscape and Visual

The study area falls entirely within an area defined by both Louth County Council and Newry and Mourne District Council as being of very high landscape quality. Accordingly the development plans for both areas contain restrictive planning policies which are intended to prevent deterioration of either the natural or cultural landscapes in the area.

In order to assess the potential impact of any one of the route options they must be assessed in terms of their visual impact. The visual impact depends upon the critical views of the bridge which are available and thus is directly dependant on bridge design.

Route Option B, due to its proximity to Narrow Water Keep will have a very significant impact on the cultural landscape. In addition, one of the most significant short range critical views is on the approach to Narrow Water from Newry along the A2. On that basis, Route Option C, being located in front of Narrow Water as it is approached, will have a high visual impact. Similarly, an important long range critical view occurs from Flag Staff view point looking down the Newry River valley towards Narrow Water and Warrenpoint. Route Option C would directly interrupt this view whereas the views towards Route Option A, depending on bridge design, could be alleviated and mitigated by harnessing the presence of the cranes of the industrial area beyond.

Geology and Hydrogeology

The assessment of geological and geotechnical constraints for the three route options was carried out in advance of any specific ground investigation and is based on desk study information only.

The bedrock underlying all three routes is the same sedimentary greywacke turbiditic sandstone. It is known to be metamorphosed to hard hornfels adjacent to major intrusions such as the Slieve Gullion Complex, which all three options are relatively close to. The northern route option is the closest but is not necessarily any more likely to have been altered in this way. Hornfels is more dense than sandstone and much harder to excavate but less likely to have stability concerns. None of the proposed routes are situated on any fault-lines indicated on geological mapping.

The slope stability of excavations in rock is affected by the orientation of the alignment to the dip direction of the discontinuities in the rock when the dip angle is high, as it is in this case. Both the central and southern route options run almost orthogonal to the dip direction indicated on geological mapping. This means that plane failure would be the most likely mechanism for kinematic instability of rock masses daylighting in excavations. The northern route option runs at approximately 46° to the other two options, so wedge failure mechanisms are much more likely to be prevailing. The likelihood and severity of either failure mechanism is unknown without detailed information on discontinuities and groundwater conditions.

The topsoil types indicated on the southern riverbank show that the central route option is based predominantly on lithosols (soil derived from rock and typically very shallow) while the other two route options are indicated to be on a mixture of organic peaty podsolic clays and lithosols, also assumed to be relatively shallow. Any subsoils present are indicated to be tills derived from granite. Bedrock is indicated to be close to surface at all three options on the southern riverbank.

The alluvial soils at and adjacent to the river are generally soft to very soft. It would be preferable to minimise the length of soft alluvium over which the bridge alignment crosses. In particular it would be preferable to minimise the depth of alluvium encountered during construction. The central route option crosses a shorter distance of alluvium and river channel compared to the northern and southern route options. The depth of alluvium present at each location is currently not known.

The superficial groundwater aquifer on the northern riverbank does not extend to include the northern route option however it does cover the other two. None of the three route options propose to extend for any considerable distance into the northern riverbank.

There is no appreciable difference in the route selection based on geological, geotechnical or hydrogeological constraints.

Archaeology and Cultural Heritage

The Constraints Study highlights that the study area is located within a very archaeologically sensitive area. The sites shown include state monuments, such as Narrow Water Castle and its associated buildings, historic buildings and industrial heritage sites. Despite the fact that none of the options will directly impact physically upon any of these sites, there is a requirement within planning policy to minimise the visual impact and to protect the settings of these sites.

Route Option B will directly impact a slipway on the southern side and comes within 150m of Narrow Water Keep on the northern side. The impact on the setting of the Keep, forming as it does the entrance to Warrenpoint and the Lough, is too great for this option to be considered further.

Route Option A comes across at the existing roundabout on the A2. When compared against Option B, this will have a significantly reduced visual impact on the setting of Narrow Water. However it will still have some impact on the motte to the north of the roundabout and to the immediate setting of the tower and lighthouse.

Route Option C ties into the A2 600 metres north of the Narrow Water Keep and would appear to have the least direct impact. However, it should be noted that another potential constraint are as yet undetected archaeological sites and in that respect it is interesting that the Built Heritage Directorate of Northern Ireland Environment Agency identified, during the Pre-Application Discussion Process with Northern Ireland Planning Service, that Route Option A is their preferred route as they believe upstream to be the potentially richer archaeological zone.

Preferred Route

Table 4.1 summarises the above information. In order to determine the preferred route option all the routes were ranked against the various aspects considered in this route selection. The preferred route selected is the route that was considered most favourable overall.

Table 4.1: Summary of Route Options Assessment

Constraints	Route Options		
	Southern	Central	Northern
Engineering and Topographical	1	2	2
Planning and Socio-Economic	1	2	3
Aquatic Ecology	1	1	1
Terrestrial Ecology	1	3	2
Landscape and Visual	1	3	2
Geology and Hydrogeology	1	1	1
Archaeology and Architectural Heritage	2	3	1
Overall Rank	**1**	**3**	**2**

This process came out strongly in favour of the Southern Option (Route Option A – **Figure 4.1** in Volume 3).

In summary, this route option was identified as the preferred option for the following reasons:

(i) It is the shortest crossing and has the least impact on the foreshore and on terrestrial habitats;

(ii) Minimises the visual impact from Flag Staff (protected view) by harnessing the presence of the cranes of the industrial area beyond and being partly obscured by Ferry Hill;

(iii) Minimises the impact on the existing road network by utilising the existing A2 roundabout; and

(iv) Most advantageous for cyclists and pedestrians due to its proximity to Warrenpoint and Omeath.

4.5 Bridge Design Options

4.5.1 Moveable Bridge Design Options

Generally speaking there are three basic types of movable bridges in common operation; bascule, swing and vertical lifts. Each of these options, along with variations of each, was evaluated for suitability to this project. Each is described briefly below:

Bascule bridges rotate vertically about a horizontal axis called a trunnion. Bascule spans are generally counterweighted so that the power required to open or close the span is limited to that which is required to overcome inertia, wind and unbalanced forces and not actually to lift the full dead weight of the span. Electric motor and gear drives are commonly used to pivot the span about the trunnion although hydraulically actuated cylinders may also be used to provide the force required to move the span.

Swing bridges rotate horizontally about a vertical axis called the centre pivot. The swing bridge spans may either be symmetric about the pivot, or may have unequal length spans with the shorter span counterweighted, with the latter form referred to as a bobtail swing. Again, electric motor and gear drives are most commonly used to rotate the span about the centre pivot. Hydraulically actuated cylinders may also be used to provide the force required to move the span.

In the most conventional configuration, a vertical lift bridge has a simple span which raises and lowers guided by a tower on each end. One end of a set of wire ropes is fixed to the lift span, the other to a counterweight with a pulley, or sheave, between them. The sum of the counterweights roughly equals the weight of the span, thus providing a balanced system. Movement can be accommodated either by mechanizing the span, the sheave, or the counterweights.

Bascule and swing bridges were considered for the moveable span as described below.

4.5.2 Design Options Considered

Design Option 1 – Multi-span Bridge with Bascule Opening Span

This bridge option is illustrated on **Figure 4.2** in Volume 3 and consists of a northern approach embankment (57m), a northern fixed span (60m), a moveable span & substructure (61m), two southern fixed spans (60m & 48m) and a southern embankment (66m) resulting in a total bridge length of 238m. As a result of the multi-span nature of the bridge three significant (13m x 13m) piled substructures will be required in the Newry River.

Design Option 2 – Multi-span Bridge with Twin Swing Opening Span

This approach was developed around focusing on the bridge opening span as a gateway from Carlingford Lough to the Newry River. This bridge option is illustrated on **Figure 4.3** in Volume 3 and consists of a northern approach embankment (36m), two northern fixed spans (2 x 37m), a moveable span & substructure (49m), three southern fixed spans (2 x 37m) and a southern embankment (92m) resulting in a total bridge length of 234m. In this instance 5 piled substructures are required within the Newry River, with the two needed to support the opening span being significant structures (20m x 8m).

Design Option 3 – Cable-stayed Bridge with Rolling Bascule Opening Span

Option 3 has been chosen as a Signature Bridge Option to mark a unique and historic bridge crossing between the Republic of Ireland and Northern Ireland.

This bridge option is illustrated on **Figure 4.4** in Volume 3 and at the time of bridge options consisted of a northern approach embankment (42m), a northern fixed span (60m), a moveable span & substructure (49m), a cable-stayed suspended span (148m), a southern approach span (25m) and a southern embankment (35m) resulting in a total bridge length of 283m. The cable-stayed span is supported by a double plane of cable-stays which are anchored to an inclined vertical tower. The cable stayed nature of the bridge requires only one small piled leaf pier substructure to be located in the Newry River.

4.5.3 Hydrodynamics and Marine Modelling

Early consultations with the Loughs Agency and Warrenpoint Harbour Authority highlighted the importance of minimising the release of sediment during both the construction and operation of the bridge.

The presence of commercially licensed aquaculture beds (mussels and oysters) within Carlingford Lough directed the Loughs Agency to advise of the requirement to ensure that these commercial interests were not impacted by the release of either sediment or contaminants into the water body.

Warrenpoint Harbour Authority made it clear that any release of sediment could impact their dredging contract which is required to maintain the deep water channel and turning circle serving the harbour.

As a consequence of the above substantial constraints AQUAFACT International Services Ltd. were commissioned to develop a computer model to assess the hydrodynamics of Newry River Estuary and to assess the effects of a proposed bridge on the water circulation patterns of the estuary. With respect to developing the hydrodynamic model, Bridge Options 1 and 2 are considered as one within the model due to the requirement in both designs to have substantial bridge pier foundations in the central river channel. The cable stayed option was considered separately.

Hydrodynamic Modelling

A hydrodynamic model was used to calculate current speeds and directions within the estuary. For this study two models were developed, one to examine the existing circulation patterns in the estuary and the other to examine the circulation patterns in the estuary due to the presence of the proposed bridge (for which two different construction options were examined). The first model was calibrated against field measurements of water surface elevations and current magnitude and direction. The second was then executed using these same parameters to determine the relative effects due to the proposed bridges.

The bathymetry defining existing conditions in the estuary is presented in Plate 4.1. A more localised bathymetry plot outlining the area of interest adjacent to the proposed bridge site is presented in Plate 4.2.

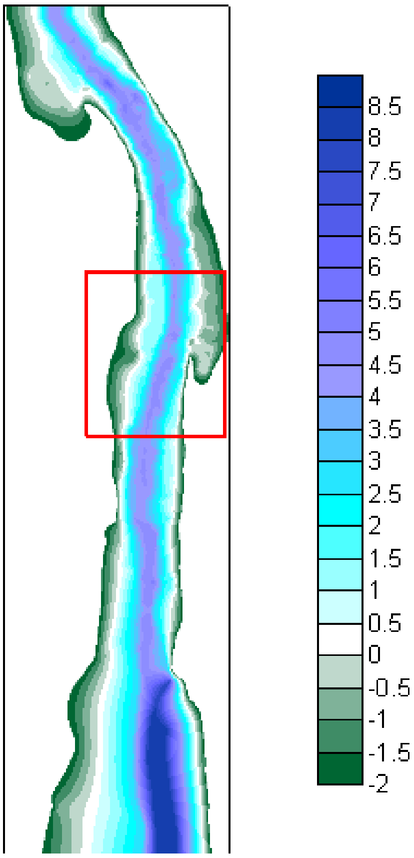

Plate 4.1: Bathymetry plot of Newry River Estuary with the area of interest outlined

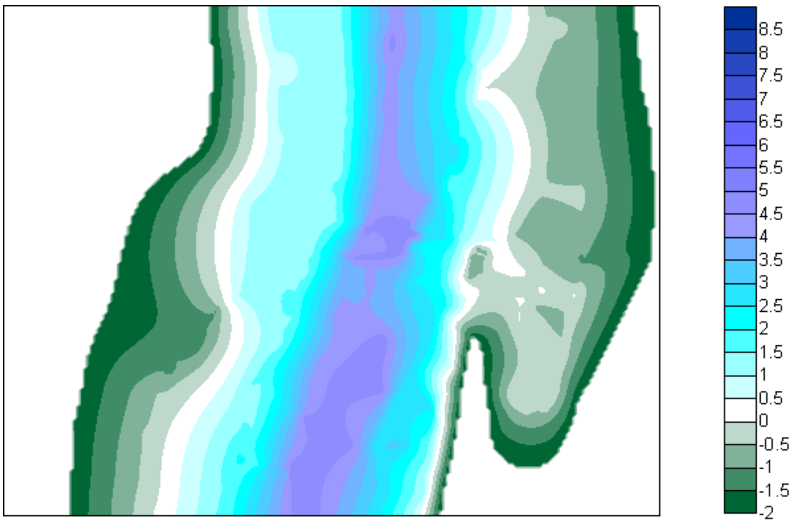

Plate 4.2: Bathymetry plot of the area of interest in the vicinity of the proposed bridge site

Model Description

The type of model used in this study, DIVAST (Depth Integrated Velocity and Solute Transport) is a two-dimensional, finite difference model. It is amongst the best tools available for the modelling of hydrodynamic conditions within a coastal environment. The mathematical formulation of the model is based on the Navier-Stokes equations that describe variations in current speeds and directions. DIVAST uses an implicit finite difference scheme to solve the Navier-Stokes equations for unsteady flow conditions. The finite difference technique is the most common method employed to solve these equations and is ideally suited for total water quality management of a water body as well as evaluating individual problems.

The computer model DIVAST was used to carry out a study of the Newry River Estuary to examine the hydrodynamic patterns in the area and to assess the possibility of alterations in these patterns due to the construction of a bridge. The model is widely used in Ireland and the U.K. for many different types of hydro-environmental studies in coastal waters such as sewage effluent discharges, oil spill modelling, aquaculture assessment and water quality management planning. The model has been used to date on more than 200 such studies and has proven to be a reliable tool for such analysis. DIVAST is an industry standard package for water quality studies.

Model Development

This hydrodynamic model study was carried out by developing a model to simulate water circulation for a full spring to neap tidal cycle. This was performed, as typical in all such model studies, in three interactive stages.

- The first stage consisted of developing a water circulation model of Newry River to compute the hydrodynamic patterns and tidal elevations within the estuary for prescribed environmental conditions.
- The second stage in the study was the calibration of this hydrodynamic model against field data.
- The third stage of the study consisted of the development of a hydrodynamic model to assess the circulation pattern with the two different bridge options present.

The finite difference model of Newry River Estuary was developed by overlaying a grid on top of the relevant Admiralty Chart. The data obtained from the Admiralty Chart was then interpolated and a finite difference grid was produced using the commercially available software SURFER. The grid had equal spacing of 2m x 2m in two orthogonal directions. A total of 479,226 grid points were used to define the model. At each grid point the water depth at that location is identified to the model using the bathymetric data. A two-dimensional surface plot of the bathymetry of the bay is shown in Plate 4.1.

The topography of the area is defined by specifying land boundaries, which delineate the extent of the water body. At the northern and southern limits of the model water elevation boundaries are specified. These boundary conditions are the main forcing functions that induce circulation in the water body.

The water currents that are observed in coastal waters are induced by many different forces. In the model employed for this study the following significant forcing functions were incorporated into all simulation runs of the hydrodynamic model:

- Tide elevations
- Coriolis effect

The Coriolis force induces water currents due to the fact that the water body is on the surface of a rotating globe. The force is a function of the latitude of the water body and the rotational velocity of the earth, in this case considered to be 54.15° and 400 m/s respectively.

Model Calibration

Before a model can be employed with any degree of credibility as a water quality simulation tool, its hydrodynamic predictions must first be shown to give good agreement with actual field measurements. Therefore, the hydrodynamic calibration process is an integral part of the water circulation modelling process. Details of the calibration exercise for the Newry Estuary model used in this study are presented in this section.

A field survey was carried out by Aqua-Fact International Services Ltd. in February 2008 to provide information about the tidal regime in the vicinity of the proposed development in Newry River. The field survey included both water surface elevation measurements and current speed and direction measurements over a full tidal cycle. These hydrodynamic data sets were used to calibrate the hydrodynamic model.

For the calibration analyses, the environmental conditions, which were recorded during the field survey were used as input for the model simulations. The tidal elevations as measured on the day when the hydrographic survey was carried out were specified to the model. Wind blowing over the surface of a large body of water will transmit some of its energy to the water, thereby inducing currents. The induced water circulation is a function of the wind speed, direction and transfer coefficient. Therefore, during the simulation the prevailing wind conditions were also defined in the hydrodynamic model.

A number of runs of the hydrodynamic model were necessary before sufficiently accurate correlations were obtained between the predicted and measured current velocities, directions and water surface elevations. The bed roughness length was adjusted until adequate agreement was obtained. A number of fine adjustments were applied to other empirical coefficients. The hydrodynamic model was calibrated by comparing current velocities and water surface elevations as calculated by the model against their field-measured counterparts.

Hydrodynamic Calibration

The hydrodynamic model was calibrated by comparing model predictions against field measurements of current speeds and water surface elevations for given environmental conditions. When running the model, tidal elevations were specified at the northern and southern open sea boundaries for spring and neap tides. These elevations corresponded with measured tidal dynamics. In the current study, the model was calibrated from physically measured field data, using an Acoustic Wave and Current (AWAC) meter.

Hydrodynamic Modelling Results

Plates 4.3 – 4.10 present snapshots of water velocity during various tidal conditions at the study site in the Newry River while Plates 4.11 – 4.18 present the snapshots with the introduction of the bridge structure (two design options) to the river.

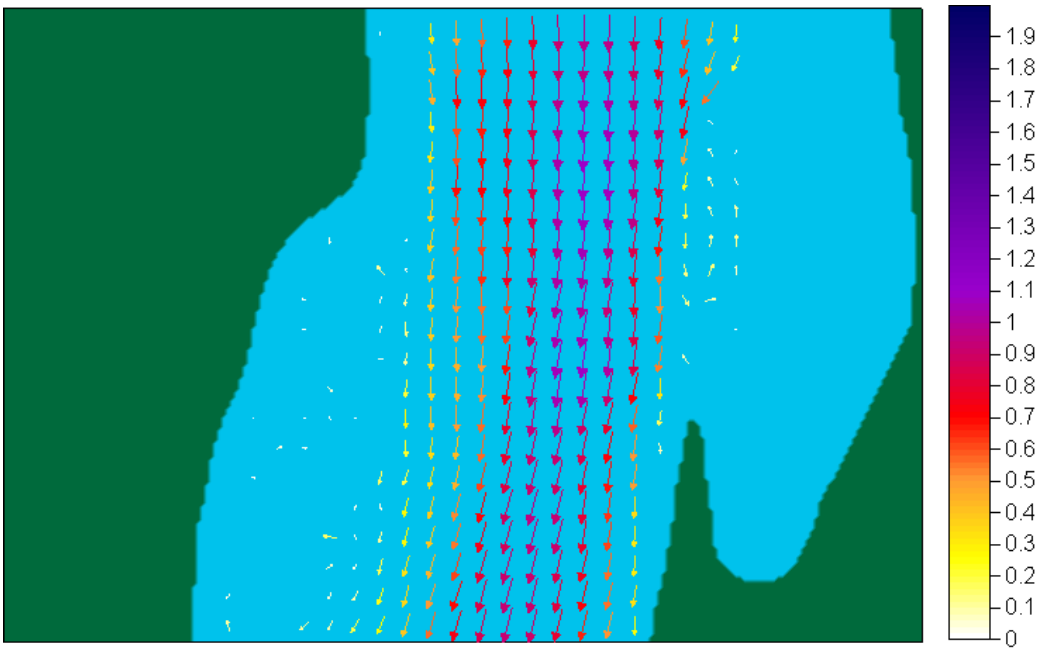

Plate 4.3: Snapshot of current velocity vectors within Newry River Estuary at mid-ebb during a spring tidal cycle

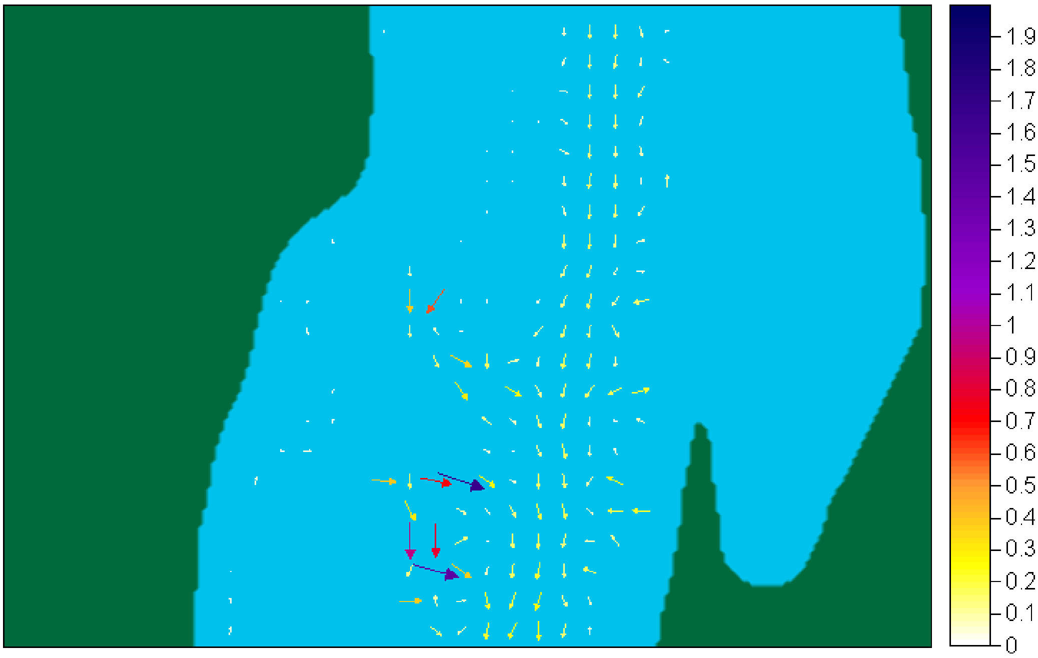

Plate 4.4.: Snapshot of current velocity vectors within Newry River Estuary at low water during a spring tidal cycle

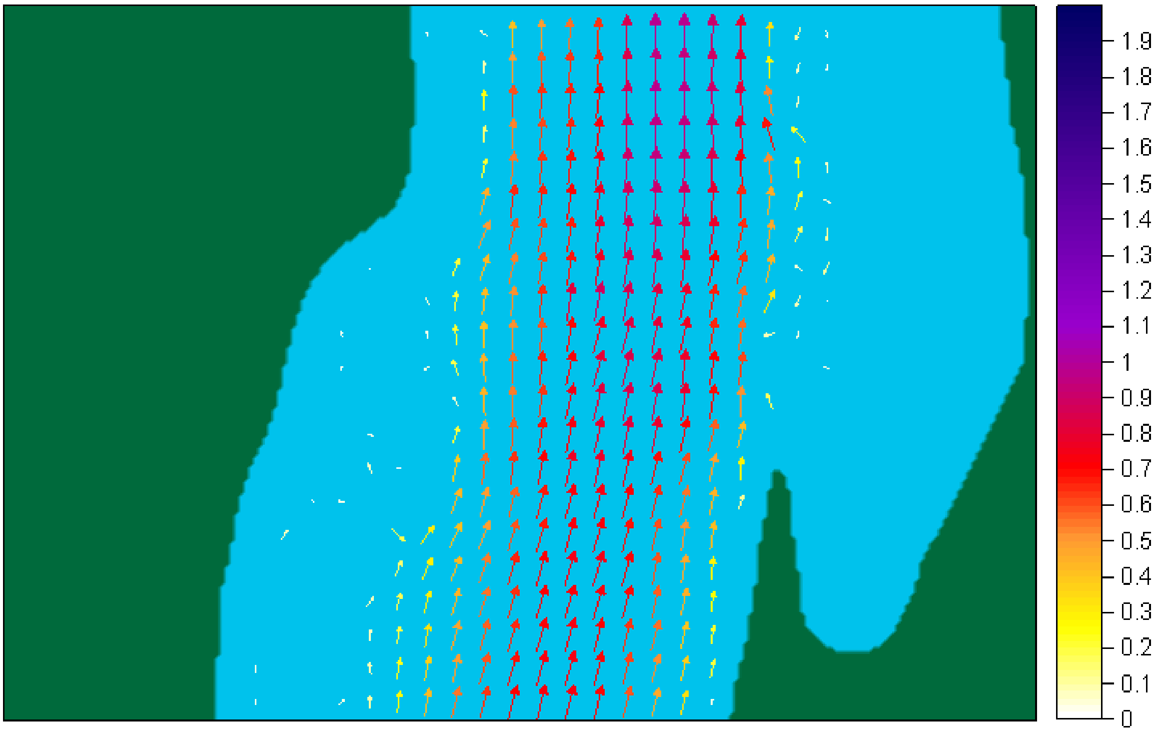

Plate 4.5.: **Snapshot of current velocity vectors within Newry River Estuary at mid-flood during a spring tidal cycle**

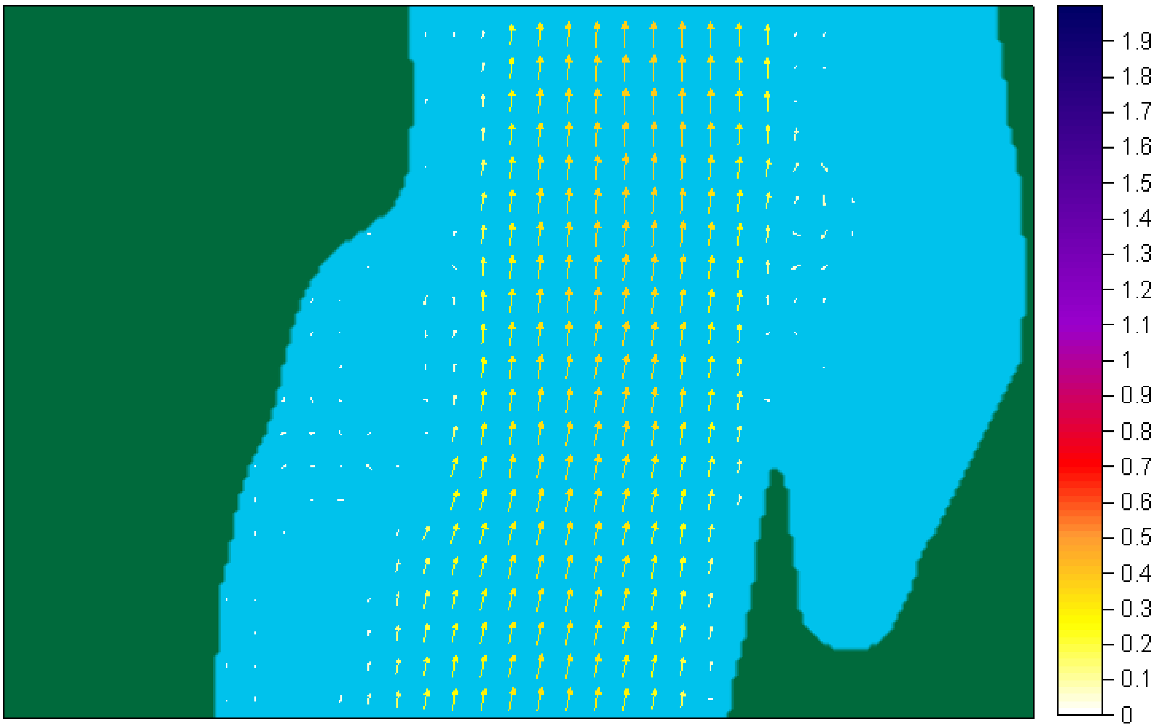

Plate 4.6: **Snapshot of current velocity vectors within Newry River Estuary at high water during a spring tidal cycle**

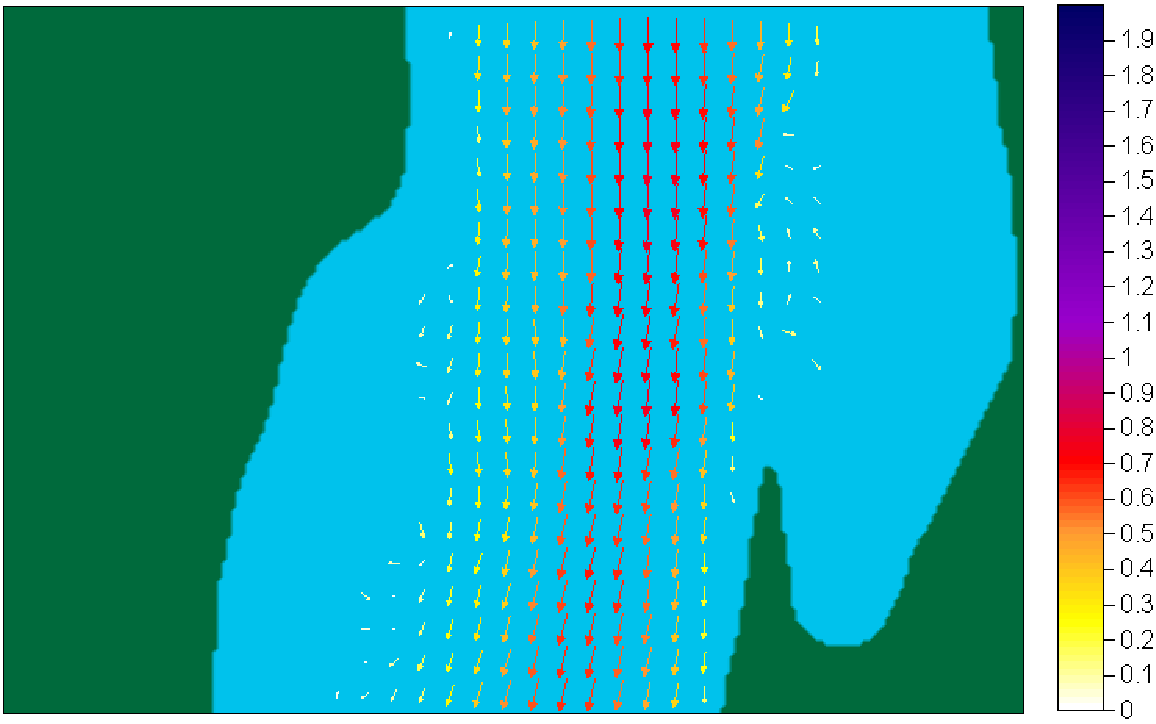

Plate 4.7: Snapshot of current velocity vectors within Newry River Estuary at mid-ebb during a neap tidal cycle

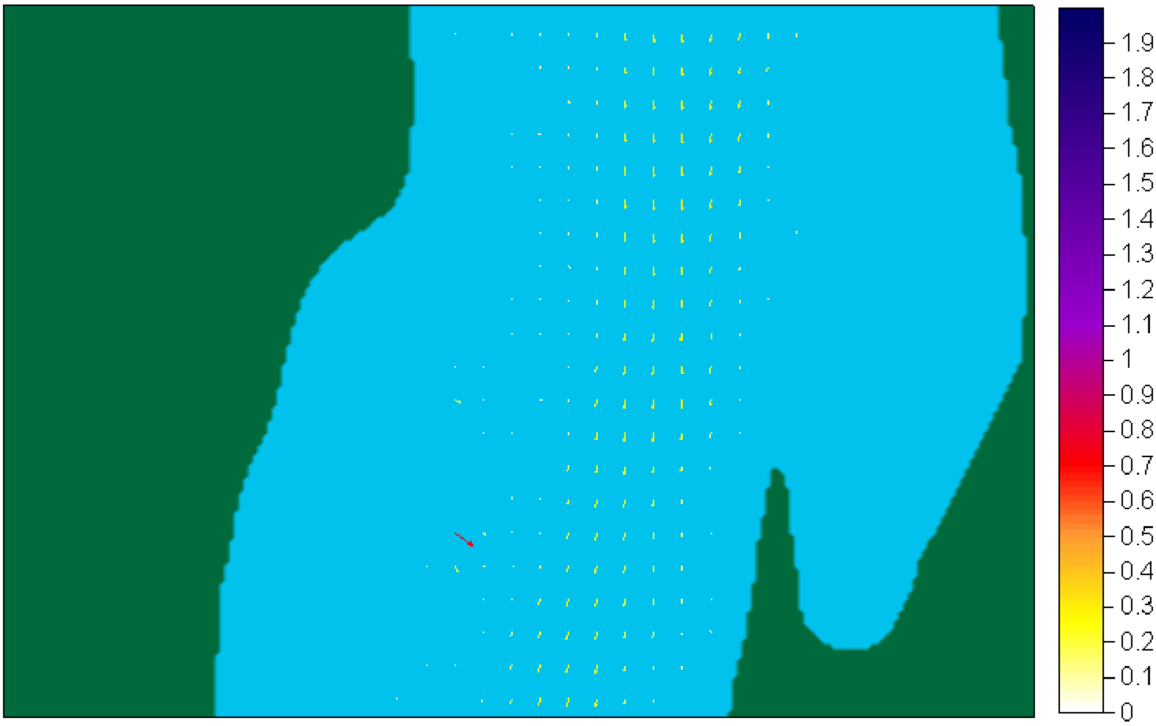

Plate 4.8: Snapshot of current velocity vectors within Newry River Estuary at low water during a neap tidal cycle

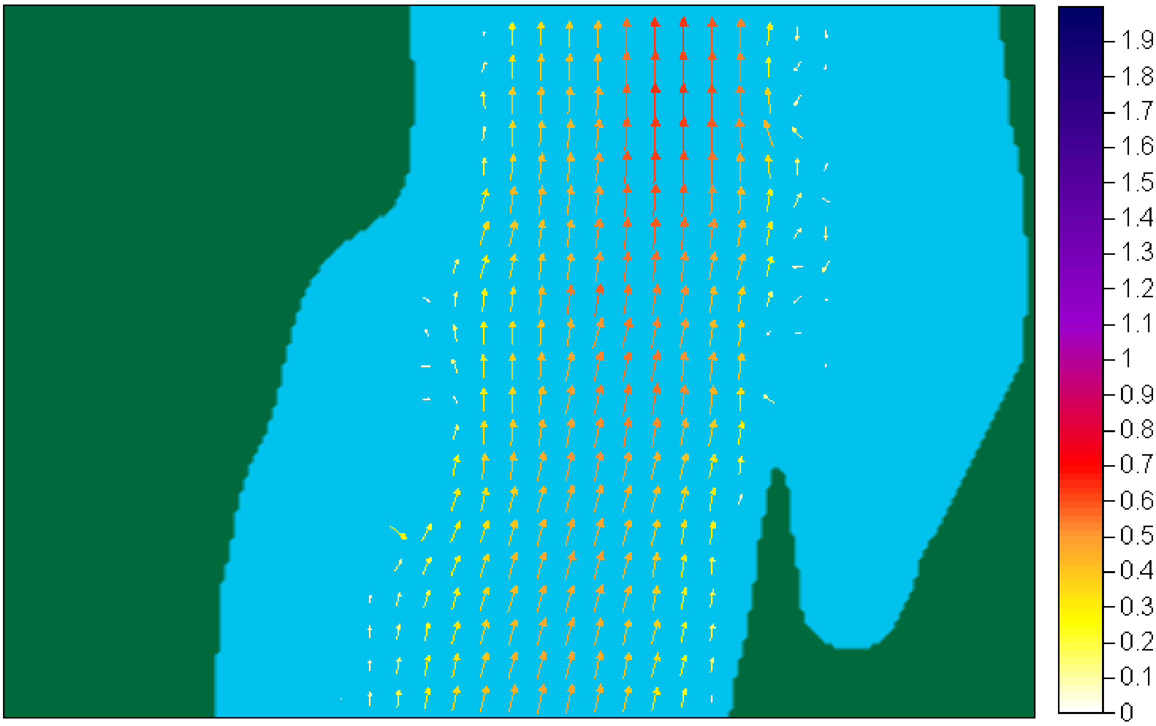

Plate 4.9: Snapshot of current velocity vectors within Newry River Estuary at mid-flood during a neap tidal cycle

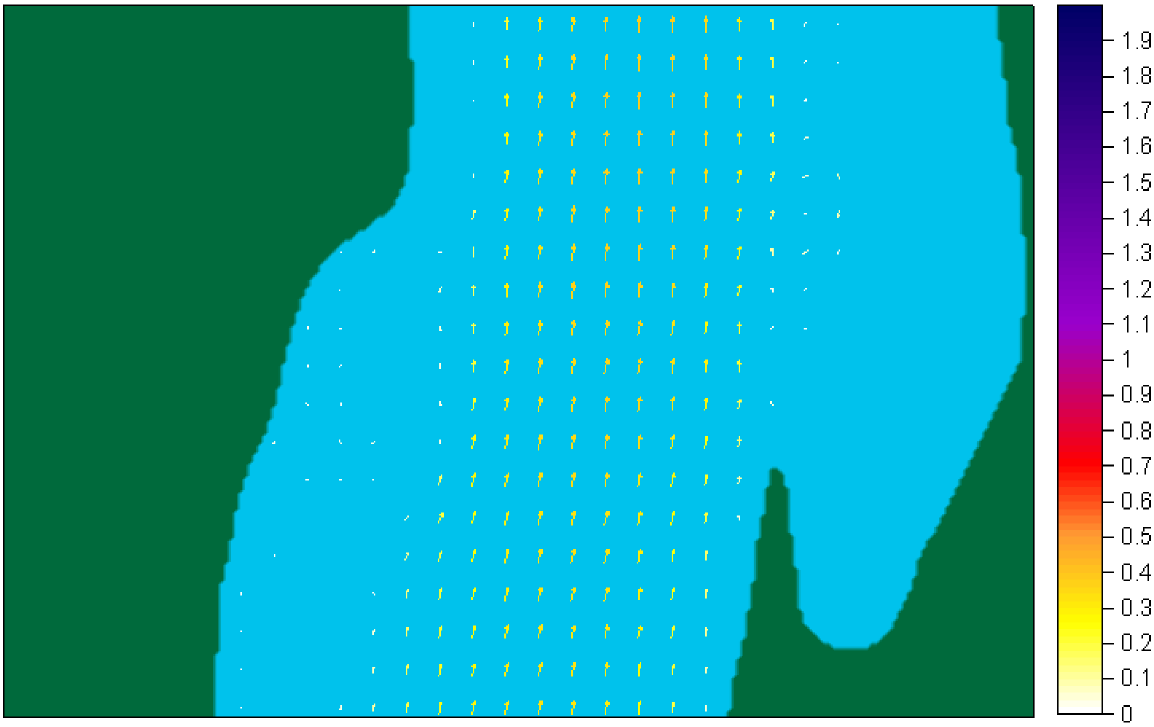

Plate 4.10: Snapshot of current velocity vectors within Newry River Estuary at high water during a neap tidal cycle

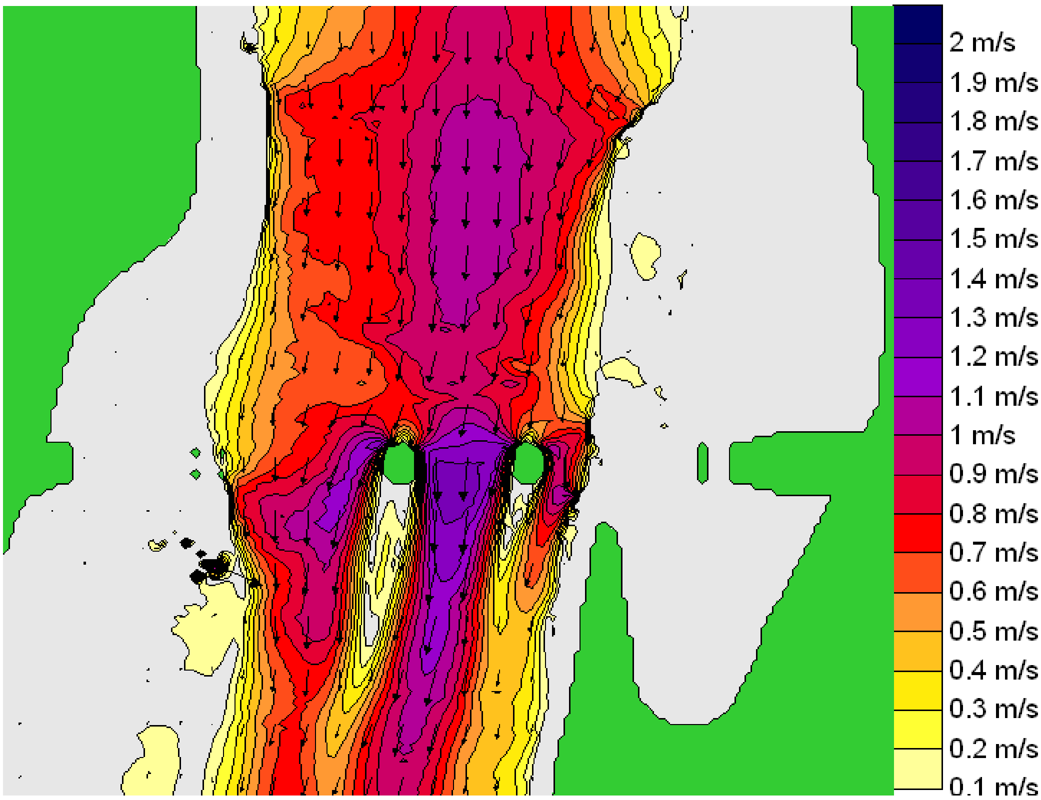

Plate 4.11: Snapshot of current velocity vectors within Newry River Estuary at mid-ebb during a spring tidal cycle with the proposed Design Option 1 structure present

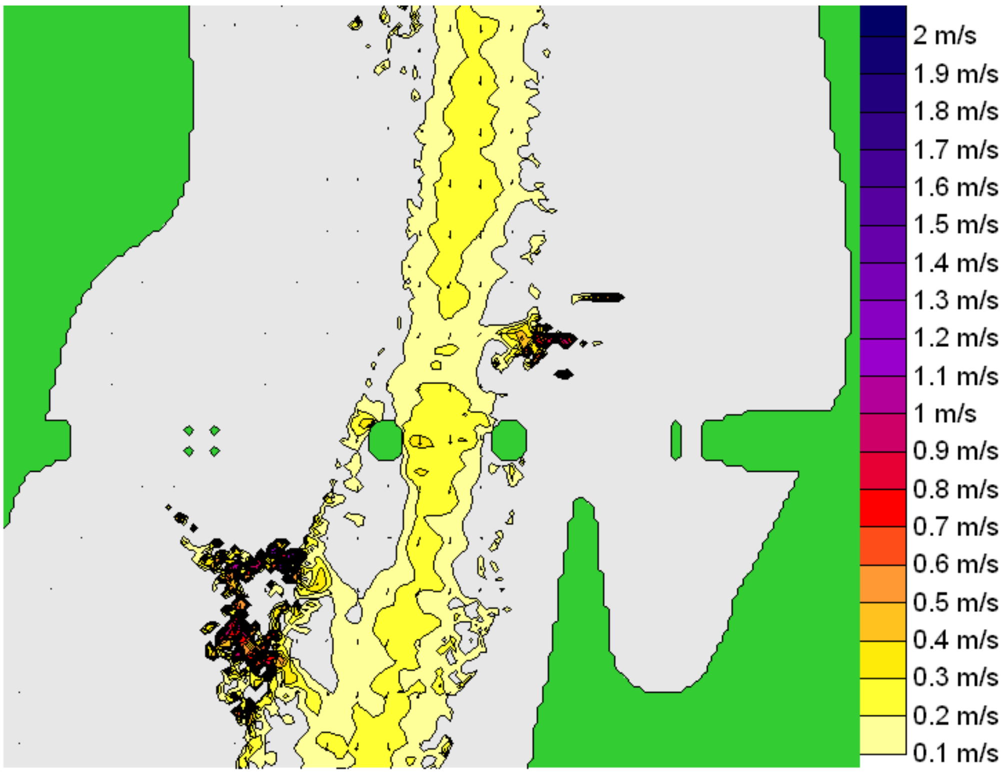

Plate 4.12: Snapshot of current velocity vectors within Newry River Estuary at low water during a spring tidal cycle with the proposed Design Option 1 structure present

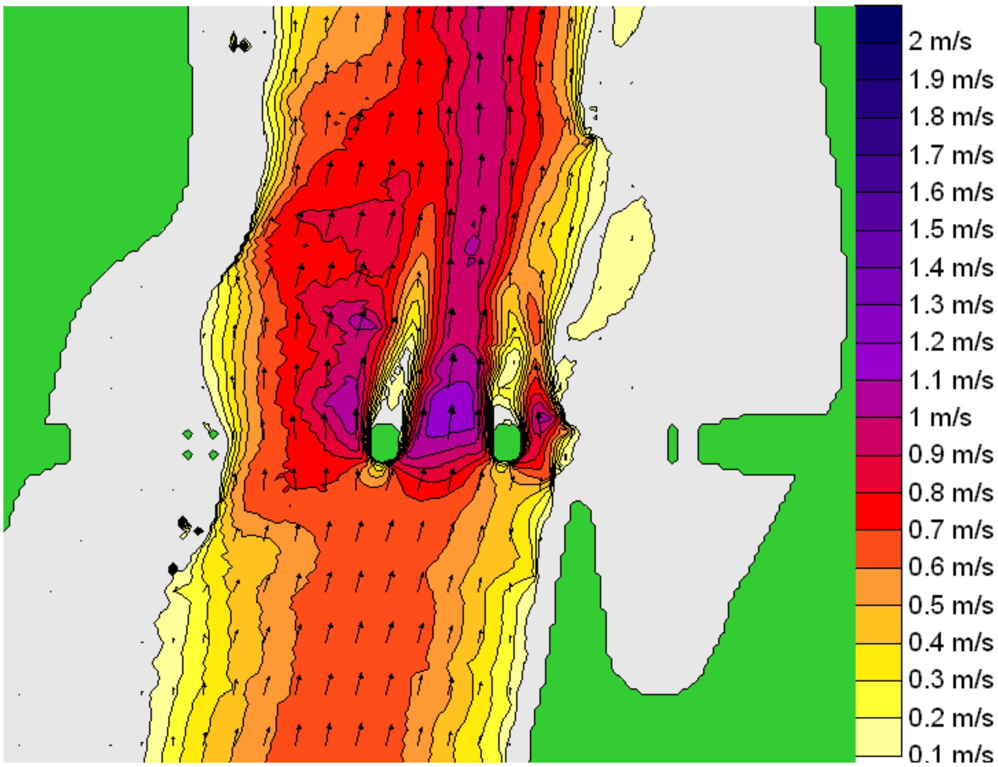

Plate 4.13: Snapshot of current velocity vectors within Newry River Estuary at mid flood during a spring tidal cycle with the proposed Design Option1 structure present

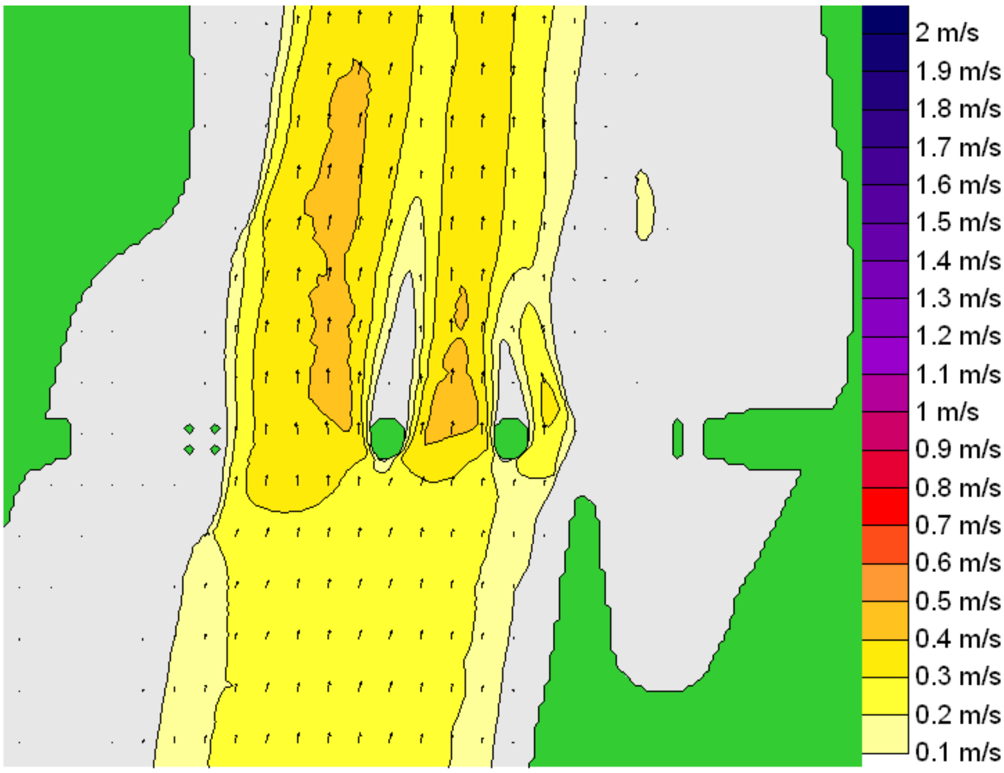

Plate 4.14: Snapshot of current velocity vectors within Newry River Estuary at high water during a spring tidal cycle with the proposed Design Option1 structure present

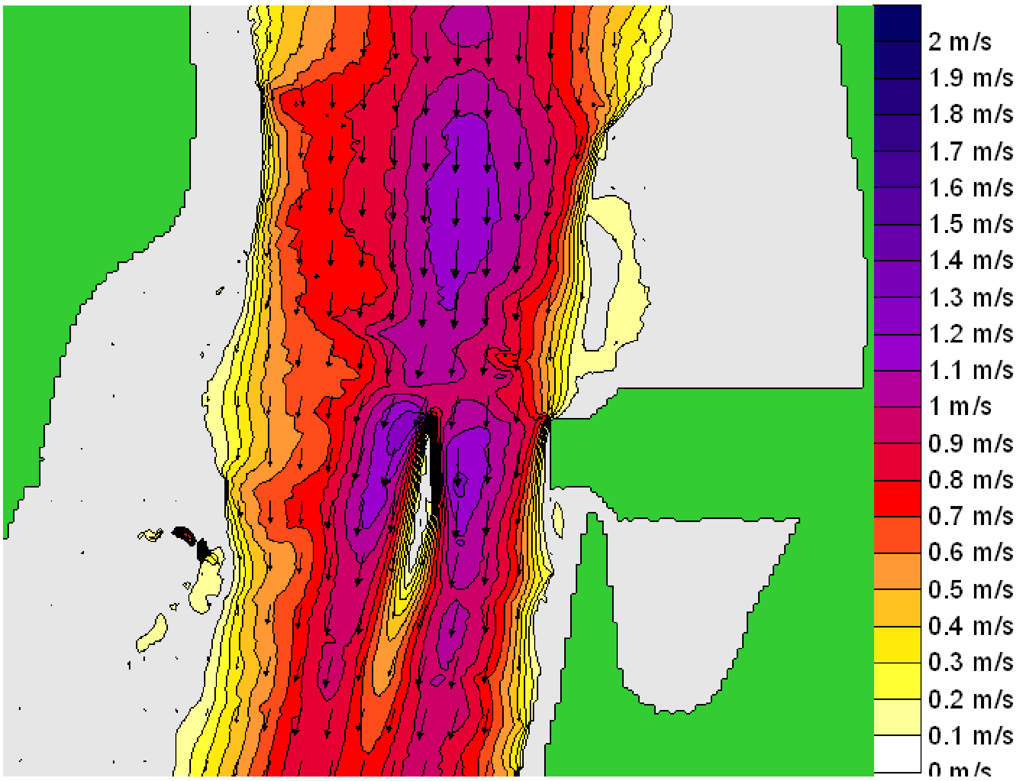

Plate 4.15: Snapshot of current velocity vectors within Newry River Estuary at mid-ebb during a spring tidal cycle with proposed Cable-stayed structure present.

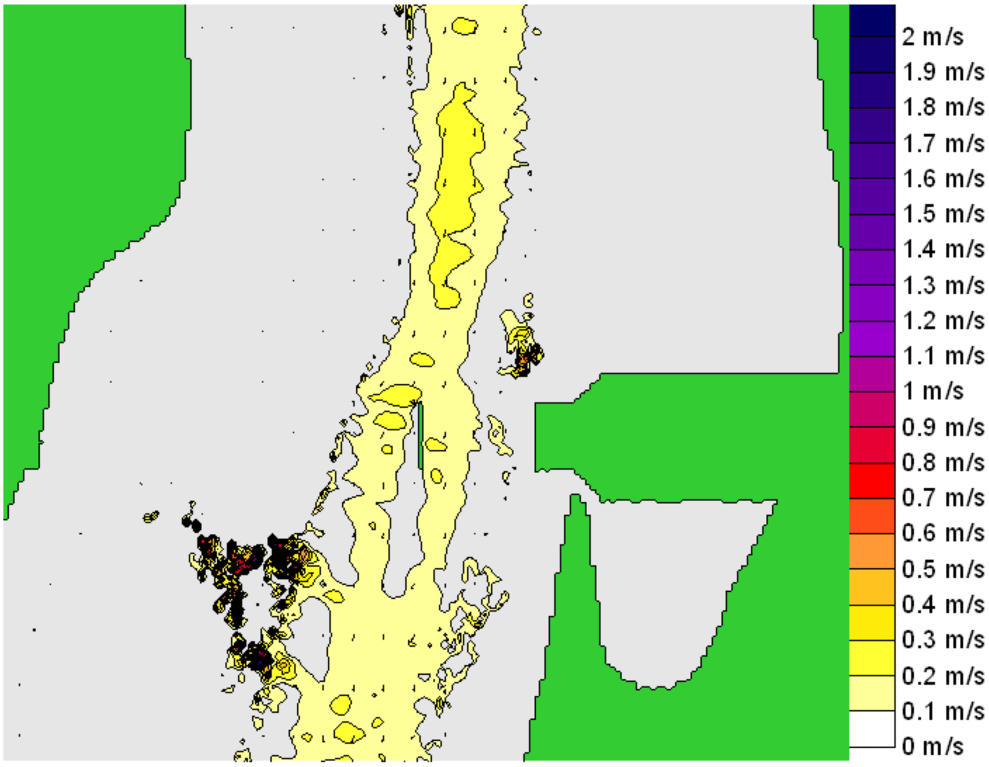

Plate 4.16: Snapshot of current velocity vectors within Newry River Estuary at low-water during a spring tidal cycle with proposed Cable-stayed structure present.

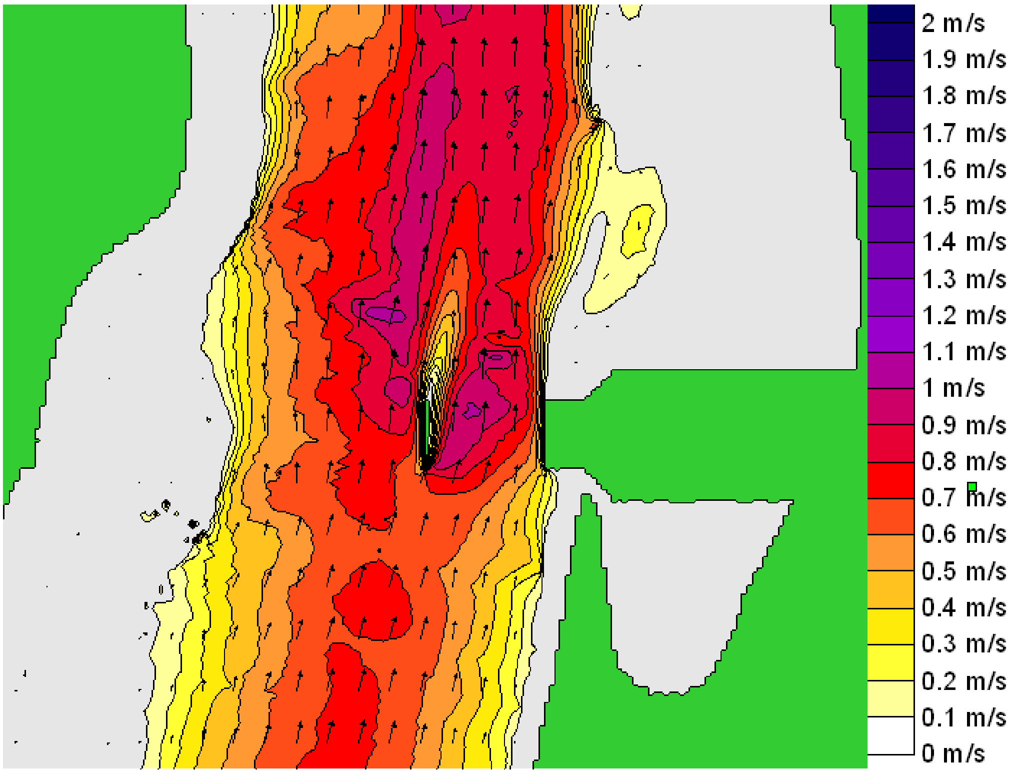

Plate 4.17: Snapshot of current velocity vectors within Newry River Estuary at mid-flood during a spring tidal cycle with proposed Cable-stayed structure present.

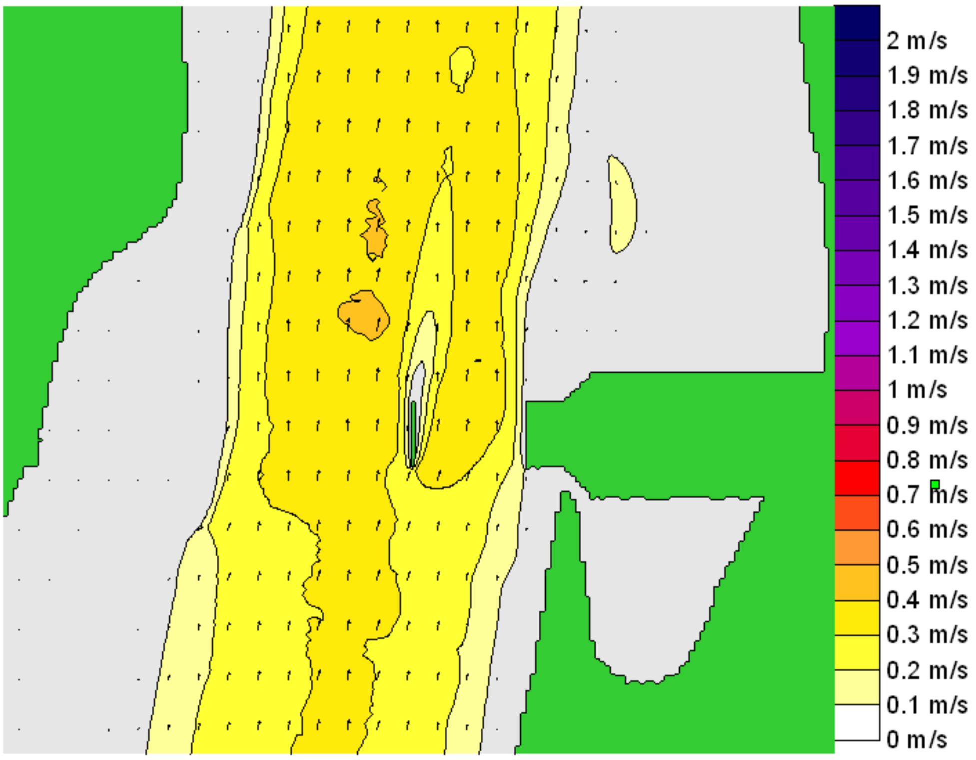

Plate 4.18: Snapshot of current velocity vectors within Newry River Estuary at high-water during a spring tidal cycle with proposed Cable-stayed structure present.

Interpretation of Results

The model predicts that the velocity of the water current and the natural hydrodynamic regime in the river channel at the location of the proposed crossing was altered as a result of the proposed structures.

The existing velocities were predicted to be approximately 0.85 m/s in the centre of the channel during flooding tides, rising to approximately 1.24 m/s during ebb tides during spring tide conditions.

With the proposed Design Option 1 structure in place, the model predicted the water currents to be approximately 1.18 m/s during flood tides and 1.15 m/s during ebb tides on a spring tide. The regions of high velocity are located on the outside of the bridge piers and between the piers. This represents an increase of 39% in water current velocities on a flood tide and a decrease of 8% on an ebbing tide.

With the proposed Cable-stayed structure in place, the model predicted the water currents to be approximately 0.81 m/s during flood tides and 1.11m/s during ebb tides on a spring tide. The regions of high velocity are located either side of the central pier. This represents no change in water current velocities on a flood tide and a decrease of 10% on an ebbing tide.

In the immediate vicinity of the piers, the predicted changes in current velocity for both options indicate that there will be scouring effects around their bases, which will lead to mobilisation of sediments upstream and downstream of the structures.

The scouring effects occur at the north face of the piers during an ebbing tide with regions of slack water occurring in the wake region to the south of the structure. The inverse occurs during flooding tides when the scouring effects is in evidence on the south face of the piers with regions of slack water occurring in the wake region of the piers to the north of the proposed structures.

It is unlikely that the scoured material would be deposited in the wake region on the opposite side of the piers given the magnitude of the current velocities as the water passes around the bridge piers and the associated transport distance of the entrained sediments. It is more likely that the sediments on the ebb tide will be exported eastwards into the main body of Carlingford Lough and deposit when velocities fall to ca 0.1m/s. The opposite pattern will occur on the flood tide *i.e.* re-suspended sediments will be transported up stream.

Conclusion

Plates 4.11 to 4.18 clearly identify that the chosen bridge design will have the least impact on the existing marine hydrodynamics, on sediment transport and on the ecological functioning of the estuary.

Given the very low effect of the chosen design on current velocity and therefore sediment mobilisation, this design is considered to have negligible impact on the ecological functioning of the estuary.

Further Design Review

Since the completion of the hydrodynamic modelling further design reviews of the proposed cable stayed option have been completed. This has resulted in the bridge abutment on the County Down foreshore being further limited in size such that it no longer extends into the river channel (refer to Plates 4.15 to 4.18). The outcome of this design amendment is to further reduce the impact on the existing hydrodynamic situation.

4.5.4 Bridge Options Assessment and Design Choice

Assessment Criteria

In addition to undertaking the hydrodynamic modelling exercise, the three feasible bridge design options were evaluated against the various engineering, environmental and economic issues. The Bridge Feasibility Report was completed in November 2008 and reviews each option against all environmental, engineering and economic issues identified. The parameters which were identified as the key environmental factors influencing the design choice were:

- Archaeology and cultural heritage;
- Aquatic Environment;
- Terrestrial Ecology;
- Socio-economic impact; and
- Landscape and visual amenity.

Archaeology and Cultural Heritage

The Constraints Report highlighted that the proposed site lies within an area of very high archaeological sensitivity. There is a concentration of known sites around the vicinity of Narrow Water, dating from Early Christian to Post Medieval. Narrow Water is considered to be a strategic location, an idea that is borne out by the presence of the motte to the side of the A2 roundabout and by Narrow Water Castle itself.

During the consultation process both DoEHLG and NIEA identified the requirement for extensive archaeological surveys along the entire route of the scheme. Geophysical surveys, dive surveys and ground truthing were requested in order to identify the presence of any remains or artefacts. This is considered an essential requirement as the area around Narrow Water is believed to have been a significant crossing point, thus making the presence of remains or artefacts a significant possibility.

In archaeological terms, the three bridge options all have the potential to impact Archaeology and Cultural Heritage through direct impact on buried or unrecorded remains. However, during the series of consultations held with both of the statutory bodies, it was made clear that the least impact on the Newry River channel and the inter-tidal area would be preferable as it is believed that if any significant remains or artefacts exist they are likely to be located within this environment. Therefore, Option 3 was the preferred option.

Aquatic Environment

As highlighted during the Hydrodynamic Modelling exercise, the issue, which has been strongly identified during the consultation meetings with The Loughs Agency, is that any significant level of additional sediment release as a consequence of the construction and operational phases of the bridge could result in compensation claims (the Loughs Agency have stated that the aquaculture industry is currently worth €3.5 million annually) from aquaculture licence holders. The perception being that the release of sediment could smother or cause disease of the cultured shellfish.

In addition to potential for compensation claims to be made by the aquaculture industry, the possibility of Warrenpoint Harbour Authority requesting a contribution to its dredging fund should sediment release be significant must also be borne in mind.

The Hydrodynamic modelling of the water flows within the Newry River and the associated potential sediment release have clearly shown that Bridge Options 1 and 2 will result in significant sediment release as a consequence of the large central piers required to allow for the bridge opening mechanism. The cable stayed nature of Option 3 allows this design to span from one shore to the other with only minimal impact on sediment release due to the requirement for only a small singular central pier.

The Loughs Agency has indicated that, as with archaeology, the preferred option would have the least impact on the aquatic environment in terms of sediment release and also in terms of the Habitats Directive Annex IV species – Eel and Brook and Sea Lamprey. The Loughs Agency also expressed concern regarding the presence of significant substructures in the Newry River and therefore would not be in favour of Options 1 and 2. Therefore, Option 3 would be the preferential option.

Terrestrial Ecology

The proposed route is within an area of high nature conservation value. On the southern side the shoreline falls within Carlingford Shore cSAC, although no SAC feature habitat occurs at the site. On the northern side the foreshore is within Carlingford Lough ASSI. Mudflat and wintering waterbirds are important elements of this ASSI.

Each of the three bridge options will have a similar impact on the habitats present. Further, these habitats in themselves are not considered of sufficient quality for the impact on them to be considered significant.

However, the potential impact on the wetland birds, which use the area, is a concern. The Warrenpoint to Newry section of the Newry River estuary supports a significant proportion of Carlingford Loughs' population of Shelduck, Teal, Black-tailed Godwit and Redshank, all of which are named as feature species of the neighbouring Carlingford Lough SPA. In addition, the ASSI is specifically selected for a number of the wetland species which occur in the Narrow Water area (Shelduck, Oystercatcher, Dunlin and Redshank).

Field surveys have indicated that small scale movements of these species do occur up and down the Newry River estuary. The risk that the bridge could pose to these movements is a concern. Options 1 being a low lying structure should not pose any significant barrier to this movement. However, the cable stayed nature of Option 2 and 3 may create a significant barrier and may prevent the movement of these birds to upstream feeding sites. This will need to be examined further by monitoring the exact flight paths as for Options 2 and 3 only parts of the structure would provide a restriction to movements.

In addition, the possibility of birds striking the cables could be significant, especially for the larger species such as Shelduck. The presence of a heronry in the adjacent woodland should also be noted as juvenile herons are not agile fliers.

Therefore, in terms of terrestrial ecology, Option 1 was identifies as the preferred option.

Socio-economic Impact

The bridge is proposed in the Louth County Development Plan as a piece of essential tourism infrastructure. The intention is to provide access across Carlingford Lough, linking Omeath and Warrenpoint, enhancing the tourism potential of both areas. It is believed that the bridge will increase tourist numbers through connecting these exceptionally scenic areas.

All three bridges can be considered equally beneficial in so much as they provide the required road and pedestrian link. However, in terms of providing a landmark structure with the potential to add to the amenity of the area, which is itself a tourist feature, than Option 3, with its slim deck, impressive towers, portal like entrance to the Newry River and its unique opening mechanism, must be considered as the front runner in terms of positive economic impact.

Landscape and Visual Amenity

The proposed bridge is located within an area of high landscape quality and high visual amenity. This is recognised by the landscape designations contained within the Development Plans of both jurisdictions. Planning policy attached to these designations is designed to ensure that any development does not detract from the existing landscape quality and visual amenity. In addition, the setting of Narrow Water Castle is protected, in Northern Ireland, by Planning Policy Statement 6 ‘Planning, Archaeology and the Built Heritage’.

Furthermore, it should be noted that the Planning Policy Statement (PPS) 6 states in ‘Conservation and Economic Prosperity’ that “Just as there is continuity between past and present, so also there is between present and future. We have a duty to care for what we ourselves have inherited not simply for our own benefit but also with a view to passing it on, as a living legacy, to those who come after us. We can add to our historic legacy by creating examples of high quality architecture and townscape and landscape design which can fittingly represent our own age in the decades and centuries to come”.

The potential landscape and visual impact of each option is, hence, of significant importance in determining which Bridge Option performs best in this setting at the entrance to Carlingford Lough.

The second Pre-Application Discussion meeting with The Planning Service in Northern Ireland was attended by Landscape Architects Branch personnel of Planning Service. The three bridge options and photomontages were discussed.

Option 1 was agreed to possess a simple floating elegance of the substructure which blended well into the surrounding environment and had minimal visual intrusion. However, the chunky central piers appear starkly incongruous to this elegance.

The central arrangement of Option 2 was considered to detract from views down the river and leaves the observer with the impression that the bridge is the focus of this environment rather than the landscape or cultural heritage. It was suggested that this bridge would work in an urban regeneration situation.

Option 3 has been driven by the unique nature of the landscape. The contrasting tower heights mirroring the landscape, rising tall adjacent to the mountains of the Cooley Peninsula and retaining modesty to match the drumlin landscape to the north. The slim deck and narrow cables allow the bridge to blend into this environment, while simultaneously framing the important significant landscape and cultural features.

In terms of Planning Policy Statement (PPS) 6 it is important to note that, in terms of protecting the setting of Narrow Water, the Planning Service considers the critical views of and from Narrow Water to be of paramount importance. Option 1 is subtle enough not to detract from these views, while Option 3 in essence frames and directs these views towards the monument and downstream.

The three bridge options were presented to Louth County Council in terms of aesthetics in June 2008. Roughan & O'Donovan Consulting Engineers have also received opinions on the relevant aesthetic merits of the three options from Brady Shipman Martin (the Landscape and Visual Specialist Sub-Consultant for the Environmental Impact Assessment) and other independent architectural and aesthetic advisors.

Consideration of visual aesthetics and responses to such structures is recognised as being highly subjective. However, the general response has been overwhelming favourable in terms of the uniqueness of Design Option 3, which will be a fitting legacy of the design representing our own age in future years.

Ranking and Design Selection

Each constraint does not have the same significance as the others and certain constraints should therefore be more influential than others. Therefore, an importance rating has been assigned to each constraint. For example, the Narrow Water Bridge is located in an Area of Outstanding Natural Beauty (AONB) and therefore, a high level of importance has been allocated to the landscape and visual amenity parameter, while a low importance has been allotted to existing utilities and services since this impact can be readily and easily considered at the detailed design and construction stage.

Once the importance of the constraint is decided, each bridge option is assessed as to whether it has a negative, neutral or positive impact. That option is then assigned a score for that constraint in accordance with **Table 4.2** below. The preferred bridge option selected is the option that scores the highest since this option represents the most favourable option overall. The colours are included in the table as a visual aid to clarify this selection process.

Table 4.2 Scoring System

Impact		Negative			Positive	
		Significant	Slight	Neutral	Minor	Major
Importance	Low	-2	-1	0	1	2
	Medium	-4	-2	0	2	4
	High	-8	-4	0	4	8

Table 4.3 Bridge Option Assessment Matrix

Constraints	Importance	Bridge Options		
		1	2	3
Traffic & Road Design	Low	-1	0	1
Geotechnical Design	Low	0	0	0
Maintenance & Durability: Superstructure Fixed	Medium	2	2	-2
Maintenance & Durability: Superstructure Moveable Span	Medium	-4	-4	-2
Maintenance & Durability; Substructure	Medium	0	0	0
Navigational Requirements	Low	1	1	0
Operational Issues	Low	1	0	0
Existing Utilities & Services	Low	0	0	0
Agricultural Impacts	Low	0	0	0
Archaeology & Cultural Heritage	High	-8	-8	-4
Aquatic Environment	High	-8	-8	0
Terrestrial Ecology	Medium	0	-2	-4
Socio-Economic / Material Assets	High	4	4	8
Air Quality	Low	0	0	0
Noise & Vibration	Low	-1	-1	0
Landscape & Visual Impact	High	0	-8	8
Construction Impact	Medium	-2	-2	2
Capital & Whole Life Costs[1]	High	0	-8	-8
Overall Score		**-16**	**-34**	**1**
Overall Rank		**2**	**3**	**1**

This process identified the preferred bridge option when weighted against the above factors as being Option 3 – the Cable-Stayed Option. The factors which weighted the decision in favour of Option 3 were the minimal impact this option will have on the aquatic environment and on the archaeological and cultural heritage.

This bridge design option was presented to the public in October 2008 as discussed in Section 1.4.3 of this document.

4.5.5 Bridge Design Review and Amendment

Since the chosen bridge design was selected the Narrow Water Bridge Project has engaged with the statutory authorities within both jurisdictions in order to allow the design team to address all possible concerns.

This process was assisted significantly by the invitation from the Planning Service (Northern Ireland) to engage with the Pre Application Discussion process. Through this process the design team were able to routinely engage with all the Northern Ireland statutory consultees round one table. This has allowed many of the concerns of the consultees, such as the requirement for terrestrial and aquatic geophysical archaeological surveys, to be addressed and completed.

During consultations with the Landscape Architects Branch of Planning Services concerns with respect to the impact of the tall southern tower were raised and, while the reasoning behind the bridge design selection was accepted, it was agreed that the bridge design engineers would explore the potential to reduce the height and bulk of the southern tower.
These investigations revealed that a cable could be omitted from the main span by relocating the southern tower 4.5m further north on to the foreshore. The reduction from 13 cables to 12 cables enabled the height of the tower to be reduced by around 7m without compromising the structural integrity of the bridge or intruding into the river channel, which is a fundamental requirement of the Loughs Agency.

A different alignment across the bridge compared to that shown previously has the additional benefit of lowering the southern tower by almost 2m. Together these two modifications have had the overall combined effect of reducing the highest point of the structure by approximately 10m and the width by 1m, from 5m to 4m.

These modifications have also had the additional benefit of reducing the length of the northern abutment such that it does not intrude into the river channel (refer Section 4.5.3). This further reduces the hydrodynamic impact of the bridge structure.

4.5.6 Siting of Control Building

A control building is required to facilitate the opening of the bridge. The main requirements of the location of the control building are to have a clear unobstructed view to the bridge and along the river and to be sufficiently close to the proposed bridge for opening and closing.

It is clear theat the most suitable location is on the northern bank as cloe to the bridge s possible with an unrestricted view up and downstream. Therefore, the proposed control building is located at the edge of the river on the north side approximately 200m from the bridge as shown in Figures 3.16. The owners of the lands which have planning permission for development have been consulted and have cooperated in ensuring a design and access to the control building which matches with their proposals.

Chapter 5

Traffic & Transport Impacts

Chapter 5 Traffic and Transport Impacts

5.1 Introduction

5.1.1 General

This chapter provides an overview of the traffic and transport impact assessment undertaken for the Narrow Water Bridge project. This includes the following activities:

- Examine the existing traffic conditions and transport facilities;
- Estimate future traffic growth;
- Appraise the proposed development;
- Assess the traffic and transport impacts of the scheme during operation and construction;
- Determine any mitigation measures required.

The transport assessment indicates that the proposed Narrow Water Bridge will significantly improve connectivity between the Cooley peninsula and the Mourne District, which will enhance the tourist potential of the region. In addition, the analysis illustrates that using traffic management it is possible to accommodate all the queues, which form when the bridge opens, safely without compromising the operation of the A2 roundabout. Furthermore, the study indicates that the construction traffic will have a negligible impact on the local road network.

5.1.2 Background

A comprehensive traffic study was undertaken as part of the 'Omeath – Warrenpoint Road Link, Feasibility Study' published by RPS Consulting Engineers in 2001.

This traffic model was developed using data collected from manual traffic counts and roadside interviews. This model was based on the principal assumption that "the local traffic using the R173 and A2 via Newry for journeys between County Down and the Cooley Peninsula will transfer to a new 'crossing route' if there is a time saving to be gained". This traffic model found that a bridge crossing "would account for a travel time benefit of 40 minutes for each return trip" and therefore, the study predicted that between 883 and 1116 AADT would utilise the new bridge crossing in the base year (2000).

A similar model has been developed for this traffic study. The latest model utilises the same roadside interview data collated in the previous study to determine the likely trip distribution, however, the traffic flows, which are based on more recent traffic counts conducted by Scott Wilson, are representative of existing traffic conditions.

5.2 Existing Conditions

5.2.1 Local Road Network

The local road network is distinctly different on each side of the Newry River, as shown in **Figure 5.1** in Volume 3.

On the south side, the R173 (B79) is the primary route serving the Cooley Peninsula. The R173 starts north of Dundalk where the N52 Dundalk Eastern Bypass meets the M1 Motorway. It continues along the peninsula edge before turning around the

Cooley Mountains and passing through Carlingford and Omeath. It terminates in Newry at Bridge Street.

The R173 carriageway cross-section is typically wide, although at certain locations, such as in the vicinity of Narrow Water, the cross-section is no greater than a reduced single carriageway. These discrepancies in carriageway cross-section cause road users to speed where it is not appropriate to do so.

The R173 primarily serves local and tourist traffic, although it does accommodate some Heavy Goods Vehicle (HGV) traffic, which the road is not particularly well suited, generated by Greenore. Traffic originating and terminating outside the Cooley Peninsula is not attracted onto the R173 as the M1 Motorway offers a reliable, fast and direct route between Newry and Dundalk.

The remaining road network on the Cooley Peninsula with exception to the R174, which connects the M1 Motorway and the R173 through Ravensdale, and the R175, which connects Greenore to the R173, consists of narrow winding local roads that are not suitable for distributing large volumes of traffic.

On the north side, the A2 dual carriageway, which has few junctions, connects Newry to Warrenpoint. Beyond Warrenpoint, the A2 route continues as a single carriageway road and it terminates at Clough providing access to Ballynahinch, Downpatrick and ultimately Belfast. The A2 dual carriageway is currently operating well within capacity.

The existing Warrenpoint Roundabout is a 3-arm roundabout situated at the end of the A2 dual carriageway at a junction between the A2 route and a local road. This local road leads to the B7 route, which connects Warrenpoint to Rathfriland.

Any vehicles travelling between the Cooley Peninsula and the Mourne District are required to travel through Newry. Bridge Street and William Street, which cross the Newry River, join the R173 (B79) Omeath Road with the A2 dual carriageway.

5.2.2 Accessibility for Cyclists and Pedestrians

Any trips between the Cooley Peninsula and the Mourne District pass through Newry, which is a distance of 20km. The length of the journey ensures that there are negligible pedestrian movements and few cyclist journeys between Omeath and Warrenpoint.

On the north side, there is an existing footway around the A2 roundabout and cycle tracks along the A2 dual carriageway. On the south side, however, no pedestrian or cyclist facilities exist. A number of accidents have occurred on the R173, which involved pedestrians.

5.2.3 Existing Traffic

Scott Wilson conducted data collection surveys commissioned by Roads Service Northern Ireland in the Newry Area during April and May 2007. The data collection surveys consisted of the following:

- Manual classified traffic counts (MCC) at 14 junctions on Tuesday, 17th April 2007, or Thursday, 3rd May 2007;
- Automatic traffic counts (ATC) at separate locations between Monday, 16th April 2007 and Sunday, 6th May 2007;

- Journey time surveys along two routes on Tuesday, 17th April 2007, and Wednesday, 18th April 2007;
- Vehicle registration number surveys at 6 locations on Thursday, 19th April 2007;
- Roadside interview surveys at 2 locations on Thursday, 3rd May 2007.

These surveys also examined the data from a permanent automatic traffic counter (ATC421), which is located on the A2 Warrenpoint Road, Newry.

Roughan & O'Donovan conducted an additional manual traffic count during the morning peak hour at the A2 roundabout on Tuesday, 21st October 2008. This survey was conducted to assess the typical peak hour turning movements at the A2 roundabout.

The Annual Average Daily Traffic (AADT) is the total volume of vehicle traffic in both directions of a road for a year divided by 365 days. AADT is a useful and simple measurement of how busy the road is. The AADT flows on the A2 dual carriageway were estimated using the permanent automatic traffic counter (ATC421) as the near continuous collection of traffic data ensures a high degree of accuracy. Examination of the estimated AADT flows from the permanent automatic traffic counter, ATC421, indicates that there has been negligible growth on the A2 dual carriageway over the past number of years as shown in the table below.

There is no permanent automatic traffic counter on the R173 (B79). Instead, the AADT flows on this link were calculated from the traffic data collected over 3 weeks. The daily traffic counts were factored using 'RT 201 - Expansion Factors for Short Period Traffic Counts' by J Devlin to generate the AADT flows. However, it would appear a substantial increase traffic has occurred on the R173 (B79) when the existing traffic flows are compared with base year flows (2000) provided in the 'Omeath – Warrenpoint Road Link Feasibility Study, 2001'. This discrepancy in traffic growth between the A2 and the R173 (B79) is attributed to the economic growth experienced in southern Ireland.

Table 5.1 Traffic Growth on A2 and R173 (B79) between 2000 and 2007

Link	2000	2001	2002	2003	2004	2005	2006	2007	Growth
A2 Dual-carriageway	11,955[1]	13,564[2]	13,643[2]	14,344[2]	13,734[2]	13,283[2]	14,035[2]	14,351[3]	20%
R173 (B79)	2,612[1]	-	-	-	-	-	-	4,421[3]	69%

[1] The mean AADT flows taken from the 'Omeath – Warrenpoint Road Link Feasibility Study, 2001'
[2] The estimated AADT flows from the ATC421 permanent automatic traffic counter
[3] The mean AADT flows derived using 'RT 201 - Expansion Factors for Short Period Traffic Counts' by J Devlin

Table 5.2 Base Year (2007) Traffic Flows

Location	Base Year Traffic (AADT)		
	Lower	Mean	Upper
R173 Omeath Road	4,254	4,421	4,588
A2 Dual-carriageway	13,017	14,351	15,686
A2 Warrenpoint Harbour	12,821	14,136	15,450
Burren Road	196	216	236

Although traffic flows have increased in the intervening years, the traffic distribution identified within the 'Omeath – Warrenpoint Road Link Feasibility Study, 2001' has remained largely unchanged particularly since the dominant link is the A2 dual carriageway and any vehicles travelling between the Cooley Peninsula and the Mourne District must pass through Newry. The existing traffic flows are shown in Table 5.2 above.

Warrenpoint Harbour

Warrenpoint Harbour is a busy commercial port situated near the A2 roundabout at the edge of the town of Warrenpoint. The port generates a significant volume of traffic (~500 AADT), which a large proportion consists of HGVs. It should be noted the port traffic is taken into account by the traffic surveys used to determine the base year traffic flows.

The port facilitates both scheduled and unscheduled services. The scheduled services consist of a Roll On Roll Off (RORO) service to Heysham and a container line service to Cardiff. The unscheduled services consists of a broad range of ships of varying size that can be accommodated at the harbours 7 berths.

The RORO service operates 3 times daily or 28 sailings a week. It is considered to be responsible for much of the traffic generated by the port. The ships operating this service can accommodate 12 accompanied units or 120 unaccompanied units. In the worst case, it is assumed that the RORO service will generate vehicle 120 trips in an hour. The RORO service arrival and departure times are given in Table 3.3 below:

Table 5.3 Warrenpoint Harbour RORO Service Schedule

	Arrive	Depart	Arrive	Depart	Arrive	Depart
Monday	05:00					20:00
Tuesday	05:00	09:00	10:00	13:00	16:30	20:30
Wednesday	05:00	09:00	10:00	13:00	16:30	20:30
Thursday	05:00	09:00	10:00	13:00	16:30	20:30
Friday	05:00	09:00			16:30	20:30
Saturday	05:00					19:00
Sunday	05:00					19:00

It should be noted that the RORO service schedule is arranged to minimise the impact on the existing road network. It is apparent from the table above that the RORO service typically arrives or departs during off peak hours with the exception of the 09:00 departure and the 16:30 arrival. However, in both exceptional cases, the port traffic passing through Newry travels in the opposite direction to the primary peak hour flows and therefore, its impact on the existing road network is minimal.

5.2.4 Road Accidents

A total of 12 road traffic accidents (1 serious, 10 minor & 1 material damage) have been recorded in the vicinity of the proposed Narrow Water Bridge and the locations of these accidents are shown in **Figure 5.2** in Volume 3.

According to Louth County Council's accident database, between 1990 and 2006, 6 road traffic accidents have occurred on the R173 Omeath Road in the vicinity of the crossing. Fortunately, 5 accidents resulted in only minor injuries and 1 accident in material damage although it should be noted that a single vehicle fatal collision did occur nearby. A total of 5 accidents, including an accident involving a pedestrian, have occurred in close proximity to Davies' Crossroads and therefore it would appear to be particularly hazardous junction.

Based on accident data received from the Roads Service Northern Ireland (RSNI), in the past 5 years it would appear that 6 road traffic accidents have occurred on the A2 dual carriageway near the crossing location. However, only one accident causing serious injury has occurred as the remaining accidents consisted of minor injuries or material damage. There is no clear hazard on the north side as the accidents occurred at numerous locations for a variety of reasons.

5.3 Proposed Development

5.3.1 Description

The primary objective of the Narrow Water Bridge is to assist in the social economic development of the Cooley Peninsula and the Mourne District, through enhancing the tourist potential of the region and through cross-border community co-operation. The proposed development seeks to achieve this by providing a new single carriageway link between Omeath and Warrenpoint in counties Louth and Down, respectively.

It is intended that the proposed 6.0m wide carriageway will intersect the R173 Omeath Road south of Ferry Hill in the townland of Cornamucklagh and the A2 dual carriageway at the exsiting roundabout north of Warrenpoint. A roundabout is proposed at the junction with the R173 Omeath Road and the existing A2 roundabout is to be upgraded to accommodate an additional arm. The total length of the scheme is approximately 620m.

The proposed Narrow Water Bridge will be a cable-stayed bridge with a rolling bascule opening section. The carriageway alignment will split around the pylon for the main cable-stayed span. The rolling bascule opening section is required to permit marine vessels including pleasure craft, dredgers and tall ships access to the Victoria Lock and Newry. The opening procedure will be managed from a control building situated on the north side of the River Newry.

5.3.2 Pedestrian and Cyclist Facilities

The proposed Narrow Water Bridge includes the provision of pedestrian and cyclist facilities between the proposed Cornamucklagh Roundabout on the R173 and the A2 roundabout. Both the Cooley Peninsula and the Mourne Mountains are popular among hill walkers and cyclists. Therefore, it is important that the Narrow Water Bridge should cater for pedestrians and cyclists, particularly given that it is being promoted as a tourist bridge.

On the northern approach to the structure, a 3.0m combined cycle / footway will be provided on either side of the carriageway. This combined cycle / footway will tie into the existing footpath on the A2 roundabout. The cyclists will be able to access this combined cycle / footway via that dished kerbs that are to be provided at crossing points.

The 3.0m combined cycle / footway is continued across the opening span. The rolling bascule pylons and cables act to segregate pedestrians and cyclists from traffic.

The footway and cycleway diverge around the cable anchors on the main span providing a dedicated 2.0m footway and 1.5m cycle track on each side of the bridge. After approximately 100m the footway and cycleway merge once to give a 3.0m combined cycle / footway.

On the southern approach, the western combined cycle / footway terminates shortly after leaving the structure while the eastern cycle / footway gradually reduces from 3.0m to 1.75m wide. This 1.75m combined cycle / footway, which is separated from the roadway by a 0.75m grass segregation continues up the hill to the proposed Cornamucklagh Roundabout.

Presently, there are no pedestrian or cyclist facilities on the R173 Omeath Road, hence the termination at the proposed Cornamucklagh Roundabout. Furthermore, the population centres are Omeath, Warrenpoint and Newry. Therefore, it is considered appropriate that pedestrian and cyclist facilities should be provided on both sides across the bridge but only on the eastern side on the southern approach to the structure.

Dedicated uncontrolled pedestrian and cyclist crossing points at 60m to 100m intervals are to be provided on the bridge.

5.3.3 Traffic Management during Bridge Opening

Louth County Council will open the Narrow Water Bridge for marine vessels that cannot pass underneath Narrow Water Bridge. This includes opening the bridge for leisure craft heading for the Albert Basin and fishing vessels heading upstream of Narrow Water. Traffic management is necessary before, during and after the bridge opens and queuing facilities will need to be provided for traffic wishing to cross the bridge.

Traffic management measures including wig wag warning lights, barriers, advance warning and variable message signs will be required to control traffic and pedestrians when the bridge is open.

The following traffic management procedures have been assumed in the preliminary design. These procedures will be confirmed and agreed at Detailed Design stage with Louth County Council and Newry and Mourne District Council.

Proposed Advance Procedure

Step 1:

Vessels seeking to pass through Narrow Water Bridge will be required to contact Louth County Council or Newry and Mourne District Council 48 hours in advance of arrival giving details of vessel and estimated time of arrival.

Step 2:

Louth County Council to send a minimum of 3 no. operatives to Narrow Water on the day of arrival.

Step 3:

The vessel requiring the bridge to be opened shall contact the Narrow Water Bridge control building upon arrival in Carlingford Lough giving details of the updated time of arrival.

Step 4:

The operatives in the control building shall contact Warrenpoint Harbour to confirm that the passage of the marine vessel past the harbour is permitted. If the passage is not permissible, the vessel will be requested to make anchorage. Once Warrenpoint Harbour confirms the passage is clear, the marine vessel will be instructed to proceed beyond Warrenpoint Harbour and wait for further instruction.

Step 5:

Once the vessel is proceeding past Warrenpoint Harbour, the VMS signs in north and south, respectively, will display “BRIDGE OPENING QUEUES LIKELY” or “BRIDGE OPENING EXPECT QUEUES” informing road users that the bridge will open soon.

Step 6:

An operative shall leave the control building and walk along the Narrow Water Bridge informing pedestrians and cyclists to retreat from the structure as it is soon to open.

It should be noted that a similar procedure is required for vessels heading from Newry. In this circumstance, the control building should be initially contacted from the Victoria Lock.

Proposed Opening Procedure

Step 1:

Once the operative in the control building has verbal and visual confirmation that the vessel has passed Warrenpoint Harbour (or arrived at Narrow Water Keep for vessels approaching from Newry), the operative shall illuminate the wig wag signs and raise the vehicle barriers.

Step 2:

An operative on each side of the bridge (i.e. fixed and opening bridges) will ensure that all cyclists and pedestrians have disembarked from the bridge and place pedestrian barriers restricting access on to the bridge. The operatives will inform the control building once both sides of the bridge is clear.

Step 3:

Once the bridge is clear, the operative in the control building will begin opening the bridge. Initially, the locking pins at the central pier and northern abutment will retract permitting the opening span to roll. Once the locking pins have disengaged, the liftin jacks will lower the opening span counterbalance causing the opening span to roll open.

Step 4:

Once the bridge is fully open, the operative on the control building instructs the vessel to proceed through the opening bridge. It is anticipated that the opening procedure will take 5 minutes to complete.

It should be noted that vessels entering Carlingford Lough are expected to contact Warrenpoint Harbour before proceeding into the lough.

Proposed Closing Procedure

Step 1:

Once the operative in the control building receives verbal and visual confirmation the vessel has successfully passed through the bridge, the opening span is lowered.

Step 2:

Once the opening span is fully closed, the operative in the control building informs the operatives on the bridge.

Step 3:

The operatives on each side of the bridge remove pedestrian barriers, which permits pedestrians and cyclists to cross the bridge.

Step 4:

The vehicle barriers are lowered and the wig wag signs are turned off, which allows traffic to proceed across the bridge.

Step 5:

Once the queuing on the approaches to the bridge has cleared, the operative in the control building will stop displaying the warning message on the VMS signs. It is estimated that the bridge will be open to traffic 5 minutes after commencing the closing sequence.

5.4 Traffic Forecasts

5.4.1 Traffic Assessment Methodology

Traffic forecasts for the Narrow Water Bridge are based on a simple reassignment of traffic based on the results of origin-destination surveys and junction turning counts.

It should be noted that the crossing is beneficial for HGV traffic departing from the port of Greenore destined for Northern Ireland as it enables access to the A2 dual carriageway and improves access to the Newry and beyond. However, it is not anticipated that Greenore traffic heading south towards Dublin will divert across the bridge as this would not result in a travel time saving. Furthermore, it is considered that commercial vehicles originating from or destined for Warrenpoint Harbour will not utilise the crossing as the A2 dual carriageway is a higher quality link to Newry than the R173 Omeath Road. An allowance has been made in the analysis for Greenore traffic that may utilise the crossing while, at the same time, no allowance has been made for Warrenpoint Harbour traffic.

5.4.2 Future Traffic Growth Forecasts

The base year, 2007, has been chosen for the traffic analysis as this is the year the traffic counts and surveys were undertaken. The opening and design years for the bridge have been assumed to be 2013 and 2033, respectively. The same growth rates have been applied to the traffic on both sides of the Newry River, although in recent years a significant difference in traffic growth has been observed. The growth rates, shown below, have been derived using NRA Circular Letter 01/2004 “Future Traffic Forecasts 2002 to 2040”.

Table 5.4 Traffic Growth Rates

Year	Cars & LGVS	HGVs
Base Year (2007)	1.00	1.00
Opening Year (2013)	1.09	1.08
Design Year (2033)	1.26	1.31

5.4.3 Induced Traffic

It is recognised that a new link can generate additional traffic that cannot be identified from roadside interviews. This induced traffic can arise from developments that the new link would stimulate. In this case, the bridge, which increases mobility between the Cooley Peninsula and the Mourne District, enhances the tourist amenity of Carlingford Lough and this is likely to induce traffic in the region. The exact quantity of induced traffic is difficult to determine but in order to ensure a robust traffic assessment, the traffic flows have been increased by 25% to account for induced.

5.4.4 Trip Distribution

Specific Roadside Interviews were undertaken as part of the 'Omeath – Warrenpoint Road Link Feasibility Study, 2001' in order to assess the likely trip distribution.

The traffic study area, which included the Republic of Ireland and Northern Ireland, was divided up into thirteen zones. The interzonal flows, which were obtained from these surveys, were used to predict the traffic distribution with the new crossing in place. Trips were distributed assuming that local traffic using the R173 and A2 via Newry for journeys between County Down and the Cooley Peninsula will transfer across the bridge if there is a time saving.

In this report, the traffic distribution was based on the same interzonal flows. As in the previous study, any traffic travelling between the Cooley Peninsula and south Co. Down is predicted use the Narrow Water Bridge. In addition, it is anticipated that some traffic between the Cooley Peninsula and Newry might utilise the new link. The lower bound assumes that no Newry traffic will use the link while the upper bound assumes all traffic from central, east and north Newry will use the bridge. The Origin-Destination Surveys are summarised in the Table 5.6 below. For further details on the inter-zonal flows and traffic distribution refer **Appendix 5.1** at the end of this chapter.

Table 5.6 Origin – Destination Surveys

Origin	**Destination**							
Omeath	Cooley	Mourne	Newry East & North	Newry South & West	Rathfriland & Newcastle	Downpatrick	Northern Ireland	Republic of Ireland
	8%	14%	40%	14%	3%	1%	20%	1%
Destination	**Origin**							
Omeath	Cooley	Mourne	Newry East & North	Newry South & West	Rathfriland & Newcastle	Downpatrick	Northern Ireland	Republic of Ireland
	6%	13%	40%	12%	3%	0%	22%	3%

5.4.5 Traffic Assignment

Roughan O'Donovan have prepared a traffic model using the above parameters (i.e. existing traffic, traffic distribution, traffic and induced growth) was developed to predict the future traffic flows.
The predicted traffic flows in the Opening Year (2013) are given in Table 5.7 below.

Table 5.7 Opening Year (2013) Traffic Forecast

Location	Opening Year Traffic (AADT)		
	Lower	Mean	Upper
Narrow Water Bridge	1,037	2,227	3,503
R173 Omeath Road North	3,815	3,056	2,229
R173 Omeath Road South	4,813	5,198	5,599
A2 Dual-carriageway	13,568	15,266	16,989
A2 Warrenpoint Harbour	14,131	15,569	17,005
Burren Road	247	269	297

The traffic forecasted in the Design Year (2033) is illustrated in Table 5.8 below.

Table 5.8 Design Year (2033) Traffic Forecast

Location	Design Year Traffic (AADT)		
	Lower	Mean	Upper
Narrow Water Bridge	1,036	2,309	3,767
R173 Omeath Road North	4,549	3,722	2,728
R173 Omeath Road South	5,584	6,031	6,495
A2 Dual-carriageway	15,768	16,959	18,944
A2 Warrenpoint Harbour	16,423	18,100	19,777
Burren Road	286	299	323

It is the predicted design year traffic would be low across the Narrow Water Bridge and therefore, in light of its location would constitute a rural low-flow road.

5.5 Traffic and Transport Impacts

5.5.1 Narrow Water Bridge Mainline

The future traffic forecasts indicate low traffic flows (3,500 AADT or less) in the design year, which are significantly below the capacity of a reduced single in accordance with Table 4 of design standard TD9 of the NRA DMRB. Therefore, a 6.0m wide carriageway has been provided, which is more appropriate for a rural road carrying low volumes of traffic. This is consistent with NRA TD27/00 Annex A, which suggests that the cross-sections for non-national roads within national road schemes should be between 5.5m and 7.5m wide.

The peak hour traffic flows in the Base (2007), Opening (2013) and Design (2033) years are given in **Figures 5.3**, **5.4** and **5.5** in Volume 3

5.5.2 Proposed Cornamucklagh Roundabout

A new roundabout is proposed at the junction between the Narrow Water Bridge and the R173 Omeath Road. The layout of the proposed Cornamucklagh Roundabout is shown in **Figure 3.2** in Volume 3. The new roundabout was assessed using the Transport Research laboratory (TRL) ARCADY software for roundabout junctions. The junction assessments were carried out for the opening year (2013) and design year (2033) during the morning and evening peak hours. The results of this analysis are tabulated below in Table 5.9 below.

Table 5.9 Proposed Cornamucklagh Roundabout ARCADY Analysis

Time	Arm	Max. Degree of Saturation (RFC)			Queue Length (veh)			Average Delay (min/veh)		
		Base	Opening	Design	Base	Opening	Design	Base	Opening	Design
AM	R173 North	-	0.151	0.191	-	0.2	0.2	-	0.07	0.07
	Narrow Water Bridge	-	0.098	0.105	-	0.1	0.1	-	0.06	0.06
	R173 South	-	0.226	0.266	-	0.3	0.4	-	0.07	0.07
PM	R173 North	-	0.151	0.191	-	0.2	0.2	-	0.07	0.07
	Narrow Water Bridge	-	0.098	0.105	-	0.1	0.1	-	0.06	0.06
	R173 South	-	0.226	0.266	-	0.3	0.4	-	0.07	0.07

A roundabout is considered to operate within capacity if the Ratio of Flow to Capacity (RFC) is less than 0.85. It is clear that the proposed Cornamucklagh Roundabout operates satisfactorily without any queuing or delay. The RFC on all arms is so low (<25%) that a smaller roundabout may seem more appropriate, however, the proposed roundabout has an ICD of 36m and reducing the roundabout to a mini-roundabout would remove much of the traffic calming benefits of the roundabout given its rural location. The proposed roundabout is also suited to the significant amount of HGV utilising this road.

5.5.3 Existing A2 Roundabout

The existing A2 roundabout is to be upgraded to accommodate an additional arm. The revised layout of the A2 roundabout is shown in **Figure 3.2** in Volume 3. Therefore, the junction was analysed using the Transport Research laboratory (TRL) ARCADY software for roundabout junctions. The junction assessments were carried out for the base year (2007), opening year (2013) and design year (2033) during the morning and evening peak hours. The results of this analysis are tabulated below in Table 5.10 below.

Table 5.10 Proposed Cornamucklagh Roundabout ARCADY Analysis

Time	Arm	Max. Degree of Saturation (RFC)			Queue Length (veh)			Average Delay (min/veh)		
		Base	Opening	Design	Base	Opening	Design	Base	Opening	Design
AM	A2 North	0.229	0.198	0.222	0.3	0.2	0.3	0.04	0.03	0.03
	Burren Road	0.015	0.038	0.044	0.0	0.0	0.0	0.09	0.09	0.10
	A2 South	0.456	0.555	0.656	0.8	1.2	1.9	0.05	0.07	0.09
	Narrow Water Bridge	-	0.157	0.187	-	0.2	0.2	-	0.11	0.13
PM	A2 North	0.341	0.377	0.423	0.5	0.6	0.7	0.03	0.03	0.04
	Burren Road	0.014	0.035	0.045	0.0	0.0	0.0	0.12	0.13	0.14
	A2 South	0.228	0.276	0.328	0.3	0.4	0.5	0.04	0.05	0.05
	Narrow Water Bridge	-	0.118	0.129	-	0.1	0.1	-	0.08	0.08

As stated above, a roundabout is considered to operate within capacity if the Ratio of Flow to Capacity (RFC) is less than 0.85. It is clear in Table 5.10 that the proposed Cornamucklagh Roundabout operates satisfactorily without any queuing or delay.

5.5.4 Queuing Facilities during Bridge Opening

The bridge is required to open to accommodate marine traffic. While the opening operation is taking place traffic on either side of the Newry River will queue. These queues are to be accommodated in a safe manner that does not compromise the operation capacity of the Cornamucklagh or A2 roundabouts. The maximum queue lengths have been calculated using the following assumptions:

- The bridge opening occurs during the morning or evening peak hours;
- Two-way peak hour traffic is equivalent to 10% of AADT;
- Traffic arrives at a constant rate;
- Traffic will divert if the travel time saving is less than waiting time.

As previously stated, the travel time saving for vehicles travelling between Omeath and Warrenpoint is 18 minutes. In addition, it is predicted that the entire opening operation of the bridge will take approximately 20 minutes to complete. This is based on the following assumptions:

Bridge section to fully open	5 minutes
Passage of marine vessel through bridge	10 minutes
Bridge section to close	5 minutes
	20 minutes

Therefore, the maximum queue lengths have been calculated based on an 18 minute time to maximum queuing. The predicted queue lengths on either side of the bridge are given in Table 5.11 above.

It is clear from Table 5.11 that the queues can be accommodated in the 310m length of carriageway between the wig wag warning signals and the Cornamucklagh roundabout. Therefore, a sufficient length of carriageway has been provided to accommodate any queuing that may occur in the design year.

On the north side, however, the queuing length provided between the wig wag signals and the A2 roundabout is insufficient to accommodate the predicted queues. The queues will extend beyond the A2 roundabout and these queues will impact the operational capacity of the roundabout unless alternatives measures such as those outlined in **Figure 5.6** and **Figure 5.7** are adopted to mitigate this.

These alternative measures include providing advance fixed and variable message signage to inform drivers of the opening bridge ahead and the queuing that is likely to occur. In addition, yellow hatch road markings will be provided on the A2 roundabout to indicate where queuing is permitted, which will ensure the queuing does not adversely affect the operational capacity of the roundabout. Furthermore, signage will be provided on the Burren Road to prohibit vehicles queuing on this arm. These traffic management proposals are currently being developed in consultation with Roads Service Northern Ireland (RSNI) and Louth County Council. These proposals will be fully developed, finalised and agreed with the relevant authorities at Detailed Design stage. The adoption of these measures will enable vehicles to queue safely on the approaches to the A2 roundabout without impeding the operation of the roundabout.

Table 5.11 Predicted Queue Lengths

Arm			Opening Year (2013) Peak Hour					Design Year (2033) Peak Hour				
Description	Length		Demand		Queue Length		Capacity	Demand		Queue Length		Capacity
	m	pcu	per hour	per period	pcu	m	%	per hour	per period	pcu	m	%total
Lower bound												
Narrow Water Bridge South	366	63	52	16	16	121	26%	52	16	16	121	26%
Narrow Water Bridge North	60	10	52	16	10	58	100%	52	16	10	58	100%
A2 North	200	43	2	1	0	0	0%	3	1	0	0	0%
A2 South	100	17	41	12	12	71	73%	41	12	12	70	72%
Burren Road	6	1	8	3	0	0	0%	8	2	0	0	0%
Mean												
Narrow Water Bridge South	366	63	111	33	33	192	52%	115	35	35	199	57%
Narrow Water Bridge North	60	10	111	33	10	58	100%	115	35	10	58	100%
A2 North	200	43	60	18	9	52	27%	63	19	10	56	30%
A2 South	100	17	43	13	13	74	76%	44	13	13	76	78%
Burren Road	6	1	8	3	2	9	154%	9	3	2	9	161%
Upper bound												
Narrow Water Bridge South	366	63	175	53	53	307	83%	188	56	56	325	88%
Narrow Water Bridge North	60	10	175	53	10	58	100%	188	56	10	58	100%
A2 North	200	43	121	36	27	157	83%	130	39	30	173	91%
A2 South	100	17	43	13	13	76	76%	47	14	14	76	78%
Burren Road	6	1	10	3	2	11	200%	11	3	2	11	220%

It should be noted that the queues will not extend far enough to obstruct any accesses on to the A2 including the Warrenpoint Harbour access or Narrow Water Castle entrance. However, the existence of these queues in the nearside and offside lanes of the south and north approaches to the A2 Roundabout, respectively, will reduce the operational capacity of the junction. Therefore, a further assessment of the A2 Roundabout was undertaken using the Transport Research Laboratory (TRL) ARCADY software considering the queuing on the approaches.

Table 5.12: A2 Roundabout during Bridge Opening ARCADY Analysis

Time	Arm	Max. Degree of Saturation (RFC)			Queue Length (veh)			Average Delay (min/veh)		
		Base	Opening	Design	Base	Opening	Design	Base	Opening	Design
AM	A2 North	-	0.372	0.413	-	0.6	0.7	-	0.07	0.09
	Burren Road	-	0.024	0.029	-	0.0	0.0	-	0.09	0.09
	A2 South	-	0.720	0.837	-	2.5	4.7	-	0.14	0.22
	Narrow Water Bridge	-	0.000	0.000	-	0.0	0.0	-	0.00	0.00
PM	A2 North	-	0.743	0.824	-	2.8	4.6	-	0.16	0.25
	Burren Road	-	0.018	0.022	-	0.0	0.0	-	0.12	0.13
	A2 South	-	0.359	0.417	-	0.6	0.7	-	0.07	0.07
	Narrow Water Bridge	-	0.000	0.000	-	0.0	0.0	-	0.00	0.00

The assessment considers the unlikely event of a RORO ship arriving in Warrenpoint Harbour when the bridge is opening during the morning and evening peak hours. The analysis revealed that the northern approach to the A2 roundabout and the Burren could accommodate the future traffic flows even when the queuing was considered. However, the southern approach required a small modification to facilitate the predicted queues and future traffic volumes, which involves widening the approach to accommodate a third entry lane.

It is clear from Table 5.12 above that the existing A2 Roundabout with a minor alteration to the southern approach operates satisfactorily without any queuing or delay when the bridge is opening.

A further assessment has been undertaken to investigate the unlikely event of a RORO ship arriving in Warrenpoint Harbour when the bridge is opening during the morning and evening peak hours.

Table 5.13: A2 Roundabout during Bridge Opening and RORO Arrival Analysis

Time	Arm	Max. Degree of Saturation (RFC)			Queue Length (veh)			Average Delay (min/veh)		
		Base	Opening	Design	Base	Opening	Design	Base	Opening	Design
AM	A2 North	-	0.372	0.413	-	0.6	0.7	-	0.07	0.09
	Burren Road	-	0.024	0.029	-	0.0	0.0	-	0.09	0.09
	A2 South	-	0.804	0.921	-	3.8	8.7	-	0.19	0.35
	Narrow Water Bridge	-	0.000	0.000	-	0.0	0.0	-	0.00	0.00
PM	A2 North	-	0.743	0.824	-	2.8	4.6	-	0.16	0.25
	Burren Road	-	0.018	0.022	-	0.0	0.0	-	0.12	0.13
	A2 South	-	0.443	0.501	-	0.8	1.0	-	0.08	0.08
	Narrow Water Bridge	-	0.000	0.000	-	0.0	0.0	-	0.00	0.00

It is apparent from Table 5.13 above that A2 roundabout operates within capacity with minor queuing and delays when the bridge is opening and a large shipment of containers arrives during peak hours with the exception of the morning peak hour in the design year. In the design year, the roundabout will operate marginally over capacity with moderate queuing and delay if a large shipment arrives in Warrenpoint at the same time as the bridge opening.

It is highly unlikely that this event will occur. Based on the following assumptions it is predicted that the probability of this event occurring is in excess 1 in 10 years:

- The Narrow Water Bridge is opened 90 times a year within an hour of high tide;
- High or near high tides (within 1 hour) and the morning peak hour coincide for 10 days of every 60 days;
- The RORO service scheduled to arrive at 05:00 is between 3 and 4 hours late once every 100 sailings.

Although it is unlikely that a ship will be unloading while the bridge is open during the peak, it may occur on occasion and therefore, procedures should be in place to prevent queues developing at the A2 roundabout. To mitigate this it is proposed that the opening of the bridge be delayed until the ship in Warrenpoint Harbour is fully unloaded or peak hour traffic flows on the A2 roundabout have dissipated.

5.5.5 Parking

As described in Section 3.4.6, there is an existing recently refurbished lay-by on the northbound carriageway of the A2 dual carriageway situated between the A2 roundabout and the Narrow Water Keep. It is considered that the lay-by can accommodate 18 vehicles parallel to the kerb including 2 mobility impaired vehicles. Based on visitor information between 21st April 2011 and 31st August 2011, it is estimated that between 3 and 4 vehicles utilise this lay-by at peak times. It is only during exceptional circumstances that the parking provision of the lay-by is exceeded.

It is possible that the parking demand at this location will increase due to the provision of the Narrow Water Bridge. However, it is not anticipated that the increase in the parking will compromise the safe operation of the existing lay-by. In the worst case, it is estimated that an additional 9 vehicles will utilise the lay-by at peak times. Even though this is a two- or three-fold increase in parking demand, the lay-by can easily accommodate these additional vehicles. Therefore, it is not proposed to provide any additional parking spaces as part of the Narrow Water bridge scheme. It is difficult to accurately predict tourist traffic, and therefore, it is recommended that the parking demand at this lay-by is monitored by local authorities following completion of the bridge.

5.5.6 Improvement of Journey Times

Journey time surveys were undertaken on Wednesday, 11th November 2009 between Omeath and Warrenpoint via Newry during the AM peak and interpeak periods, with the data collected on a link by link basis. This survey indicated that the provision of the Narrow Water Bridge would result in an 18 minute journey time saving for traffic travelling between Omeath and Warrenpoint.

5.5.7 Safety Benefits of the Narrow Water Bridge

The provision of link between the R173 Omeath Road and the A2 Dual-carriageway has the benefit of reducing journey times and distances for road users travelling between Omeath and Warrenpoint. The likelihood of accidents occurring in the vicinity of the crossing should decrease due to the reduction in journey times and distances.

In addition, traffic heading from Omeath to Newry is also likely to divert across the bridge to the high standard road in the north. The A2 dual-carriageway is designed to accommodate significant volumes of traffic and it would provide a safer for traffic travelling between Omeath and Newry.

The Narrow Water Bridge will reduce the traffic volumes passing through Davies' Crossroads where a significant number of accidents have occurred in recent years. In addition, the proposed Cornamucklagh Roundabout will calm traffic on the R173 Omeath Road. In particular, it should reduce traffic speeds on the approach to Davies' Crossroads and subsequently, improving safety at the junction.

Furthermore, the proposed carriageway is only 6.0m wide. A major reason for selecting such a narrow carriageway is to calm traffic and create a safer road environment. Research has shown that carriageway width is an important factor in limiting vehicular speeds

Finally, the proposed Narrow Water Bridge includes the provision of segregated and combined pedestrian and cyclist facilities. These facilities provide safe environment pedestrians and cyclists to utilise away for the full length of the proposed link.

In summary, the Narrow Water Bridge has the benefit of improving road safety in the vicinity of the crossing.

5.6 Construction Stage

5.6.1 Construction Traffic Estimates

Chapter 3 of this report outlines the details of the existing ground conditions and proposals for earthworks design based on data obtained from the preliminary site investigations.

5.6.2 Earthworks Traffic

The scheme involves the excavation and transportation of large volumes of material excavated both within and from the site.

The estimated earthworks quantities for the scheme sees an earthworks balance south of the River and a deficit of 8,300 cubic metres north of the River. Additional, a total amount of unsuitable material of 1,700 south of the River and 3,500 North of the river will need to be disposed of within the working area, being used in other uses on site such as landscaping and noise bunds.

In the worst case scenario if it is necessary to export the residual surplus volume of earthworks of up to 9,000 cubic metres of cut material this would involve 820 truck loads (assuming 20 Tonnes or 11 cubic metres per truck load). This would represent an average of 13 loads per day if the bulk earthworks are spread over a period of 3 months.

5.6.3 Pavement Materials

The main materials that will be hauled to site in bulk are: granular sub-base material, and bituminous pavement materials, amounting to a volume of 1720 cubic metres. It is likely that surplus cut material will be processed on site for use as sub-base material, which would reduce the volume of pavement materials to be transported to site. In the worst case scenario of 800 cubic metres of material to be imported to site, this represents some 75 truck loads assuming 11 cubic metres per truck load, which would represent an average of 12 loads per day if the pavement works are spread over a period of 1.5 months.

The haulage of pavement and construction materials is not likely to coincide with the earthworks operations and therefore the haulage of materials will peak during the earlier earthworks phase.

5.6.4 Concrete Works

The scheme includes the construction of the Narrow Water Bridge and a number of culverts. These structures are likely to contain both pre-cast reinforced concrete units and in situ concrete. Assuming an in-situ concrete will be used in the construction of Narrow Water Bridge, it is estimated that the construction of these structures will involve some 2,900 cubic metres of concrete, which could involve up to 485 truckloads of concrete inbound to the site (6 cubic metres per truck) over a 12 month period, which would represent an average of 3 truck movements per day.

5.6.5 Prefabricated Steel Sections

The bridge deck and towers are steel orthotropic and steel composite sections respectively. This will require the assembly on site of large sections of steel elements previously fabricated elsewhere and transported to site. The south bridge will have a total tonnage of approximately 1600 tons of steel. Assuming an average section of 25 tons this will require a total of 65 loads, considering a construction period of 18 months; this will require an average of 4 movements per month.

5.6.6 Overall Volume of Construction Truck Traffic

The peak truck traffic during the construction period is estimated to amount to 20 truck movements per day during the first 4 months of the construction period, and to then drop to 10 truck movements per day for the following 20 months.

5.6.7 Construction Site Access

It is anticipated that the main site compound would be located on the south side and the access to the southern site and the site compound would be from the R173 Omeath Road. Access to the northern site will be provided off the A2 roundabout.

5.6.8 Construction Traffic Routing

The haulage of materials to and from the site could create a significant temporary impact to both road users and to residents living along haul roads. To minimise these impacts it is important that only authorised roads are to be used by construction vehicles.

5.6.9 Traffic Management

The scheme construction also impacts on the existing roads at the following locations:

- R173 Omeath Road in Cornamucklagh;
- A2 Roundabout north of Warrenpoint.

It is likely that significant temporary works and traffic management will be required to facilitate the passage of traffic on the existing R173 and A2 at these locations during construction.

In addition, the Narrow Water Bridge crosses the Newry River, which is navigable via the Newry Canal as far as Newry. Although the proposed bridge clearly has implications for marine traffic when operational, it also has an impact on marine vessels during construction.

In particular, a single leaf pier, which is located in the centre of the river, will be constructed adjacent the navigational channel prior to the construction of the main cable-stayed span. Vessels could collide with this pier, unless this pier is highlighted to approaching vessels. A similar problem occurs when the main cable-stayed span extends over the navigational channel unless adequately highlighted.

Finally, the opening section extends over the navigational channel. The channel will need to be closed during the installation of this span.

An Environmental Operating Plan will be put in place by the contractor during the construction phase of the scheme with regard to the NRA Guidelines for the Creation and Maintenance of an Environmental Operating Plan (2007). This EOP will include a Traffic Management Plan.

Further detail of the construction phase impacts and mitigations measures are included in Chapter 13.

5.7 Conclusions

5.7.1 Traffic and Transport Impact

The proposed Narrow Water Bridge will significantly improve connectivity between the Cooley peninsula and the Mourne District, which will enhance the tourist potential of the region.

(a) The proposed bypass is forecast to carry a design year traffic flow of between 1,036 and 3,767 AADT in 2033.

(b) The provision of a link results in an 18 minute journey time saving for traffic travelling between Omeath and Warrenpoint.

(c) It is expected that the road geometry will discourage HGVs from crossing the Narrow Water Bridge. The HGV traffic, which is likely to use the crossing, will result in a minimal increase of HGV traffic on the A2 dual carriageway.

(d) A 6.0m wide carriageway is the most suitable road type for the Narrow Water Bridge.

(e) The opening operation is estimated to take 20 minutes to complete.

(f) On the south side, queues can be accommodated between the wig wag signals and the Cornamucklagh Roundabout.

(g) On the north side, queues can be accommodated on the approaches to the A2 roundabout without blocking any accesses with the appropriate traffic management.

(h) On the north side, queues can be accommodated on the approaches to the A2 roundabout without blocking any accesses with a slight modification to the A2 roundabout southern approach and the appropriate traffic management

(i) In the unlikely event of a RORO ship arriving when the bridge is opening during the morning peak hour, the bridge shall not be opened until the ship is unloaded or peak hour traffic has dissipated. This procedure should be included in the Environmental Operating Plan.

(j) The existing lay-by on the northbound carriageway of the A2 dual-carriageway is capable of accommodating any additional parking demand arising from the provision of the bridge;

(k) The segregated and combined pedestrian and cyclist facilities along the bridge and approaches provide a safe environment pedestrians and cyclists to utilise.

(l) The Narrow Water Bridge is beneficial as it improves road safety in the vicinity of the crossing;

(m) The peak truck traffic during the construction period is estimated to amount to 20 truck movements per day during the first 4 months of the construction period, and to then drop to 10 truck movements per day for the following 20 months.

(n) Construction near or adjacent the navigational channel shall be highlighted to approaching vessels.

(o) The navigational channel shall be closed during the installation of this opening span.

(p) An Environmental Operating Plan, which will include a Traffic Management Plan, will be put in place by the contractor during the construction phase of the scheme with regard to the NRA Guidelines for the Creation and Maintenance of an Environmental Operating Plan (2007). This EOP will include a Traffic Management Plan.

The noise and air quality impacts associated with traffic are detailed in Chapter 7. In addition, further detail of the construction phase impacts are included in Chapter 11.

5.7.2 Mitigation Measures

The following measures are proposed to mitigate any adverse impacts addressed above:

(a) A traffic management plan will be finalised at detailed design stage with the relevant authorities to ensure that A2 Roundabout flows freely during the opening of the bridge.

(b) An Environmental Operating Plan, which will include a Traffic Management Plan, will be put in place by the contractor during the construction phase of the scheme with regard to the NRA Guidelines for the Creation and Maintenance of an Environmental Operating Plan (2007). This EOP will include a Traffic Management Plan;

(c) The parking at the lay-by on the northbound carriageway of the A2 dual-carriageway should be monitored by local authorities following completion of the bridge.

The measures to mitigate the noise and air quality impacts are detailed in Chapter 7 while the construction phase mitigation measures are discussed in Chapter 11.

5.8 References

'Omeath – Warrenpoint Road Link, Feasibility Study' by M. C. O'Sullivan & Co. Ltd. (now RPS Consulting Engineers), 2001.

'Newry Southern Relief Road, Traffic Survey and Data Report' by Scott Wilson, Draft Issue, May 2008.

'Narrow Water Bridge, Constraints Study Report' by Roughan & O'Donovan Consulting Engineers, Final Issue, November 2008.

'Narrow Water Bridge, Route Selection Report' by Roughan & O'Donovan Consulting Engineers, Final Issue, November 2008.

'Narrow Water Bridge, Bridge Feasibility Study' by Roughan & O'Donovan Consulting Engineers, Final Issue, November 2008.

'Narrow Water Bridge, Preliminary Design Report, Volume 1A' by Roughan & O'Donovan Consulting Engineers, Issued for Client Approval, November 2010.

Appendix 5.1 - Trip Distribution

From Omeath										To Omeath									
Origin		Destination		Trip						Origin		Destination		Trip					
Zone	Name	Zone	Name	Non Leisure	Leisure	Petrol	All	%	Trip Factor	Zone	Name	Zone	Name	Non Leisure	Leisure	Petrol	All	%	Trip Factor
1	Cooley Mountains	1	Cooley Mountains	24	12	7	43	7.49%	0.00	1	Cooley Mountains	1	Cooley Mountains	14	18	12	44	6.04%	0.00
										1	Cooley Mountains	7	Centre County Louth	2	1	0	3	0.41%	0.00
										1	Cooley Mountains	12	West Ireland	1	0	0	1	0.14%	0.00
										1	Cooley Mountains	13	East Ireland	1	1	0	2	0.27%	0.00
1	Cooley Mountains	2	Mourne Mountains	45	17	15	77	13.41%	1.00	2	Mourne Mountains	1	Cooley Mountains	34	33	26	93	12.76%	1.00
										2	Mourne Mountains	13	East Ireland	1	1	0	2	0.27%	0.00
1	Cooley Mountains	3	Rathfirland & Newcastle	17	1	1	19	3.31%	1.00	3	Rathfirland & Newcastle	1	Cooley Mountains	4	13	7	24	3.29%	1.00
1	Cooley Mountains	4	Banbridge	11	1	10	22	3.83%	0.00	4	Banbridge	1	Cooley Mountains	5	10	10	25	3.43%	0.00
1	Cooley Mountains	5	Bessbrook, Tandridge and	4	0	1	5	0.87%	0.00	5	Bessbrook, Tandridge and	1	Cooley Mountains	1	7	4	12	1.65%	0.00
1	Cooley Mountains	6	South County Armagh	2	1	1	4	0.70%	0.00	6	South County Armagh	1	Cooley Mountains	4	2	0	6	0.82%	0.00
1	Cooley Mountains	7	Centre`County Louth	8	4	0	12	2.09%	0.00	7	Centre`County Louth	1	Cooley Mountains	9	10	0	19	2.61%	0.00
1	Cooley Mountains	81	Central Newry	98	34	1	133	23.17%	0.50	81	Central Newry	1	Cooley Mountains	118	50	3	171	23.46%	0.50
1	Cooley Mountains	82	East Newry	11	0	6	17	2.96%	0.50	82	East Newry	1	Cooley Mountains	7	12	7	26	3.57%	0.50
1	Cooley Mountains	83	North Newry	44	0	32	76	13.24%	0.50	83	North Newry	1	Cooley Mountains	13	42	33	88	12.07%	0.50
1	Cooley Mountains	84	West Newry	15	1	11	27	4.70%	0.00	84	West Newry	1	Cooley Mountains	4	21	12	37	5.08%	0.00
1	Cooley Mountains	85	South Newry	22	1	30	53	9.23%	0.00	85	South Newry	1	Cooley Mountains	11	22	19	52	7.13%	0.00
1	Cooley Mountains	9	Downpatrick	8	0	0	8	1.39%	1.00	9	Downpatrick	1	Cooley Mountains	1	0	2	3	0.41%	1.00

Appendix 5.1 - Trip Distribution

From Omeath										To Omeath									
Origin		Destination		Trip						Origin		Destination		Trip					
Zone	Name	Zone	Name	Non Leisure	Leisure	Petrol	All	%	Trip Factor	Zone	Name	Zone	Name	Non Leisure	Leisure	Petrol	All	%	Trip Factor
1	Cooley Mountains	10	Belfast and County Antrim	38	11	4	53	9.23%	0.00	10	Belfast and County Antrim	1	Cooley Mountains	34	40	8	82	11.25%	0.00
										10	Belfast and County Antrim	7	Centre County Louth	1	1	0	2		
										10	Belfast and County Antrim	13	East Ireland	0	1	0	1		
1	Cooley Mountains	11	North Armagh and Donegal	17	1	0	18	3.14%	0.00	11	North Armagh and Donegal	1	Cooley Mountains	8	22	5	35	4.80%	0.00
										11	North Armagh and Donegal	7	Centre County Louth	1	0	0	1		
1	Cooley Mountains	12	West Ireland	1	1	0	2	0.35%	0.00	12	West Ireland	1	Cooley Mountains	1	1	0	2	0.27%	0.00
1	Cooley Mountains	13	East Ireland	1	0	0	1	0.17%	0.00	13	East Ireland	1	Cooley Mountains	1	1	0	2	0.27%	0.00
7	Centre County Louth	1	Cooley Mountains	1	1	0	2	0.35%	0.00										
7	Centre County Louth	2	Mourne Mountains	0	2	0	2	0.35%	1.00										
7	Centre County Louth	4	Banbridge	1	0	0	1												
7	Centre County Louth	7	Centre County Louth	1	1	0	2												
7	Centre County Louth	81	Central Newry	1	2	0	3			81	Central Newry	7	Centre County Louth	1	1	0	2		
7	Centre County Louth	83	North Newry	1	0	0	1												
13	East Ireland	11	North Armagh and Donegal	2	1	0	3												
13	East Ireland	81	Central Newry	1	0	0	1			81	Central Newry	13	East Ireland	0	1	0	1		
										83	North Newry	7	Centre County Louth	1	1	0	2		
Total Outbound Trips				374	92	119	585	100%		Total Inbound Trips				278	312	148	738	100%	

Appendix 5.1 - Trip Distribution

From Omeath										**To Omeath**									
Origin		**Destination**		**Trip**						**Origin**		Destination		Trip					
Zone	Name	Zone	Name	Non Leisure	Leisure	Petrol	All	%	Trip Factor	Zone	Name	Zone	Name	Non Leisure	Leisure	Petrol	All	%	Trip Factor
Bridge Trips Lowerbound				70	20	16	106	18%		Bridge Trips Lowerbound				39	46	35	120	16%	
Bridge Trips Mean				147	37	36	219	37%		Bridge Trips Mean				108	98	57	263	36%	
Bridge Trips Upperbound				223	54	55	332	57%		Bridge Trips Upperbound				177	150	78	405	55%	
Total Omeath Road Trips				367	88	119	574	98%		Total Omeath Road Trips				274	307	148	729	99%	

Notes:

1. Trip distribution to and from Omeath was derived from the information gathered during Roadside Interview Surveys undertaken on Wednesday, 23rd August 2000, for the 'Omeath - Warrenpoint Road Link Feasability Study, June 2001'.

Part II

Significant Environmental Effects & Proposed Ameliorative Measures

Chapter 6

Socio-Economic Impacts

Chapter 6 Socio-Economic Impacts

6.1 Introduction and Terms of Reference

This section examines the effects of the proposed development on human beings that are adjacent to, and are affected by, the proposed project; in particular focusing on socio-economic issues including land-use, population, economic activity, agriculture, tourism and residential amenity.

In preparing this section, regard was had to the relevant policies and objectives of various spatial plans including Louth County Development Plan 2009–2015; Carlingford Local Area Plan September 2002, Omeath Local Area Plan May 2002 and the Banbridge / Newry & Mourne Area Plan 2015 (Draft Plan).

The Carlingford and Louth Local Area Plans are currently under review and Issues Papers were published for consultation in June 2010.

6.2 Methodology

6.2.1 Desk and Field Studies

Both desk and field studies were used in order to complete the assessment presented in this section. The desk study involved preliminary identification of the relevant legislation and guidance regarding road and bridge projects in the EU and Ireland. A thorough review of all national and local government development plans and other relevant plans and strategies followed this, in order to assess how the bridge project would relate to and affect the future development of the areas affected by the scheme.

In addition to the information detailed above, the desk study used the following sources: maps and site layout plan of the existing area and proposed development; national, regional, and local planning policies for the area and demographic data.

Site visits were undertaken during 2008 and supplemented with further visits in 2010. This involved driving surveys of the wider surrounding areas on both sides of Narrow Water and walking surveys of the immediate areas where the project is located. Where available, local literature and information sources were consulted, as well as unstructured interviews with local people.

6.2.2 Social Profile and Studies

A social profile of the study area has been prepared which describes the existing social environment. This social profile has been developed based on:

- An analysis of the current and historical demographic characteristics of the study area;
- A description of the employment patterns of the labour-force;
- The identification of existing and proposed local land uses;
- The identification of local businesses, services and facilities;
- The identification of social patterns and linkages; and
- A review of available information and documents from previous studies.

Based on this information the potential construction and operation related social impacts of the proposed works have been identified, analysed and discussed.

In addition to the relevant development plans the social assessment was based on the following key documents:

- CSO Census data from 1991, 1996, 2002 and 2006;
- Louth Heritage Plan 2007-2011;
- Ireland North and South: A Statistical Profile, 2008 Edition, CSO (Central Statistics Office) and NISRC (Northern Ireland Statistics and Research Agency);
- Landscape Character Assessment of County Louth, December 2002;
- Banbridge / Newry & Mourne Area Plan 2015, Draft Plan - August 2006, Technical Supplement 9: Tourism.

Other chapters of this EIS/ES also provided some information for this chapter.

6.2.3 Planning Policy

This section provides a general overview of the current strategic and local planning policies that are relevant to the project.

National and Regional Strategies

National Development Plan – Transforming Ireland 2007-2013

The National Development Plan (NDP) outlines a strategy for all-island collaboration, which acknowledges competitive advantage for both the North and the South. The Irish Government commits to pursuing collaborative actions to address the competitive challenges facing both parts of the island and the economic problems that persist as a result of the border, throughout the life of the Plan.

"*Collaborative actions will be pursued on the basis of cost-effectiveness and the delivery of benefits to the North and the South."*

Infrastructure is identified as one key area where "*meeting common challenges means building competitive strengths."* The Plan commits to the development of strategic cross-border road links in border regions as a priority, acknowledging that "*strengthened cross-border transport infrastructure will enhance the potential for major economic and social gains for the whole of the island."*

The NDP supports the development of cross-border economic, social and environmental activities through joint strategies for sustainable territorial development through the Territorial Co-Operation Initiative, including in relation to enterprise, linkages and access; encouraging tourism, culture and cross-border trade, supporting links between urban and rural areas and reducing isolation through improved access to transport and information.

National Spatial Strategy 2002–2020

A priority identified in the National Spatial Strategy 2002–2020, relates to the provision of strategic radial and linking corridors and international access points. The potential of Dundalk, Newry and Drogheda as urban centres along the Dublin-Belfast corridor is recognised, with Dundalk noted in relation to its capacity to develop as a gateway in this regard. Particular mention is given to underpinning cross-border co-operation with neighbouring Newry, through the strengthening of transport and business links, aiming to achieve critical mass and drive development throughout the eastern part of the border region.

Section 3.5.5, *Co-Operating in an All-Island Context,* discusses the importance of an all-island economy with an emphasis on co-operation for economic advantage across a range of activities. The Dublin-Belfast Corridor is one such opportunity for large-scale co-operation. The position of Dundalk as a gateway and the importance of energising the potential arising from cross-border co-operation, "*in sectors including enterprise, tourism and food as well as encouraging potential new cross-border linkages such as inland waterways"* is also noted.

Border Regional Authority Planning Guidelines 2010 - 2022

The aim of the guidelines is to provide a long term strategic planning framework for the border region. The current guidelines were published in September 2010 and are in compliance with the National Spatial Strategy, as required by the Planning and Development (Amendment) Act 2010.

The guidelines recognise the strong potential of the region to develop tourism and its position as an interface between the two economies. Under the title Tourism and Connectivity it notes that a large portion of visitors to the Region are from Northern Ireland and as such access opportunities need to be improved. The Sustainable Transport Strategy outlined under Chapter 5 adds further support to this requirement.

Regional Development Strategy for Northern Ireland 2025 – Shaping Our Future

'Shaping Our Future - The Regional for Northern Ireland 2025' was first published in 2001 and was reviewed in 2008 with the publication of 'Adjustments to the Regional Development Strategy 2025'. Together these documents from the overarching development strategy for the North of Ireland and the Development Plans must be in 'general conformity' to it (Planning (Northern Ireland) (Amendment) Order 2003).

Under the banner 'Supporting Economic Development' the Strategy, through the provision of policy SPG-ECON 7, promotes the provision of sustainable tourism infrastructure as essential to the development of a sustainable tourism industry. A number of related sub policies identify the Mournes as a Signature Project area and identify the need to improve access to such facilities.

Regional cohesion is supported in the strategy, in which it is committed to:

- Developing cross-border networks/clusters of co-operation to exploit economic opportunities for towns and smaller settlements and help rejuvenate areas in need of investment;
- Stimulating rural revitalisation based on cross-border joint initiatives to provide cumulative benefits in terms of employment, services, tourism and infrastructure, and cultural understanding; and

Regional Strategic Transport Network Transport Plan 2015 (RSTN TP)

The RSTN TP has been prepared by the Department for Regional Development, based on the guidance set out in the Regional Development Strategy (RDS) and the Regional Transportation Strategy (RTS). The Strategy addresses access to regional gateways and cross border links with an emphasis on improving connections from the 5 key transport and 4 link corridors. Warrenpoint is included in the Eastern Seaboard Corridor, which includes "*road and rail links between BMA and Dublin and northward to Larne, improving access to Warrenpoint and Rosslare*".

In line with the Strategic Planning Guidelines, **SPG-Tran 1**; "*To develop a Regional Strategic Transport Network based on key transport corridors, to enhance accessibility to regional facilities and services*", the Guideline was further developed into **Tran 1.3**, which has a stated aim to: "*contribute to the creation of an integrated sustainable transport network for the island of Ireland as a whole. The development of a co-ordinated approach to spatial planning between Northern Ireland and the Republic of Ireland will assist the effective development of cross-border roads and public transport routes, and help the tourism industry.*"

Planning Strategy for Rural Northern Ireland (PSRNI)

The PSRNI outlines the Department's operational planning policies for tourism development and accommodation, protection of tourist assets, recreational schemes and also in exploiting the potential of coastlines and marinas in maximising tourist potential in Northern Ireland. As it may be several years before there is a Planning Policy Statement relevant to tourism, PSRNI currently provides the Department's policies for tourism development in the rural area.

A Sustainable Development Strategy for Northern Ireland - First Steps Towards Sustainability

The Strategy, published in 2006, has as **Strategic Objective 1**: "*To increase the economic wellbeing of the people of Northern Ireland*", with the following key target: *"Invest in modern infrastructure to support the needs of the people of Northern Ireland".* This is to be achieved through a number of steps including:

- Use technology and land use planning to improve employment opportunities for all and access to jobs in remote areas;
- Promote a culture which supports enterprise and entrepreneurship;
- Develop a globally competitive sustainable tourism industry.

Furthermore, the Strategy aims to address the needs of rural communities and their access to services and transport links and increase social and community cohesion.

Tourism in Northern Ireland – A Strategic Framework for Action 2004-2007

The Northern Ireland Tourist Board have published a strategic framework, which in line with their Corporate Plan, aims to increase visitor tourism revenue by 9% each year, visitor numbers by 7% and to increase Northern Ireland's share of visitors to the island of Ireland. One of the key areas identified as important in achieving these targets is to ensure direct access into Northern Ireland is increased and that improvements are made to transport linkage. The Mournes National Park area is one of the key signature projects identified for progress in the short to medium term of the framework.

Development Plans

Louth County Development Plan 2009-2015

A review of the policies relevant to this project within the existing County Louth Development Plan, 2009 – 2015 has been undertaken. Chapter 7 of the Plan sets out the policies of the Council in relation to Economic Development, Employment and Tourism.

Referencing the '*Economic Development Strategy for County Louth 2008'* the Plan, at Section 7.4 identifies the potential of tourism to contribute to the economic development of the county through the promotion of its various assets and attractions.

Policy TOU 1 aims to promote Louth as a quality tourist destination and is "supportive of innovative tourism projects that would boost employment and promote County Louth as a tourism destination..."

In addition the Plan, at Policy TOU 6, specifically supports the development of Narrow Water Bridge

> ***"7.5.4 Narrow Water Bridge***
> *The provision of a road link through the construction of a bridge between the Cooley Peninsula in County Louth and the southern portion of the Mourne Mountains in County Down at Narrow Water would make a valuable contribution to the development of tourism in Louth and the Mournes. Initial funding for the project has been provided in the National Development Plan 2007-2013 and preliminary design work commenced."*

Policy

TOU 6 To co-operate with the authorities in Northern Ireland in the provision of a road bridge between Cooley and south County Down."

Banbridge, Newry and Mourne Area Plan 2015 (Draft Plan)

A brief review of the policies relevant to this project within the Draft Banbridge, Newry and Mourne Area Plan, 2015 Plan have been undertaken. **Technical Supplement 9** of the Plan sets out the policies of the Council in relation to Tourism and is the most relevant chapter to this report. The key issue emerging is that the infrastructure has to be properly developed as a means of meeting the needs of visitors and tourists. Specific issues are detailed below under the Warrenpoint Strategic Development Framework.

Section 2.4.4 of Supplement 9 describes the importance of co-operation with the Republic of Ireland and Great Britain in relation to tourism growth, drawing more tourists into Northern Ireland from the West Coast of Ireland tourism circuit.

In particular, the following objectives relate to tourism development in the region:

- **SPG-ECON 7**: To promote a sustainable approach to the provision of tourism infrastructure.
- **SPG-ECON 8**: To establish a world-wide image for Northern Ireland based on positive images of progress, and attractive places to visit.
- **SPG-ECON 9**: To protect and enhance a varied range of tourism development opportunities.
- **SPG-ECON 10**: Identify major tourism development opportunities for the private sector to develop 'destination resort' complexes in Northern Ireland, based on distinctive tourism themes.
- **SPG-ECON 11**: To promote the region as a centre for cultural, business and sports tourism.

Section 3.2 of this Technical Supplement within the Plan relates to sustainable tourism and in particular includes policy **ECON 7.1**, which outlines the objective to take a sustainable approach to tourism development that would:

(i). Found its development projects carefully within the culture and environment of the region;

(ii). Recognise that visitors are increasingly attracted to a place that has a definable and genuine local character;

(iii). Recognise the potential of 'knowledge-based tourism and recreation', for which both the environment and local cultural events are key attractions;

(iv). Diversify the visitor opportunities to extend the season, thereby spreading the benefits to local economies throughout the year, and

(v). Strive to improve the **regional spread of tourism**, target areas of social need, and ensure that local economies gain benefit from tourism development.

The Plan identifies ***Sustainable Tourism Strategy for the Mournes*** identified (within Section 5.2 of the Technical Supplement relating to tourism) as a district-wide tourism strategy with the following aim:

> *"To develop a sustainable rural tourism sector based on the natural, social, cultural and recreational resources of Mourne and to develop the Mournes as both a day visit and overnight holiday destination with management of the environment, tourism infrastructure development and visitor management standards commensurate to those of a National Park"* – from 'Mournes Heritage Trust – Natural Resource Rural Tourism Initiative 17'.

The Sustainable Tourism Strategy also notes the importance of developing and enhancing the location and access to tourism through the provision of infrastructure at key locations. It also sets out an objective to facilitate the development of rural industries and integration into the area along with ensuring that local economies can benefit from tourism development.

Conclusion

This review of planning policy highlights that the Narrow Water Bridge project complies with the economic aims and objectives of the development strategies, both north and south, and will assist in the realisation of a number of existing opportunities.

6.3 Proposed Development

The proposed new bridge and link road will cater primarily for local journeys and tourist related traffic. It will link the R173 Carlingford to Newry road with the A2 Newry to Warrenpoint Road at a point to the north west of Omeath in the Republic of Ireland and Warrenpoint in Northern Ireland – **refer to Figure 3.1** in Volume 3.

The project will involve the construction of a road and an opening bridge across Narrow Water which will allow vessels to pass up and downstream. It will connect to the existing roundabout on the A2 on the approach to Warrenpoint and to a new Roundabout on the R173 Omeath Road.

The main objective of the Narrow Water Bridge Project is to assist in the social and economic development and cross border integration of the area, especially through the growth of tourism and cross-border community co-operation.

As the scheme will be situated both in the Republic of Ireland and Northern Ireland, a planning application will be submitted in both jurisdictions. This requires the preparation of a single Environmental Impact Statement/Environmental Statement that satisfies the requirements of both planning jurisdictions.

The main socio-economic issues which typically arise in bridge/road schemes such as these relate to:

- Improvements in connectivity within existing and new settlements by removing barriers to movement and circulation, with consequent reductions in vehicular traffic through town centres, in this case Newry.
- Population and growth that can be facilitated by these new connections and the servicing of lands with development potential, to ensure these lands can be developed in the future in accordance with Local Authority Plans and policies.

The following socio-economic analysis concentrates mainly on Omeath, Carlingford, Greenore, Warrenpoint, Rostrevor and their hinterlands. It looks at the likely impacts on tourism, employment and the local economies. There will be other secondary socio-economic impacts in locations such as Dundalk or Newry but these are not considered as likely to be significant in terms of the population and economies of those towns.

6.4 Description of the Receiving Environment

In order to gain an appreciation of how the proposed Narrow Water Bridge Project will impact the surrounding area and its population, it is important to understand the existing social dynamics of the study area. To this end a study of the area was undertaken to give a general overview, using available census statistics.

6.4.1 Demographic Profile - Historical Socio Economic Context

The social and economic profile of the overall Carlingford Lough area has experienced significant changes over the past 100 years. The resident population has at different times both increased and declined over this period. Carlingford has now become a significant tourist centre and a commuter belt for Dundalk and Newry as well as a population centre in its own right.

The Carlingford Lough area has seen an increase in employment opportunities in areas such as tourism and services, with many new residential units being constructed in recent years.

6.4.2 Existing Population and Economic Activity in the Area

Carlingford

Carlingford town is identified in Census 2006 as having a population of 623 persons (an increase of 3.1% since 2002). Population in the wider Carlingford area, including both the town and its surrounding rural hinterland, is identified in Census 2006 as having a population of 1,384 (an increase of 3.7% since 2002).

The current Carlingford Local Area Plan 2002 anticipates a significant future growth in population, which is to be accommodated within the boundaries of the town as defined by the Plan. Statistics from the 1996 Census were utilized to project population growth over a ten year period to over 1,600 persons, which equates to an increase of over 130%.

At the time of writing the Carlingford Local Area Plan is under review.

Omeath

Omeath has also experienced considerable population growth over the Census period 2002–2006, with an increase in population of 90%. The town is identified in Census 2006 as having a population of 439 persons.

The current Omeath Local Area Plan 2002 utilized statistics from the 1996 Census to project growth of over 300% in the town, to a population of 1,400 over a ten year period.

At the time of writing the Omeath Local Area Plan is under review.

Warrenpoint

Warrenpoint, located on the southwest coast of Co. Down, lies on the A2 coast road, approximately 10 kilometres south-east of Newry, with which it is linked by dual carriageway. With a population in the 2001 census of 7,000 people Warrenpoint is the largest town after Newry in the Newry and Mourne District, and accounts for 8% of the total population of the Newry and Mourne District Council area. The Regional Development Strategy for Northern Ireland identified Warrenpoint as a local hub and a Regional Gateway, given its role as Northern Ireland's third busiest port after Belfast and Larne.

The Banbridge, Newry and Mourne Area Plan, 2015 recognises Warrenpoint's coastal location within the Mournes Area of Outstanding Natural Beauty, and as a result identifies it as having opportunities for developing and strengthening its tourism function. The possibility is identified to strengthen its role as a port and tourism destination as a Gateway to the Mourne Mountains, and to promote new employment opportunities.

Narrow Water Castle is listed as a Local Landscape Policy Area (LLPA) within the Banbridge, Newry and Mourne Area Plan, 2015 with protected features which include Narrow Water Castle; the Old Narrow Water Castle with adjacent lands; amenity areas to the sea side of the A2; stream corridors and areas of nature conservation interest. As discussed elsewhere, a mixed use development is proposed on the site between the proposed bridge and Warrenpoint Harbour Authority. It is proposed that the site will accommodate a 60 bed hotel, 40-50 residential units, offices and tourist retail/restaurant/information area

Warrenpoint as a Victorian resort town resulted in the development of a well laid out and planned network of wide streets and attractive neat Victorian terraces, a park and a promenade. Its more recent decline coincided with the development of the modern port following the closure of the Newry Canal to commercial traffic in the 1970's. Its function has now somewhat shifted in recent years towards being a commuter town for Newry.

Rostrevor

Rostrevor is the largest village in the Banbridge, Mourne and Newry Plan Area. It is located on the A2 coast road, 13 kilometres south east of Newry. The village lies within the Mournes Area of Outstanding Natural Beauty (AONB), at the foot of the heavily wooded slopes where the Kilbroney, Rostrevor and Ghant Rivers flow into Carlingford Lough. It is a well known tourist and coastal destination with various coastal amenities as well as a population centre in its own right.

Other Population Centres

There are various other smaller population centres situated around Carlingford Lough including Greencastle, Greenore (which is also a port) and Killowen, which will experience indirect impacts arising from the proposed development.

6.4.3 Employment and Industry

In terms of employment in both North County Louth and South County Down, Dundalk and Newry rank as the largest centres of employment, with significant levels of commuting from the surrounding towns, villages and rural areas. Lower tier employment centres include Carlingford, Omeath and Warrenpoint - with a significant proportion of the working population employed in tourism and related industries.

In general over many years, unemployment in the peripheral areas of both Counties Louth and Down has been above the national average for a variety of reasons, including peripherality from main centres, severance caused by the border, poor infrastructure etc. The peripheral location and lack of adequate infrastructure have been cited as the main reasons for lack of employment growth. The proposed development will assist in overcoming some of the reasons for higher levels of unemployment.

The demand for industrial and services employment has risen from the increase in the labour force and the decline in agricultural and industrial employment. The traditional industrial activities in the area have declined, resulting in significant efforts to diversify into the fast growing technology/telecommunications sector and other high growth service sectors including tourism.

The lands in and around the area south of the proposed Narrow Water Bridge project are close to the population centres of Omeath and Carlingford primarily, with Greenore and its port further to the south-east. From an economic viewpoint, large scale employment on the Cooley Peninsula is principally provided at Carlingford. In this area employment is provided by hospitality industry (hotels, restaurants, B & Bs), holiday home developments, caravan parks, etc. Local services include the Garda Station, schools, the leisure and adventure centre, retail, the Dolmen Enterprise Centre and Four Seasons Hotel. Carlingford also has a moderately sized fishing industry and is increasingly becoming a destination for pleasure craft and watersports – with associated employment.

Warrenpoint has an important role in the Newry and Mourne District with the presence of Warrenpoint Harbour and the associated Warrenpoint Industrial Estate providing significant economic input. There is a further designated industrial area at Milltown on the B7 to the north west of the town. Warrenpoint also plays an important tourism role with the provision of hotel and B+B accommodation. It is also a local service centre for the surrounding villages and rural hinterland. Similar to Carlingford but at a much larger scale, its facilities and associated employment base include primary and secondary schools, fire, police, health, library and community services and a wide range of business, retail and leisure / tourism facilities.

Rostrevor at a smaller scale provides a significant range of facilities that service the local community including shops, professional services, pubs, restaurants as well as barbers, beauty salons and bookmakers. The local area is strengthened by a number of community facilities, including a Post Office, a Community Association Office and the Kilbroney Centre. There are a number of churches of different denominations and it is also served by three primary schools. The impressive landscape that surrounds Rostrevor provides many opportunities for tourism, with the Rostrevor Forest providing an information centre, play areas and caravan parks in close proximity to the village.

Aquaculture and Wild Mussel Fishery

Carlingford Lough also supports a well established aquaculture industry with managed bottom cultivation of mussels and trestle cultivation of pacific oysters. The design of the proposed Narrow Water Bridge has been specifically developed to ensure that there will be no impact on this industry within the Lough during the construction or operation of the scheme (refer to Chapter 7.3).

Plate 6.1 Typical mussel dredger at Narrow Water

Plate 6.2 Mussel dredger at Narrow Water

While there are no licensed mussel beds within the estuary there is a public (wild) mussel bed within and above the location of the bridge. As a wild fishery the only way mussel seed can be deposited on these beds is by natural deposition. None of the public fishery vessels are permitted to relay seed in this area.

The wild mussel fishery is generally exploited between the months of September and April. The wild fishery is currently unregulated and as such formal information on the volumes of wild mussel exploited, where landed, etc is not readily available.

The Loughs Agency have proposed a series of regulations designed to control and conserve the wild mussel fishery which would include for the licensing of vessels, the keeping of logbooks, stipulation of designated landing areas, etc. These have not yet been enacted.

6.4.4 Existing Road Connections across Carlingford Lough

At present, to travel from north to south and vice versa across Carlingford Lough, it is necessary to travel via Newry, as there are no links for motorists, pedestrians or cyclists. For this journey, the road network requires traffic to pass through the periphery of Newry city centre, which can experience frequent traffic congestion, particularly at peak times. It is noted in the Banbridge, Newry and Mourne Area Plan, 2015 that there are a number of locations where there is congestion and conflict with traffic, pedestrians and cyclists, particularly at peak periods – leading to long journey times.

6.4.5 Existing Land Uses

Outside of urban centres land-use in the immediate area of Carlingford Lough, on both its Northern and Southern shores, is predominantly agricultural, interspersed with rural housing. Land is generally of poor to medium quality with the main activity being rough grazing, with much land committed to forestry due to its upland topography. The location of the proposed bridge at Narrow Water in the tidal area of Newry River within the Carlingford Lough estuary, is within a designated Special Area of Conservation (SAC) and a proposed Natural Heritage Area (pNHA) in the South and an ASSI in the north. The area is generally sparsely populated with a small number of rural dwellings in the vicinity. There is an existing dual carriageway running parallel to the Narrow Water Estuary. The existing roundabout at Narrow Water is where the proposed bridge will connect to this road.

Narrow Water is located approximately 10km south-east of Newry Town. The Castle and keep on the northern shore form part of a wider landscape that attracts tourists. The basic tourism resources of Carlingford Lough are present as a consequence of the setting and can be summarised as follows:

- The overall character of the area, taking in Carlingford Lough, the Cooley Peninsula and the Mourne Mountains;
- The natural beauty of the entrance into Carlingford Lough;
- The services provided in the hotels, guesthouses, restaurants, shops, cultural events, etc. in the various towns including Carlingford, Omeath, Warrenpoint and Rostrevor; and
- The reputation of the area for walking trails, culture and crafts.

6.5 Predicted Impacts

Impacts will typically arise at three levels – Regional, Sub-regional and Local. These are examined below.

6.5.1 Regional Impacts

Ireland has an infrastructural deficit that threatens to inhibit achievement of its economic and employment potential and in particular the Border areas. The pressure on physical and human resource infrastructure in the region is compounded by a lack of sufficient balance in cross-border economic development.

Regional impacts by their very nature tend to be general and longer term than local impacts. County Louth and County Down are both economically and politically inter-linked with the rest of island of Ireland. The provision of improved internal infrastructural links would not only provide for increased interaction, both commercial and social, between inhabitants on both sides of the border, but should also encourage visits from outside the area by allowing reduced journey times and the removing the perception of the border .

There has always been a large volume of tourism attracted to both the Mourne Mountains and Cooley Peninsula but joint development as an integrated tourist region has been hindered by the physical presence of the border and the lack of road or sea connections between both areas.

A more efficient transportation network should encourage further development of commercial and tourism interests in the region, which has experienced a growing divergence between itself and the commercial centres of Newry and Dundalk, in terms of both commercial and tourism development. In particular, the tourism authorities on both sides of the border are promoting the joint development of the Mourne/Cooley Geopark. Improving access to the area, including through the completion of Narrow Water Bridge will greatly facilitate this regional objective.

6.5.2 Sub-Regional Impacts

The main population centres of Omeath and Carlingford on the southern side of the crossing, and Warrenpoint and Rostrevor on the Northern side will benefit from the increased economic and social interactions between the two areas. The scheme will effectively provide a better economic situation within both peninsulas as there will be a greater pool of labour available, greater employment opportunities which are not currently available due to the requirement to cross the estuary at Newry, reduced journey-to-work times, the potential for reduced car usage etc.

6.5.3 Local Impacts

Economic Activity

The proposed bridge will provide a link across the Carlingford Lough, thereby facilitating the development of tourist route (for vehicles, cyclists, public transport and pedestrians) around the Cooley Peninsula and Mourne Mountains which does not require passing through Newry. This should give rise to increased tourist spending within the area, which will assist in the retention of the existing facilities and encourage further such developments. One such project is identified in the Warrenpoint Strategic Development Framework, which discussed the requirement for a significant cross border attraction and leisure facility, and listed the Baths site as a potential location for such a facility.

The route has the potential to attract economic development to the region insofar as modern infrastructural investment acts as a catalyst for such. Due to the availability of a larger labour force and opportunities to reduce transport costs by the use of alternative routes, the area should become more attractive to commercial enterprises.
The crossing will provide for increased and enhanced social interaction between those residing within the two Counties, with increased access to existing facilities, outlets and services concentrated within Warrenpoint, Omeath, Carlingford and other nearby settlements. This will effectively stabilize the existing populations and encourage others to locate therein. Consequently, it is envisaged this growth will strengthen the viability of existing settlements and contribute to the retention of the existing facilities. Existing retail units should benefit from increased passing trade.

Land values may change marginally as a consequence and the rural amenity of some areas may be reduced. Existing retail outlets and services may have increased competition, with those residing in proximity of the bridge having a more extensive range of services to choose from.

The influx of visitors or new residents could have a detrimental impact on the existing communities, but it is envisioned that the increased connection between the two areas will serve to strengthen the identity of the region, with its positive impacts including increased tourism, commercial interest in the area, access to existing facilities and increased social interactions outweighing potential negative impacts. In any case development proposals will be subject normal planning requirements.

Agriculture

The principal economic activity in the surrounding area is mixed agriculture, primarily grazing and forestry. There are likely to be some but limited agricultural impacts arising from the proposed developments. These are addressed in detail in Chapter 9.

Aquaculture and wild mussel fishery

There will be no impact on the aquaculture industry within Carlingford Lough. The design of the proposed bridge has been specifically developed to ensure that there will be no significant impact on this industry within the Lough during the construction or operation of the scheme (refer to Section 7.3 Marine Modelling and Chapter 11 which outlines the Construction Sequence/Method).

The wild fishery which occurs within the estuary, including the Narrow Water area, is seasonally fished (dredged) by approximately twelve boats (pers. comm. Barry Fox, Loughs Agency). The bridge structure will impact this fishery in two ways. In the first instance, the area under and in the immediate vicinity of the bridge will be effectively removed from the fishery as it will not be possible for the boats to pass underneath the bridge nor safe for them to dredge in proximity to the bridge. Secondly the boats will not be able to pass freely under the bridge and as such the fishery operation will be restricted. However, consultations between Louth County Council and interested parties will ensure that the bridge will be opened at regular intervals. This is expected to be a twice daily opening at high tide to allow boats pass beneath the structure which will minimise the inconvenience experienced by these boats.

At time of writing no information has been received with respect to annual volume of mussels landed from this wild fishery, market for them, etc. However, as some element of compensation for loss of available fishery may be legally required, it is considered that this requires further detailed investigation and consultation with the impacted licensed fishing vessels. This investigation is beyond the scope of this environmental impact assessment.

Planned Development

Carneyhaugh Properties Ltd have been granted outline planning permission for a large mixed-use development on the lands along the A2 immediately to the south east of the A2 roundabout. The proposed development as described within the outline application includes for provision of a hotel and restaurant, residential units and office and retail units. The developer of this project has cooperated with the Design Team in the development of the proposed Narrow Water Bridge Project and welcomes the development of the control building within the site of the proposed development as the proposed bridge is likely to make the development more attractive.

Community Severance

The Narrow Water Bridge project will reinvigorate historic community linkages between Omeath and Warrenpoint.

As a cross border project the bridge will represent a symbol of continuing co-operation between two communities north and south of the border. Enabling both locals and tourists to make a journey in a few hundred metres which is presently many kilometres, reduces the perception of the border, creating one region with the potential to interact economically through a common tourism and social appeal. Clubs, societies and various groups can also extend their activities and opportunities to their neighbours on either side of the estuary, which was not possible previously, thereby encouraging interaction and community building on both sides of the bridge.

The development of the alignment and design of the new length of road in County Louth has been undertaken to ensure that there is no severance of individual farm holdings (refer to Chapter 9). In addition the presence of the roundabout on the R173 will have the knock on effect of substantially slowing traffic in the area. This will make vehicular and pedestrian access onto the R173 less stressful resulting in a feeling of greater connectivity with Omeath.

The proposed scheme includes footways and cyclepaths and will thus improve access within the area for pedestrians and cyclists.

Loss of Dwellings and Land with Development Potential

No demolition of dwellings will be required. There may be a marginal impact in terms of land-uses in the surrounding area. The construction of a new road connection to the proposed Narrow Water Bridge may marginally reduce the residential amenity of the immediate area, making the area less attractive for the location of new dwelling houses. The provision of new dwellings will require a planning application and any such application will be assessed in accordance with the planning policies of the relevant Development Plans for the area. The predicted impacts from specific environmental topics such as noise, traffic etc. are assessed in separate chapters of this EIS/ES.

Increased Connectivity – Creation of a Region

It is considered that the proposed scheme will have a locally and regionally positive impact on tourism in that it will increase linkages to these areas and make them more accessible for tourists and visitors. The proposed Narrow Water Bridge will serve to increase connectivity between communities on the north and south of the River by offering an alternative crossing point, which will reduce the level of traffic through Newry. The proposed bridge can in this sense be described as an attraction in itself, posing the opportunity to provide a physical symbol of peace and co-operation for tourists. Through the creation of a physical connection, the psychological border perception can be deconstructed. The Cooley Peninsula and Mourne region will effectively become one - accessible to tourists and local communities alike.

Traffic and Journey Times

This topic is examined in detail in Chapter 5 of the EIS/ES but is referred to here in general terms. The journey time between Warrenpoint and Omeath with no congested traffic is currently approximately 18 minutes. Traffic congestion and flow restrictions at peak hours can result in a trip between Warrenpoint and Omeath taking up to one hour. With the opening of the proposed bridge crossing, access will become quicker and easier with an additional potential to transfer a considerable number of local traffic movements off the Newry City centre system and onto this regional route.

6.5.4 Impacts on Tourism Amenity

The location of the proposed Narrow Water Bridge is within a recognized area of high landscape quality and visual amenity which forms a significant element of the tourism product offered by the region. Despite this it is considered that the proposed development will not adversely or directly alter the inherent quality of the landscape, its significance or value. Indeed as a signature bridge, this unique structure has the potential to add to the significance of its setting and to present focus and momentum towards realizing local landscape and tourist-related objectives.

The proposed cable-stay bridge, with its inclined towers, introduces a visually unique bridge design not only to this region, to the island of Ireland. It will present a visually dramatic form and structural appearance to viewers and users both off and on the bridge. The sense of uniqueness and drama is heightened in the opening operation of the lifting bridge section.

6.5.5 Conclusion

In overall terms, from a socio-economic perspective, it is considered that the Narrow Water Bridge Project will have a positive impact on tourism and economic activity in the area.

6.6 Mitigation Measures

No specific socio-economic related mitigation measures are required for this project. Specific mitigation measures to protect the residential amenity of adjacent dwellings and sensitive receptors are proposed in other sections of the EIS/ES under all the various the chapters. Also at Detailed Design stage Louth County Council will continue to consult with the fishermen to ensure that opening times of the bridge are optimised to minimise disruption to their operations.

6.7 References

A Strategy and Action Plan for the Development of Marine Tourism and Leisure in Lough Foyle and Carlingford Lough Areas, March 2007;

A Sustainable Development Strategy for Northern Ireland - First Steps Towards Sustainability

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Chapter 7

The Natural Environment

Chapter 7 The Natural Environment

7.1 Natural Environmental Issues

The issues that are assessed in this chapter of the Environmental Impact Statement / Environmental Statement are as follows:

- Terrestrial Ecology (Section 7.2)
- Aquatic Ecology and Marine Modelling (Section 7.3);
- Noise and Vibration (Section 7.4);
- Air Quality and Climate (Section 7.5); and
- Soils, Geology and Hydrogeology (Section 7.6).

7.2 Terrestrial Ecology

7.2.1 Introduction

Biosphere Environmental Services was commissioned by Roughan & O'Donovan, Consulting Engineers to prepare the terrestrial ecological component of the EIS for the proposed Narrow Water Bridge.

Whilst the development study area is specific to the Narrow Water vicinity, from the perspective of ecology and nature conservation, potential impacts on the entire Carlingford Lough system, which includes the section of the Newry River downstream of Newry, are considered.

7.2.2 General Description of Carlingford Lough

Carlingford Lough is a narrow sea inlet underlain by Carboniferous limestone. It is approximately 15km long and on average about 3 km across, and flanked by glacial moraines and mountains – the Mourne Mountains to the north and Carlingford Mountain to the south-east. The shorelines are relatively narrow, with intertidal flats best developed between Killowen and Greencastle on the north side and between Carlingford and Greenore to the south. Other shoreline habitats include salt marsh, shingle and stony beaches, annual driftline vegetation and bedrock shore. Fringes of dry grassland occur above the shoreline in places. The outer waters of the lough are fairly deep, falling to approximately 10 fathoms.

The lough is the estuary of the Newry River – this river runs in a fairly straight, relatively narrow (several hundred metres) intertidal channel for approximately 7km above Warrenpoint.

Tidal amplitude in Carlingford Lough and the Newry River is among the highest in Ireland, ranging between c.4.0m at neap tides and c.5.2m at spring tides. Exceptionally high spring tides, such as those around mid-February 2008, can exceed 6.0m.

7.2.3 General Description of Site of Proposed Bridge Location

On the County Louth side of the location for the bridge, the immediate environs of the river contain habitats of brackish water and salt marsh, which have arisen subsequent to its canalisation and impoundment and the construction of lighthouse towers to aid navigation. The remainder of the southern, County Louth portion, consists mostly of agricultural land with a mixture of pasture, arable land, hedgerows and trees though in parts remnants of an old railway line runs parallel to and close to the river. The R173 to Carlingford forms the southern border to the area under consideration.

Cillin Wood, which occurs close to the proposed bridge location, is a small area of mainly mixed deciduous woodland located on the south shore of the Newry River Estuary, at the north end of Narrow Water. The wood is centred on a mound rising to 23m above sea level. There are some very mature trees along the waterfront, but much of the interior of the wood is dominated by non-native sycamore *Acer pseudoplatanus*.

On the County Down side, there is an existing roundabout onto which the proposed road will run. The habitats immediately adjacent to this are very weedy in nature due to past disturbance. Between the main road from Newry to Warrenpoint and the main channel of the river there has been much infilling and the habitats are ruderal in nature with some scrub invading. The area closest to the river has been subjected to coastal protection measures through the construction of a revetment. This has produced an area of shallow lagoon behind which brackish and salt marsh has developed.

7.2.4 Methods

a) Habitats and Flora

The site was visited by Dr Tom Curtis on 28th July 2008 when it was seasonally appropriate to fully assess the nature and range of each habitat and vegetation type as well as investigate the site for rare flora. Particular attention was paid to the plant species, habitats and vegetation occurring within the footprint of the bridge and associated access roads. An inventory of the major vegetation types was made, together with an assessment of their conservation value. Habitats were categorised using the system given in Fossitt (2000). The equivalent EU Habitats Directive category as presented in the **Interpretation Manual of European Union Habitats** are also given.

For the Northern Ireland portion of the study area, the Phase 1 Habitat Categories proposed and used extensively by the Joint Nature Conservation Committee of the United Kingdom (Anon 2007) are presented.

Nomenclature for vascular plants follows Scannell & Synnott (1987) and for bryophytes Holyoak (2003).

Survey Constraints

There were no survey constraints as all work was carried out in the recommended survey period for botanical assessment and reviewed over the following seasons.

b) Birds

Field surveys were carried out by Mr Oscar Merne M.Sc. For the purposes of this project, the Study Area for detailed bird survey is defined as the Newry River Estuary c.500 m upstream and downstream of the A2 roundabout at Narrow Water, Cillin Wood, and the fields extending c.500 m south of Cillin Wood between the estuary and the R173 road.

Different survey/census methods were used as appropriate to different groups of bird species and their habitats, as follows:-

Waterbirds in Newry River Estuary – populations and distribution

The wintering/migratory waterbirds using the Newry River, including the Narrow Water area, for feeding and roosting were surveyed at weekly intervals on nine dates between 30th January and 26th March 2008.

For the purposes of these surveys, the c.7km stretch of the Newry River from the industrial estate at the south-east edge of Newry town to Warrenpoint/Omeath was divided into seven survey/census units (Sections A – G), each approximately 1km in length, and each clearly defined by prominent landmarks such as Victoria Lock, small headlands, the woods at Cillin, etc. The seven sections were further divided into north shore and south shore.

Waterbirds present in each of these sections were counted on each of the nine visits in order to establish the distribution pattern of bird usage in the Newry River, and totals for each of the waterbird species recorded. The nine surveys were timed so that bird distribution at various stages of the tide could be determined, and that high tide roosting sites could be identified.

The surveys were carried out in favourable weather conditions, i.e. when light and visibility were adequate for location of the waterbirds, for species identification, and for accurate counting. Optical equipment – 8x42 mm binoculars and 22-47x75 mm telescope – were used to aid identification and counting.

The Narrow Water Study Area corresponded with Section F, so the survey/census data from this section could be related to the proposed bridge crossing. In order that waterbird distribution and usage of this area could be related precisely to the position of the bridge, this section was sub-divided on both the north and south shores into sections above and below the proposed location for the bridge. In addition to the nine surveys/censuses carried out in the entire Newry River Estuary, which included the Narrow Water Study Area, two further surveys/censuses were carried out at the latter in April and May 2008.

During the various surveys of waterbirds in the Narrow Water Study Area in 2008, observations were made of birds flying up and down the water course, between feeding/roosting grounds in Carlingford Lough and the upper parts of the Newry River. The purpose of these observations was to determine the scale of such movements in relation to the possibility that the proposed bridge might be an obstacle or hazard to flying birds.

Movements of Waterbirds in Narrow Water Channel

When it became known that the chosen design for the bridge was a cable-stayed structure of substantial height, a further series of surveys focused on bird movements along the channel was carried out in 2009 to assess whether the bridge design could pose a potential collision hazard to waterbirds.

A series of three two-day survey sessions were completed early in 2009 ($16^{th}/17^{th}$ January, $24^{th}/25^{th}$ January & $6^{th}/7^{th}$ February). These surveys were chosen to coincide with peak numbers of wintering waterbirds in the Carlingford Lough/Newry River area, when it could be expected that movements of birds up and down the Narrow Water channel would be at their highest.

During these visits, commanding viewpoints on the north and south sides of the Narrow Water channel were used to record waterbird movements. Observations were carried out at all stages of the tidal cycle, with emphasis on ebbing and flowing tides, when movements could be expected to be at their peak as the birds flew between feeding and roosting sites. Also, in anticipation of dawn and dusk flighting by some waterbirds, especially gulls, these periods of the day were also covered. An attempt at nocturnal observations, using light from the lamp-posts at the A2 roundabout on the north side of Narrow Water, produced unsatisfactory results as the lights failed to pick up birds flying more than c.25m from the roundabout. However, nocturnal bird activity was detected by calling sounds from birds (Redshanks and Dunlin mainly) feeding on the mudflats at low tide – but no flight calls were heard.

The altitude at which the birds were flying in the Narrow Water channel was recorded, as this is pertinent to whether or not the new bridge design would be a potential hazard to the birds. Accordingly, all flight observations were recorded in one of three height categories:

- LOW (below the level of the bridge decking)

- MEDIUM (at the level between the bridge decking and the top of the suspension cable support towers),
- HIGH (above the top of the highest part of the bridge structure – the 90 m high tower).

During these surveys a total of 30 hours of observations were made of waterbird movements close to the site of the bridge crossing.

Terrestrial Bird Species of Cillin Wood

The woodland at Cillin, within the Narrow Water Study Area, was visited on 26th March 2008, when terrestrial bird species were beginning to establish breeding territories there. The purpose of this visit was to survey the habitats available for the breeding birds.

This preliminary visit was followed by visits on 16th April and 18th May when the woodland bird species were surveyed. The method used was to walk slowly through the woodland habitat on a pattern of four parallel transects spaced c.100m apart, and running from the northwest to the southeast edges of the wood. This was considered adequate to detect by sight and sound all terrestrial birds present in the wood. To maximise detectability of the birds the surveys were carried out in fair weather conditions when woodland birds tend to be most active. Detectability was further enhanced by pausing for five minutes at regular intervals along the transects to look for and listen for woodland birds.

Grey Heron Colony

On the first visit to the Narrow Water Study Area on 30th January 2008, it was clear that a colony of Grey Herons[1] (a heronry) was located in tall trees at the waterside edge of Cillin Wood. Up to 12 adult Grey Herons were observed perched in the trees, and a careful search by telescope from the opposite shore near the Narrow Water Castle revealed at least 11 nests. As the programme of surveys continued to late March, nesting activity became more intense, with birds observed in courtship display, carrying nesting material, and apparently incubating. A visit to Cillin Wood on 26th March established that no Grey Heron nests were located in the interior of the wood, so that viewing the heronry from the opposite shore was the optimum means of censusing pairs/nests and monitoring progress of the colony. Visits to Cillin Wood on 16th April and 18th May confirmed the absence of Grey Heron nests in the interior of the wood and also found that it was very difficult to locate all the perimeter nests from within the wood. Therefore, the census of 11 nests made by telescope from the northern shore of the estuary near Narrow Water Castle provided the best measure of the size of the colony.

Terrestrial Bird Species of Fields and Hedgerows

Two preliminary reconnaissance visits were made to the lands on the south side of Narrow Water through which the new road connecting the bridge with the R173 Newry – Omeath road will pass. These visits were made on 30th January and 26th March 2008, before and at the beginning of the bird breeding season. The purpose of these visits was to survey the habitats available for breeding terrestrial species in the vicinity of the proposed road route.

On 16th April and 18th May, when most breeding birds would be expected to be holding territories or to have nests with eggs or chicks, the road corridor between the

[1] Scientific names of bird species are given in Appendix 7.5 at the end of this Chapter.

southern landfall of the bridge and its merging point with the R173 north of Omeath was surveyed to establish the breeding bird community of the affected area. The corridor was twice walked slowly on each visit and all birds seen/heard were recorded, together with any activity indicating breeding within and immediately beside the corridor.

c) Mammals (exc Bats)

A mammal survey was conducted in October 2010 by Andrew Warwick (MIEEM) along the proposed route. The purpose of the survey was to record the present status of all badger setts and otter holts along the proposed road development and to assess its impact on large mammal populations within the study area. The report is prepared in accordance with the National Roads Authority (NRA) publications; *Guidelines for the Treatment of Badgers Prior to the Construction of National Road Schemes (*2006a*)* and *Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes (*2006b*)*.

The survey was undertaken on 8th October 2010. Weather conditions during the survey and before were dry. A full walk-over survey was carried out of the entire length of the proposed route within a 200m corridor. This involved a systematic search of all field boundaries and areas of vegetation cover for signs of badger and otter. Most mammal species in Ireland are nocturnal in habit and the survey method relies on finding signs such as burrows, resting places, tracks, feeding signs and droppings which are generally distinctive for the species concerned.

Where badger underground tunnels (or setts) were found, these were classified into active or inactive and assigned to a status as main (breeding) or other setts according to the scheme outlined by Smal (1995). In the case of otter, watercourses within the study area were systematically searched for holts (the resting or breeding places of otter) and signs of otter presence (spraints, prints, slides) were recorded.

Survey Constraints

No constraints were experienced. Badger surveys can be constrained by areas of dense vegetation as setts may not be locatable. The survey corridor is primarily heavily improved grassland with thin managed hedgerows lines and as such dense vegetation was not a constraint.

d) Bats

Aardwolf Wildlife Surveys undertook a qualified desk review in relation to possible impacts on the local bat fauna.

The author of this report, Mr. Conor Kelleher, has specialised in the study of bats since the mid-1980s and is a renowned expert in bat ecology. He was advisor to the *National Roads Authority* during the drafting of their *Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes* and *Guidelines for the Treatment of Bats during the Construction of National Road Schemes* in 2006 and is co-author of *Bat Mitigation Guidelines for Ireland – Irish Wildlife Manuals No. 25*, published by the *National Parks and Wildlife Service* in 2007.

e) Amphibians and Reptiles

Search for signs of amphibians and reptiles were made (by Dr Brian Madden) at the time of the main habitat assessment and observations were also made during the various bird surveys.

f) Consultations and Collation of Existing Data

The websites of the National Parks & Wildlife Service (NPWS) and the Environment & Heritage Service (now Northern Ireland Environment Agency (NIEA)) were accessed for information on designated sites in the Republic and Northern Ireland respectively. In addition, direct contact re. the NI conservation designations was made with Dr Ian Enlander of NIEA.

Waterbird data are available through the I-WeBS and WeBS schemes. For the purpose of bird counts, the site is divided into 11 subsites, one of which is 'Warren Point to Newry'. To assess recent trends in bird populations, data were acquired (provided by BTO on behalf of WeBS) for Carlingford Lough (total site) and for the Warren Point to Newry subsite for the most recent 5 year period (2001/02 to 2005/06) (see **Appendices 7.1 & 7.2** at the end of this Chapter).

g) Impact Assessment

Impacts on habitats and fauna were evaluated following relevant guidance documents, mainly the NRA *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (NRA 2009) and, the EPA *Guidelines on the Information to be Contained in Environmental Impact Statements* (EPA 2002).

The prediction of impacts considers such factors as the magnitude, extent, duration and the timing and frequency of the predicted impact. Where possible the likelihood of the impact occurring is also considered. From these criteria the significance of the impact is determined on the basis of the factors which characterise the receptor and take into account the effects on the conservation status or integrity of the receptor resulting from the proposed development. The integrity of a receptor can be regarded as the coherence of ecological structure and function, across the entirety of a Receptor, which enables it to sustain all of the ecological resources for which it has been valued. The following impact significance criteria (EPA 2002) are used where applicable:

Significance of Impact	Significance Criteria
Imperceptible impact	An impact capable of measurement but without noticeable consequences
Slight impact	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate impact	An impact that alters the character of the environment in a manner that is consistent with existing and emerging trends
Significant impact	An impact which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
Profound impact	An impact which obliterates sensitive characteristics

7.2.5 Designated Sites for Nature Conservation

As Carlingford Lough falls within two international jurisdictions, the number of nature conservation designations is greater than would be expected (see **Figure 7.1** in Volume 3 of this EIS and Plate 7.2.1 below). A Natura Impact Statement / Habitats Regulations Assessment has been prepared for the proposed Narrow Water Bridge and is available separately.

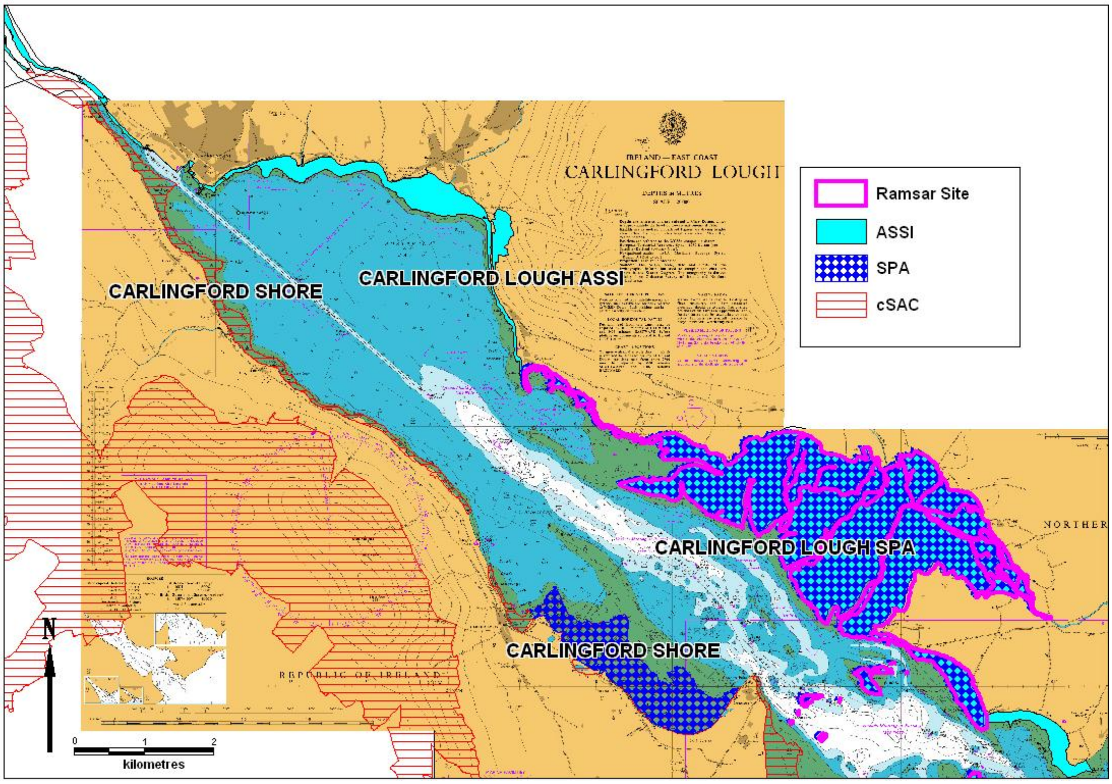

Plate 7.2.1 Nature Conservation Designations within Carlingford Lough

These are described first for the Republic of Ireland and then for Northern Ireland.

Republic of Ireland Sites

- **Carlingford Shore candidate Special Area of Conservation (code 02306)** This extensive site stretches almost continuously along the southern shore of Carlingford Lough, from the section of the Newry river/estuary in Co. Louth to just east of Cooley Point. The outer boundary is generally the low tide limit while the landward boundary is usually just above the shoreline. The site is selected for two habitats:
  - *Perennial vegetation of stony banks (Natura code 1220)*
  - *Annual vegetation of drift lines (Natura code 1210)*

  These two habitats are considered to be best developed in the vicinity of Ballagan Point to the east.

  The legally protected (Flora Protection Order 1999) species, oyster plant *Mertensia maritima*, is found on the stony bank vegetation. The site also includes strips of salt marsh and fairly extensive areas of intertidal mud and sand flats. The deciduous woodland at Cillin is included.
- **Carlingford Lough Special Protection Area (code 04078)** The SPA on the Louth side is relatively restricted in area, extending from the harbour at Carlingford to Greenore Point. It includes all the intertidal flats to the low tide mark. The site supports a nationally important population of wintering Cormorants, and a range of other wetland birds including Brent Geese, Oystercatcher, Dunlin, Bar-tailed Godwit, Redshank and Turnstone.
- **Carlingford Lough** is also a **proposed Natural Heritage Area** – the boundary on the landward side is similar to that of the SAC site but on the seaward side the pNHA boundary extends out into the lough to the international boundary.

Northern Ireland Sites

- **Carlingford Lough Special Protection Area** This SPA lies between Killowen Point and Soldiers Point on the northern shore of Carlingford Lough. It extends from the upper shoreline to the mean low water mark (total area 827.12 ha). The site is selected for European important populations of breeding Sandwich and Common terns (both Annex I species), and an internationally important population of Brent Geese. A range of other wetland species occurs during winter.
- **Carlingford Lough Area of Special Scientific Interest (ASSI no. 0103)** This large site (1,105 ha) extends from the inner part of the Newry River to Cranfield Point, which is the entire northern shore of Carlingford Lough. It includes all habitats from the upper shoreline to the mean low water mark. The site is selected for the following features:
  - Coastal salt marsh
  - Mudflats
  - Invertebrate assemblage
  - Great Crested Grebe
  - Light-bellied Brent Geese
  - Shelduck
  - Scaup
  - Red-breasted Merganser
  - Oystercatcher
  - Dunlin
  - Redshank
  - Sandwich Tern
  - Common Tern
  - Arctic Tern
  - Pleistocene geology
  - Carboniferous stratigraphy

Overview of Designations

Practically all of the shoreline habitats to the low water mark, and including the Newry River, are covered by one or more nature conservation designations. The designations are focused on shoreline habitats and wintering birds but in NI feature breeding terns and geological interests.

The Narrow Water area is covered by an SAC designation on the Republic side and by an ASSI designation on the NI side.

There are no protected flora species noted from within the immediate vicinity, which are listed on The Flora Protection Order 1999, The Wildlife (NI) Order or listed as rare or threatened by Curtis & McGough (1988).

7.2.6 Baseline Environment

a) Habitats and Flora

The vegetation and habitats that occur in the study area can be assigned to the following habitats (after Fossitt 2000; Anon. 2007):-

Improved agricultural grassland GA1 (Improved grassland B4/Bracken C.1)
Dry meadows and grassy verges GS2 (Neutral grassland-unimproved B2.1)
Wet grassland GS4 (Marsh/Marshy grassland B5)
Reed and tall sedge swamps FS1 (Swamp F1)

Scrub WS1 (Scrub A2)
Ornamental/non-native shrub WS3 (Introduced shrub J1.4)
(Mixed) broadleaved woodland WD1 (Mixed woodland A1.3)
Scattered trees and parkland WD5 (Parkland/scattered trees-broadleaved A3.1)

Hedgerows WL1 (Hedges-intact J2.1/defunct J2.2)
Treelines WL2 (Hedges with trees J2.3)

Recolonising bare ground ED3 (Cultivated/disturbed land ephemeral/short perennial J1.3)

Arable crops BC1/Tilled land BC3 (Cultivated/disturbed ground-arable J1.1)

Tidal rivers CW2 (Running water-brackish G2.6)
[2]*Lower salt marsh CM1 (Saltmarsh dense/continuous H2.6)
*Upper salt marsh CM2 (Saltmarsh-scattered plants H2.4)

Sea walls, piers and jetties CC1 (Sea wall J3.5)
Sheltered rocky shores LR3 (Intertidal boulders and rocks H1.3)
Mud shores LS4 (Intertidal mud/sand H1.1)

Target Notes for each of the habitats or features noted are presented in Table 7.2.1 and their locations shown in **Figure 7.2**.

[2] The 2 salt marsh habitats **CM1** and **CM2**, if well developed, may equate with those listed on **Annex I** of the **Habitats Directive**

Plate 7.2 View of Saltmarsh habitats from south eastern side of bridge

Table 7.2.1: Target Notes for main habitat features with their codes and assessments of their conservation value – illustrated on Figure 7.2

No. as on Map Fig. 7.2 (1-28 Co. Louth, 29-33 Co. Down)	Habitats, Vegetation & Flora	Fossitt Code (*JNCC Phase 1 Code*)	Conservation Value
1	Dry meadow with gorse, *Ulex europaeus* invading, dominated by sweet vernal grass, *Anthoxanthum odoratum*, curled dock, *Rumex crispus*, and greater bird's foot trefoil, *Lotus uliginosus*.	GS2 (B2.1)	None
2	Cut meadow (improved) with perennial rye grass, *Lolium perenne*, white clover, *Trifolium repens*, cocksfoot, *Dactylis glomerata* and dandelion, *Taraxacum officinale*.	GA1 (B4)	None
3	Fence and line of ash, *Fraxinus excelsior* with staggered shrubs of blackthorn, *Prunus spinosa* and blackberry, *Rubus fruticosus*.	WL2/WS1 (J2.3/A2)	None
4	Lower salt marsh in mosaic with brackish marsh dominated by creeping bent, *Agrostis stolonifera*, scutch, *Elymus repens*, the oraches, *Atriplex patula, A. littoralis*, with very vigorous sea purslane *Halimione portulacoides* and common salt-marsh grass, *Puccinellia maritima*.	CM1/CM2 (H2.6/H2.4)	Low value as cover sporadic and lacking good structure. Very heavily grazed and poached and not in extensive stands

Table 7.2.1: Target Notes for main habitat features with their codes and assessments of their conservation value – illustrated on Figure 7.2 Contd.

No. as on Map Fig. 7.2 (1-28 Co. Louth, 29-33 Co. Down)	Habitats, Vegetation & Flora	Fossitt Code (*JNCC Phase 1 Code*)	Conservation Value
5	Lower –middle salt marsh closer to the estuary with sea aster, *Aster tripolium*, red fescue, *Festuca rubra*, sea arrowgrass, *Triglochin maritima*, lax-flowered sea-lavender, *Limonium humile*. More open areas carry common cord grass, *Spartina maritima* and annual sea blite, *Suaeda maritima*.	CM1 (H2.6)	Low value as cover sporadic and lacking good structure. Less heavily grazed and good diversity though restricted in area
6	Rocky foreshore with knotted wrack, *Ascophyllum nodosum* and bladder wrack, *Fucus vesiculosus* with stands of glasswort *Salicornia europaea* behind	LR3 (H1.3)	Low.
7	Bracken, *Pteridium aquilinum* dominated area.	GA1 (B4/C.1)	None
8	Tall ash along west boundary Of 7	WD5 (A3.1)	Specimen
9	Raised area dominated by shrubs with gorse, hawthorn, *Crataegus monogyna*, blackthorn and ash. Area has been reclaimed and embanked And the dominant herb is perennial sow thistle, *Sonchus arvensis*	WS1 (A2)	None
10	Stands of sea club rush, *Scirpus maritimus* with reed canary grass, *Phalaris arundinacea* behind and along W side of boundary with water dropwort, *Oenanthe crocata* and yellow iris, *Iris pseudacorus*.	FS1/CW2 (F1/G2.6)	Low. Heavily trampled, poached and grazed by cattle
11	Embankment dominated by Yorkshire fog, *Holcus lanatus*, false-oat grass, *Arrhenatherum elatius*, sorrel, *Rumex acetosa* and hogweed, *Heracleum sphondylium*.	GS2 (B2.1)	None
12	Mixed broadleaved woodland of ash, sycamore, *Acer pseudoplatanus*, beech, *Fagus sylvatica*, alder, *Alnus glutinosa* with hawthorn and blackberry.	WD1 (A3.1)	Small plantation on the border of the footprint.
13	Top of field disturbed and now with scrub of gorse and broom. *Cytisus scoparius* with soft rush, *Juncus effusus,* knapweed, *Centaurea nigra* and curled dock.	WS1 (A2)	None
14	By old railway bridge very rough grassland dominated by bracken	GA1 (B4/C.1)	None

Table 7.2.1: Target Notes for main habitat features with their codes and assessments of their conservation value – illustrated on Figure 7.2 Contd.

No. as on Map Fig. 7.2 (1-28 Co. Louth, 29-33 Co. Down)	Habitats, Vegetation & Flora	Fossitt Code (*JNCC Phase 1 Code*)	Conservation Value
15	Hedgerow S of 14 has ash and grey willow, *Salix atrocinerea*	WL1 (J2.1)	None
16	Above gate on S side has hedge of gorse, blackthorn and ivy, *Hedera helix*. N side has rowan, *Sorbus aucuparia*, sessile oak, *Quercus petraea* and whitebeam, *Sorbus aria* agg.	WL1/WS1 (J2.1/A2) WL2 (J2.3)	Good collection of trees on N boundary.
17	Cut meadow of common bent, *Agrostis capillaris*, red clover, *Trifolium pratense,* cat's ear, *Hypochoeris radicata* with upper areas very poor and dominated by rough-stalked meadow grass, *Poa trivialis*.	GS2 (B2.1)	None
18	Original hedge of gorse and hawthorn has been levelled. Rough track E of this is very weedy with smooth hawk's beard, *Crepis capillaris*, perennial rye grass, and pineapple weed, *Matricaria matricarioides*.	WL1 (J2.2) ED3 (J1.3)	None
19	Re-colonising bare ground very like track in 18	ED3 (J1.3)	None
20	Hedgerow on S side of lane consisting of hawthorn and ivy with some gorse and specimen tree of sessile oak.	WL1 (J2.1)	Good example of specimen oak
21	Area of wet grassland though disturbed. The main species are soft rush and Yorkshire fog which had been cut. Some meadowsweet, *Filipendula ulmaria* and purple loosestrife, *Lythrum salicaria*. Rough embankment along edge has ragwort, *Senecio jacobaea*, gorse and blackberry.	GS4 (B5)	Low as very disturbed.
22	S side of 21 has trimmed hedgerow of hawthorn with yarrow, *Achillea millefolium* and sneezewort, *Achillea millefolium*	WL1 (J2.1)	None
23	Re-seeded pasture dominated by perennial rye grass with some sorrel and ragwort. A ruin occurs on the E side with a track to it from the main road.	GA1 (B4)	None
24	Trimmed hedgerow of hawthorn by main road	WL1 (J2.1)	None
25	Ploughed field for crops	BC1/BC3 (J1.1)	None
26	Trimmed hedgerow of blackthorn, gorse and wild rose, *Rosa* spp. which has been burnt.	WL1 (J2.1)	None
27	Hedgerow of gorse, blackthorn and ash.	WL1 (J2.1)	None

Table 7.2.1: Target Notes for main habitat features with their codes and assessments of their conservation value – illustrated on Figure 7.2 Contd.

No. as on Map Fig. 7.2 (1-28 Co. Louth, 29-33 Co. Down)	Habitats, Vegetation & Flora	Fossitt Code (*JNCC Phase 1 Code*)	Conservation Value
28	Treeline of Sitka spruce, *Picea sitchenisis*, Scot's pine, *Pinus sylvestris*, sycamore and ash.	WL2 (J2.3)	Low as contains 3 alien trees.
29	Area adjacent to roundabout W of Warrenpoint. Embankment on S side of road, adjacent to Amenity Area and opposite the tower borders the mudflats. It contains a number of salt marsh plants scattered along it principally sea purslane below with sea plantain, *Plantago maritima*, sea beet, *Beta maritima*, common salt-marsh grass, sea aster in the middle and scutch at the highest level.	Elements of H2.4/H2.6 (CM1/CM2)	None
30	Area of disturbed, waste ground E of this consists of rough grassland dominated by scutch , gorse and broom with elder, *Sambucus nigra,* butterfly bush, *Buddleja davidii* and Japanese rose, *Rosa rugosa*.	J1.3/A2 (ED3/A2)	None
31	Rectangular area of mudflat defined by embankments of rock on top of which there is disturbed ground of teasel, *Dipsacus fullonum*, kidney vetch, *Anthyllis vulneraria*, wild carrot, *Daucus carota*, with a mixture of broom, ragwort, sea mayweed, *Matricaria maritima* and spear thistle, *Cirsium vulgare*. Common cudweed, *Filago vulgaris* occurred in the more open areas.	J1.3/J3.5 (ED3/CC1)	None
32	Slopes of embankment abutting mud-flats have salt marsh species occurring mostly of sea purslane, lax-flowered sea lavender, sea aster and sea beet.	J3.5/G2.6/H1.1/H2.4 (CC1/CW2/LS4/CM1)	Low. Salt-marsh species Have invaded artificial structure.
	Fringe of salt marsh occurs on the inside of this embankment - dominated by sea purslane with red fescue, sea aster and scurvy grass, *Cochlearia officinalis*.	H2.4/G2.6/J.3.5/H1.1) CM1/CW2/CC1/Ls4	Low. Salt-marsh species Have invaded artificial structure.

Conservation assessment of habitats and flora and their value in the context of Ireland and Northern Ireland

Within the site and the footprint of the new bridge and road, no significant elements of habitats of conservation interest were located. On both sides of the Newry River small fragments of salt-marsh are found but they do not display any of the structure and diversity that are apparent in those which have arisen on natural surfaces away from human-made structures. This stretch of the river has been canalised and impounded in the past and a number of structures to aid navigation have been built, notably beacon towers. Salt marsh species have invaded much of inter-tidal areas but it is secondary in nature and lacks the proper substrate and conditions needed to allow its full diversity and structure to develop. None of the salt marsh habitats have been listed as Qualifying Interests for the Carlingford Shore SAC whilst for the corresponding ASSI Carlingford Lough, coastal salt marsh is listed as one of the interests. However, the areas of this habitat in the vicinity of where the bridge and road are proposed are also poor in structure and diversity.

Away from the river and inter-tidal areas, there is little of conservation value. Clumps of tree, listed in nos. 12 and 16 in Table 7.2.2, are of local value whilst the oak listed in no. 20 is of specimen interest.

b) Birds

Review of past information

Most historical waterbird census data relevant to the study area derive from three series of systematic monthly winter counts carried out for the Irish Wetlands Enquiry (1971-72 to 1974-75), the Winter Wetlands Survey (1984-85 to 1986-87), and the Wetland Bird Survey (WeBS - Northern Ireland)/Irish Wetland Bird Survey (I-WeBS - Republic of Ireland). The findings of these surveys are summarised below.

(i) The Irish Wetlands Enquiry (1971-72 to 1974-75)

The first systematic counts of waterbirds in Carlingford Lough appear to have been carried out during the winter months of 1971-72 to 1974-75 for the *Irish Wetlands Enquiry* (Hutchinson 1979). At that time Carlingford Lough was considered to have the fourth largest concentration of wildfowl and waders on the Irish east coast, with wintering flocks of Light-bellied Brent Geese (100), Shelduck (100), Wigeon (500), Teal (300), Mallard (up to 220), a nationally important flock of Scaup (down to 500-1000 from 2,500 in the mid-1960s), Oystercatchers (500), Dunlin (1,700), Curlews (900), and Redshanks (700). It is not clear if the Newry River Estuary was covered by these counts.

(ii) The Winter Wetlands Survey (1984-85 to 1986-87, to 1991-1992)

Between 1975-76 and 1983-84 no waterbird counts appear to have been carried out at Carlingford Lough, but between 1984-85 and 1986-87 a new series of counts was carried out for the *Winter Wetlands Survey* (Sheppard 1993). Most Northern Ireland wetlands, including Carlingford Lough, continued to be counted to 1991-92. By then Light-bellied Brent Geese had increased in Carlingford Lough to internationally important numbers (386/283)*, while ten other waterbird species were recorded in nationally important numbers. These were Great Crested Grebe (147/205), Cormorant (146/117), Shelduck (181/225), Scaup (595/264), Goldeneye (139/104), Oystercatcher (786/779), Ringed Plover (172/107), Dunlin (1,600/1,676), Redshank (738/642), and Turnstone (227/167). Other waterbirds recorded in Carlingford Lough were Grey Heron (30), Wigeon (405/360), Teal (244/317), Mallard (261/288), Long-tailed Duck (13/25), Red-breasted Merganser (65/41), Golden Plover (121/8), Grey Plover (57/41), Lapwing (614/449), Bar-tailed Godwit (229/109), Curlew (631/540), and Greenshank (19/12). Again, it is not clear if the Newry River Estuary was covered by these counts.

* Where two numbers are given, the first represents the Winter Wetlands Survey mean of the three winter peaks, while the second number is the five-year mean of annual peaks to 1991-92.

(iii) The Wetland Bird Survey/Irish Wetland Bird Survey (1994-95 to present)

Initially, waterbirds occurring on the Northern Ireland side of Carlingford Lough were counted under the *Wetland Bird Survey* (WeBS), while those on the Republic of Ireland Side were counted under the *Irish Wetland Bird Survey* (I-WeBS). However, in recent winters, all of Carlingford Lough, including the Newry River Estuary, has been covered by WeBS counters. This has ensured better co-ordination of counting and the quality of the data. WeBS waterbird summary count data for the winters 2001-02 to 2005-06 are included in this report to provide background context to the 2008 count data from the Newry River Estuary. Carlingford Lough waterbird count data for the winters 1996-97 to 2000-01 are given in Crowe (2005) and summarised in Table 3. Subsequent counts for the 2001/02-2005/06 winters are given in **Appendix 7.1** at the end of this chapter with corresponding count data specific to the Warren Point to Newry subsite is given in **Appendix 7.2** at the end of this chapter.

Table 7.2.2 Waterbirds occurring in significant concentrations at Carlingford Lough between 1994/95 and 2000/01 (3 separate and consecutive 5 yr periods are presented). Figures are five-year mean annual peaks (after Crowe 2005).

Species	5 yr period	5 yr period	5-yr period
	1994/95-1998/99	1995/96-1999/00	1996/97-2000/01
International			
Light-bellied brent goose	338	350	427
National			
Great Crested Grebe	261	251	288
Cormorant	171	193	177
Shelduck	208	214	245
Scaup	590	635	635
Goldeneye	188	185	188
Red-breasted merganser	36	39	42
Oystercatcher	950	1,025	1,047
Ringed plover	109	146	158
Dunlin	1,377	1,619	1,648
Redshank	929	1,057	1,164

Waterbirds feeding in the Narrow Water Study Area (Section F)

A total of 17 waterbird species was recorded feeding in the Narrow Water Study Area during the nine surveys/censuses carried out between 30th January and 26th March 2008, together with supplementary counts extending to 18th May.

The schematic distribution of these species and their numbers on each date (Jan-May 2008), are shown in **Appendix 7.3** at the end of this chapter, and the data for the main period January to March 2008 are summarised in Table 1 of **Appendix 7.4** at the end of this chapter. The maximum count for each species during the period is given in Table 7.2.3, below.

Table 7.2.3 Maximum count for each species in the Narrow Water Study Area (Section F), January to March 2008

Great Cormorant	6	Redshank	64
Grey Heron	10	Greenshank	1
Brent Goose	16	Turnstone	3
Shelduck	18	Mediterranean Gull	1
Teal	24	Black-headed Gull	86
Oystercatcher	51	Common Gull	13
Grey Plover	2	Herring Gull	15
Lapwing	58	Great Black-backed Gull	67
Curlew	21		

In all, 17 waterbird species were recorded in the Narrow Water Study Area during 11 visits between 30th January and 18th May 2008. The most numerous and most frequent of these were Black-headed Gull (max. 71, average 27.5), Oystercatcher (max. 51, average 21.4), Redshank (max. 64, average 12.4), Teal (max. 24, average 6.8) and Shelduck (max. 18, average 6.4). The remaining species were recorded less frequently and in numbers averaging <4.0 birds per visit.

No waterbird species was recorded in the Narrow Water Study Area in internationally or nationally important numbers. Nor were any recorded in significant numbers in relation to the overall numbers recorded during the WeBS counts in Carlingford Lough. However, a number of species occurred in the Narrow Water Study Area in 2008 in numbers which represented a significant percentage of the maxima counted in the Newry River Estuary during the present study. These are given in Table 7.2.4.

Table 7.2.4 Species occurring in significant numbers in the Narrow Water Study Area and their percentage of the total in the Newry River Estuary (data from present study)

Species	Max. at Narrow Water	% of Newry River max.
Brent Goose	16	100
Shelduck	18	5.7
Teal	24	5.8
Oystercatcher	74	68.9
Lapwing	39	67.2
Curlew	17	13.9
Redshank	64	8.5
Black-headed Gull	71	8.6
Common Gull	13	28.9

Waterbirds roosting in Narrow Water Study Area

During the bird surveys undertaken in the area in 2008 and 2009 it was noted that a saltmarsh island close to the south shore of the channel and a nearby spit were regularly used by waterbirds as high tide roosts. The island appears to be a natural feature, where stones, cobbles, etc. have been deposited on the upper shore, downstream of Cillin Wood and a high beacon tower. Over time, silty deposits on the stony base have led to the establishment of saltmarsh vegetation. The spit appears to be part of a derelict and breached man-made training wall. Again, silty deposits here have led to the establishment of saltmarsh vegetation. The surveys found that the island was regularly used by c.300 waterbirds during the high tide period. The nearby spit was also used, but less frequently and by smaller numbers of waterbirds. The bird species which used the island as roosting sites were Grey Heron, Light-bellied Brent Goose, Shelduck, Teal, Mallard, Oystercatcher, Lapwing, Dunlin, Curlew, Redshank, Greenshank, Turnstone, Mediterranean Gull, Black-headed Gull, Common Gull, Herring Gull and Great Black-backed Gull. The spit was used mainly by Oystercatcher and Redshank

Local ornithologist Mr Frank Carroll (who has been carrying out monthly Wetland Bird Surveys in the Newry River Estuary over many years) confirmed, based on his long experience of carrying out WeBS counts in the area between September and March, that the great majority of waterbirds roosting at high tide in the Narrow Water Study Area did so on the small saltmarsh island and stone training wall located on the south side of the estuary between the two beacons.

Waterbirds feeding/roosting in the Newry River Estuary

In the Newry River Estuary as a whole, a total of 24 waterbird species was recorded during the nine surveys/censuses carried out between 30th January and 26th March 2008. Numbers of birds counted in each of the Sections A-G on each survey/census visit, together with the totals recorded in the estuary are given in Appendix 7.4 (Table 2).

A comparison between these early 2008 data and data collected over the 2001-02 to 2005-06 winters for the Wetland Bird Survey (Appendix 7.2) is made in Table 7.2.5. During the autumn, winter and spring (August to April inclusive) periods of 2001-02 to 2005-06, WeBS counts of waterbirds were carried out monthly in the Newry River Estuary (Warrenpoint to Newry). The table below (Table 7.2.5) gives the five-year peak counts of each species for the August-April period (col. 2), the peak counts for the January-April period (col. 3) and, for comparison, the peak counts for the January-April 2008 period (col. 4).

Table 7.2.5 Waterbirds recorded in Newry River Estuary: Comparison between Wetland Bird Survey counts 2001/02-2005/06 (WeBS data) and 2008 counts (present study).

Species	WeBS 01/02-05/06	WeBS 01/02-05/06	Present Study 2008
	Newry R, Aug-Apr	Newry R, Jan-Apr	Newry R, Jan-Apr
Great Crested Grebe	3	3	1
Great Cormorant	59	49	29
Grey Heron	20	18	11
Mute Swan*	50	17	0
Brent Goose	22	22	16
Shelduck	533	533	313
Teal	698	698	412
Mallard	43	21	2
Moorhen	3	1	2
Oystercatcher	121	121	74
Lapwing	91	90	58

Table 7.2.5 Waterbirds recorded in Newry River Estuary: Comparison between Wetland Bird Survey counts 2001/02-2005/06 (WeBS data) and 2008 counts (present study) Contd.

Species	WeBS 01/02-05/06	WeBS 01/02-05/06	Present Study 2008
	Newry R, Aug-Apr	Newry R, Jan-Apr	Newry R, Jan-Apr
Dunlin	1500	500	775
Black-tailed Godwit	100	27	13
Bar-tailed Godwit	15	15	0
Curlew	201	200	122
Greenshank	2	2	2
Redshank	1368	1200	753
Turnstone	5	5	3
Black-headed Gull	NC	NC	827
Common Gull	NC	NC	45
Herring Gull	NC	NC	90

* Mute Swans were recorded only on the Newry Canal.

In addition to the above, Little Egret (0,0,1), Scaup (2,0,0), Goldeneye (1,0,0), Red-breasted Merganser (0,2,0), Moorhen, Grey Plover (0,0.1), Curlew Sandpiper (1,0,0), Snipe (1,0,0), Whimbrel (6,0,0), Mediterranean Gull (?,?,1), Lesser Black-backed Gull (?,?,1), Great Black-backed Gull (?,?,6), and Kingfisher (1,1,0) were recorded during the WeBS period and/or in 2008, but numbers were insignificant. Gulls were not counted (NC) during the WeBS period. Numbers in brackets are equivalent to numbers in columns 2, 3 and 4 in Table 7.2.5.

Of the 34 waterbird species recorded in the Newry River Estuary during the WeBS count period and in the 2008 survey, a number (the 13 listed above) can be omitted from considerations of impacts by the proposed bridge on account of the insignificant numbers and paucity of occurrences. Those which were recorded in 2008 are as follows (numbers in brackets are, respectively, the maximum number recorded and the number of occurrences):-

Great Crested Grebe (1/3), Mallard (2/4), Moorhen (2/1), Greenshank (2/5), Turnstone (3/5), Lesser Black-backed Gull (1/1), Great Black-backed Gull (6/2).

Although three species - Little Egret, Mediterranean Gull and Kingfisher - are included in Annex 1 of the European Union Birds Directive, these may be set aside also because only single individuals were recorded on the Newry River Estuary, on one occasion each.

It is clear from the above that the Newry River Estuary is particularly important for Shelduck, Teal, Dunlin, Redshank and Black-headed Gull. Indeed Shelduck occurs there in Nationally Important numbers (threshold 150), as does Redshank (threshold 330) (Crowe 2005).

However, the counts carried out at Narrow Water between 30th January and 16th May 2008 produced rather small numbers of these species, as follows:-

Shelduck (18), Teal (24), Lapwing (39), Dunlin (0), Curlew (17), Redshank (64), Black-headed Gull (71).

Therefore, in the context of the wintering waterbird population of the Newry River Estuary, the Narrow Water area is of minor importance as a feeding and roosting site.

Waterbird movements through the Narrow Water Study Area

Contrary to expectations that there would be considerable movement of waterbirds (especially waders) up and down the Newry River Estuary with the rising and falling tides, it was found during the early 2008 surveys that very little such movement took place in the Narrow Water Study Area. Shelduck and Teal, being swimming ducks, tended to swim/float on the water when high tides covered their main feeding areas on the extensive mudflats upstream of Narrow Water. The non-swimming wader species – Dunlin, Curlew, Redshank, etc. – generally roosted at high tide on the stone embankments and saltmarsh fringes of the estuary, close to their main feeding grounds on the mudflats. Like the ducks, the gulls tended to float on the water at high tide close to their feeding areas.

During the focused surveys in 2009, a total of 23 waterbird species was recorded during the observation periods over the six days (amounting to 30 hours of observations). These are listed in Table 7.2.6, along with the numbers of movements and the total numbers recorded. A total of 1,014 individual movements of birds, ranging from one bird to a flock of 220, were recorded during the six days of the surveys. The total number of waterbirds recorded amounted to 9,587 individuals.

The great majority of the birds observed moving up and down the Narrow Water channel were Black-headed Gulls. A total of 6,370 of these were counted in 370 movements. Dunlin was the most frequent wader species recorded, with 892 birds in 19 movements.

Dawn/dusk flighting: Of the total of 30 hours spent observing waterbird movements at Narrow Water in the 2009 surveys, 7.5 hours were spent observing dawn and dusk flighting. This was to establish if significant numbers of waterbirds were concentrating at the Narrow Water channel at these times, when light and visibility are reduced and birds may be at greater risk of collision with the bridge structure.

It was anticipated that gulls would dominate such movements and an analysis of the data showed that 74.8% of the 6,370 Black-headed Gulls recorded throughout the 30 hours of observations were engaged in dawn and dusk flighting, apparently between night roosting areas in Carlingford Lough and feeding sites further up the Newry River or on inland fields.

A large proportion of the 442 Curlews recorded also appeared to be engaged in dawn/dusk flighting, particularly the latter, as distinct from moving according to the ebb and flow of the tides. During the mid- to late afternoon and until after sunset, 359 (81.0%) of all Curlews recorded were observed flighting to roost in Carlingford Lough, with the movement peaking during the 1.5 hours centred on sunset. A total of 183 birds (41.4%) was recorded during this time. It is thought that some dawn flighting of Curlews may have been missed, as the species tends to move from roosting grounds at first light, up to one hour before sunrise.

None of the other 21 waterbird species recorded at Narrow Water in January-February 2009 showed any temporal pattern of movement indicating significant dawn and dusk flighting.

Table 7.2.6 Waterbird species recorded flying in Narrow Water channel during six days in January and February 2009.

Species	No. counted	No. of movements	% of Total
Black-headed Gull	6,370	370	66.4
Dunlin	892	19	9.3
Lapwing	504	24	5.3
Oystercatcher	500	122	5.2
Curlew	442	89	4.6
Redshank	299	84	3.1
Cormorant	157	115	1.6
Common Gull	119	68	1.2
Turnstone	76	17	
Herring Gull	65	44	
Teal	58	8	
Shelduck	42	20	
Brent Goose	11	3	
Great Crested Grebe	10	2	
Great Black-backed Gull	9	6	
Greenshank	8	7	
Grey Heron	7	6	
Red-breasted Merganser	7	4	
Mallard	5	2	
Lesser Black-backed Gull	4	1	
Mute Swan	2	1	
Red-throated Diver	1	1	
Mediterranean Gull	1	1	
Grand totals	**9,587**	**1,014**	

Note: Numbers of the last 15 species each represented <1% of the grand total, and combined account for 3.3 % of the grand total.

Bird movements related to tidal ebb and flow: Observations made in 2008 indicated that the great majority of waterbirds using the expansive intertidal areas of the Newry River Estuary upstream of Narrow Water remain there during the high tide period, instead of flying up and down between their feeding areas and roosting sites at Carlingford Lough. This was confirmed by discussions with a local ornithologist (Mr Frank Carroll) who carries out monthly waterbird counts between September and March each year for the Wetland Bird Survey (Northern Ireland) and the Irish Wetland Bird Survey (Republic of Ireland). However, the 30 hours of observations of waterbird movements at Narrow Water carried out in January and early February 2009 showed that some movement between the upper Newry River Estuary and Carlingford Lough, which was related to tidal ebb and flow, did take place.

An analysis of the bird movement data showed that little or no movement of this kind was evident during the high and low tide periods (1.0-1.5 hours either side of high and low tide), when waterbirds might be expected to be roosting (high tide) or busily feeding on the intertidal habitats (low tide). However, it was clear that Dunlin, with 19 observed movements involving 892 birds, were displaced by the rising tide from the upper Newry River Estuary and flew down to roost in Carlingford Lough. These birds were observed flying back up the Newry River as soon as the expansive mudflats were exposed by the falling tide. It was noted that Dunlin always flew very close to the water.

Flight altitude: When recording the 9,587 waterbirds in 1,014 movements during 30 hours of observations at Narrow Water channel, the flight altitude of these birds was also recorded. The birds were noted as flying in the proposed bridge area at **LOW, MEDIUM** and **HIGH** altitude (see methods).

An analysis of the data showed that 25.6% of the birds were observed flying at **LOW** altitude, 56.1% were flying at **MEDIUM** altitude, and 18.3% were flying at **HIGH** altitude. Therefore, the great majority (81.7%) of the 9,587 waterbirds recorded moving at Narrow Water were seen to do so at **LOW** and **MEDIUM** altitude, thus potentially exposing themselves to risk of collision with the proposed new bridge.

Terrestrial Bird Community in Cillin Wood

The two timed visits to Cillin Wood (16th April and 18th May 2008), together with casual observations (audio and visual), produced a total of 24 bird species. These are listed in Table 7.2.6, with estimates of their abundance expressed in “apparently occupied breeding territories”. Three Amber List species were recorded.

Table 7.2.7 Terrestrial bird species recorded in Cillin Wood in 2008, with indications of numbers, territories and presence/absence

Species	16.4.08	18.5.08	Casual Observations
Goshawk (Amber)	0	1	1
Woodpigeon	7-8 territories	9 territories	P
Swallow (Amber)	0	2 birds flying over	0
Wren	4-5 territories	5 territories	P
Dunnock	0	1 territory	0
Robin	4 territories	3 territories	P
Blackbird	4 territories	3 territories	P
Mistle Thrush	0	1 bird flying over	0
Blackcap	3 territories	2 territories	2
Chiffchaff	1 territory	1 territory	1
Willow Warbler	0	1 territory	1
Goldcrest	c.7 territories	7 territories	P
Long-tailed Tit	1 territory	0	P
Coal Tit	2 territories	1 territory	P
Blue Tit	3-5 territories	1 bird present	P
Great Tit	2 territories	1 territory	P
Magpie	0	2 birds present	2

Table 7.2.7 Terrestrial bird species recorded in Cillin Wood in 2008, with indications of numbers, territories and presence/absence Contd.

Species	16.4.08	18.5.08	Casual Observations
Jackdaw	0	0	4
Hooded Crow	1 territory	1 territory	2
Starling (Amber)	4 birds flying over	0	P
Chaffinch	3 territories	2 territories	P
Greenfinch	1 territory	0	P
Siskin	0	0	4
Lesser Redpoll	0	0	2

* While carrying out fieldwork at Narrow Water, in the vicinity of Cillin Wood, a number of woodland bird species were noted in the woodland, mainly by hearing song or calls. These are indicated in the Casual observations column by P (for present). In some cases birds were seen and their numbers noted: the numbers (of individual birds) are given. Where species were not noted during casual observations, this is indicated by 0.

Terrestrial bird community of fields and hedgerows

During the course of visiting Narrow Water to carry out surveys/censuses of waterbirds in that part of the Newry River Estuary, observations were also made of the terrestrial bird species present in the fields and hedgerows, and around buildings (occupied and unoccupied), along the proposed route of the road linking the Narrow Water bridge with the R173 Newry-Omeath Road. The main visits were made on 30th January and 26th March 2008 (reconnaissance), and 16th April and 18th May 2008, during the breeding season. In addition, some casual observations were made on other dates. A total of 33 bird species was recorded in this area between 30th January and 18th May 2008. These are listed in Table 7.2.7, with estimates of maximum numbers of individuals recorded, and indications of their breeding status. Five Amber List species were recorded.

Table 7.2.8 Terrestrial bird species recorded in study area fields and hedgerows in 2008, with indications of numbers and breeding status

Species	Max. no	Breeding Status
Woodpigeon	8	holding territory
Sand Martin (Amber)	1	not breeding
Swallow (Amber)	6	occupied nests
Grey Wagtail	2	holding territory
Pied Wagtail	2	possible territorial pair
Wren	8	territorial song
Dunnock	4	territorial song
Robin	5	territorial song
Blackbird	9	territorial song
Song Thrush	1	present, possibly breeding
Mistle Thrush	2	holding territory
Blackcap	1	territorial song
Whitethroat	2	territorial song

Table 7.2.8 Terrestrial bird species recorded in study area fields and hedgerows in 2008, with indications of numbers and breeding status Contd.

Species	Max. no	Breeding Status
Chiffchaff	1	territorial song
Willow Warbler	3	territorial song
Goldcrest	2	territorial song
Long-tailed Tit	2	possible territorial pair
Coal Tit	1	territorial song
Blue Tit	2	territorial pair
Great Tit	2	feeding young
Magpie	3	holding territory
Jackdaw	4	holding territory
Rook	6	not breeding
Hooded Crow	2	occupied nest
Starling (Amber)	22	territorial song
House Sparrow (Amber)	8	holding territory
Chaffinch	2	territorial song
Greenfinch	2	possible territorial pair
Goldfinch	4	territorial song
Siskin	4	not breeding
Linnet (Amber)	6	holding territory
Bullfinch	2	territorial pair
Reed Bunting	2	territorial pair

Conservation status of birds recorded in Newry River Estuary Study Area (2008/09 study and WeBS counts)

Five ways of describing the conservation status of birds in Ireland are generally used, in descending order of importance, numbered i to v below. Bird species recorded in the Newry River Estuary Study Area are categorised here according to their conservation status. Note that a species can fall into more than one category.

(i) Annex 1 waterbird species (EU Birds Directive)

Red-throated Diver (both)
Little Egret (2008/09 only)
Bar-tailed Godwit (WeBS only)
Mediterranean Gull (2008/09 only)
Kingfisher (both)

These five waterbird species are included in Annex 1 of the EU Birds Directive as species of conservation concern in the European Union. Three of them – Red-throated Diver, Little Egret and Mediterranean Gull – were recorded in the Narrow Water Study Area in 2008/09 but only single birds. Bar-tailed Godwit and Kingfisher have been recorded in the Newry River Estuary, the former not during the 2008 counts but on two occasions (totals of 10 and 15) during the WeBS counts; the latter on two occasions during 2008 and the WeBS counts but always singly.

In addition to the above, seven other Annex 1 waterbird species – Black-throated Diver (1), Great Northern Diver (26), Slavonian Grebe (1), Golden Plover (400), Sandwich Tern, Common Tern and Arctic Tern – have been recorded in Carlingford Lough, but not in the Newry River Estuary (Crowe 2005).

It is concluded that the Narrow Water Study Area is not of importance for any Annex 1 listed species.

(ii) Internationally Important waterbird species

Light-bellied Brent Goose (both)

This species occurs in Carlingford Lough in Internationally Important numbers (currently over 200 but due to be raised to 260 (Delany and Scott 2006), but very few appear to enter the Newry River Estuary. During the WeBS counts the maximum counted there was 44 birds, while in the early 2008 series of counts, the maximum number of birds recorded was 16. Therefore the Narrow Water Study Area is generally of very little importance for Brent Geese.

(iii) Nationally Important waterbird species

Great Crested Grebe (both, 2/1)
Great Cormorant (both, 49/29)
Shelduck (both, 533/313)
Scaup (WeBS only, 2)
Goldeneye (WeBS only, 1)
Red-breasted Merganser (WeBS only, 2)
Oystercatcher (both, 121/74)
Dunlin (both, 1,500/775)
Redshank (both, 1,368/753)

The above nine waterbird species occur in Carlingford Lough in Nationally Important numbers. However, while they have been recorded in the Narrow Water Study Area, the numbers found there are well below the Nationally Important threshold. Ringed Plover also occurs in Carlingford Lough in Nationally Important numbers, but has not been recorded in the Narrow Water Estuary.

(iv) Red List waterbird species

Birds which are included in the Red List of birds of conservation concern in Ireland are considered be of high conservation concern, usually because their populations have declined by over 50% in the last 25 years, and/or their range has contracted by over 70% over the last 25 years (see Lynas et al. 2007).

Lapwing (B) (both, 91/58)
Curlew (B) (both, 201/122)
Redshank (B) (both 1,368/775)
Black-headed Gull (B) (2008, 827, NC WeBS)
Herring Gull (B) (2008, 90, NC WeBS)

Although these five Red List species were all recorded in the Narrow Water Study area in some numbers, it should be noted that it is the breeding populations (B) which are of high conservation concern in Ireland. None of these species breeds in the Newry River Estuary, so their Red List status is not directly relevant to the proposed bridge and link road project.

In addition to the above, two other Red List species – Common Scoter (2) and Knot (140) – have been recorded in Carlingford Lough, but not in the Newry River Estuary.

(v) Amber List bird species

Birds which are included in the Amber List of birds of conservation concern in Ireland are considered to be of medium conservation concern, usually because their populations have declined between 25% and 50% over the last 25 years, and/or their breeding range has contracted by 35% to 70% over the last 25 years (see Lynas et al. 2007).

Those Amber List species which were recorded in the 2008 survey and/or the Wetland Bird Survey (WeBS) are listed below, indicating their presence in one or other, or both of these surveys.

Waterbirds

Red-throated Diver (both, 1/1)
Great Crested Grebe (both, 3/1)
Great Cormorant (both, 59/29)
Mute Swan (both, 50/0)*
Light-bellied Brent Goose (both, 41/16)
Shelduck (both, 533/313)
Teal (both, 698/412)
Scaup (WeBS only, 2)
Goldeneye (WeBS only, 1)
Oystercatcher (both, 121/74)
Grey Plover (2008 only, 2)
Dunlin (both, 1,500/775)
Black-tailed Godwit (both, 100/31)
Greenshank (both, 2/2)
Mediterranean Gull (2008 only, 1)
Common Gull (2008, 45, NC WeBS)
Lesser Black-backed Gull (2008, 1, NC WeBS)
Great Black-backed Gull (2008, 6, NC WeBS)
Kingfisher (both, 1/1)
* In Newry Canal only.

Terrestrial species recorded in 2008 (not covered by WeBS)

Goshawk
Sand Martin
Swallow
Starling
House Sparrow
Linnet

The above terrestrial birds, all of which are Amber List species, were recorded in Cillin Wood and/or in the fields and hedgerows along the route of the proposed link road, together with other species which are of no particular conservation concern in Ireland at present.

c) Mammals (exc Bats)

No badger setts were recorded within the road corridor. However signs of badger activity including paths, hair and evidence of foraging were found along a number of the hedgerows within the corridor. These signs included well used paths crossing the route of the proposed link road.

The survey was extended into Cillin Wood where two well used single entrance setts were recorded. The density of understory vegetation prevented an extensive search of this woodland. However the propensity of paths and field signs makes it likely that a Main sett is present.

Otter *Lutra lutra* signs had previously been recorded between Greenore and Ballagan Point (B. Madden 2007) and it can be assumed that they frequent the entire lough area. Despite this no signs of otter activity were recorded within the survey corridor or on the foreshore at the actual location of the bridge. The extension of the survey into Cillin Wood recorded a number of fallen trees adjacent to the estuary and approximately 300m upstream of the proposed bridge site which have potential to be used as otter holts. The proposed bridge project will have no impact on these. The otter is of high conservation significance as it is listed on Annex II of the EU Habitats Directive, although it is not recorded as a Qualifying Feature of the Carlingford Shore SAC.

On the northern side, the potential for mammals to occur in the zone between the intertidal habitats and the roundabout is negligible as the habitats here are artificial banks or planted shrubbery with a weedy character. Ubiquitous small mammal species of the countryside, such as long-tailed field mouse *Apodemus sylvaticus*, brown rat *Rattus norvegicus,* pygmy shrew *Sorex minutes* and fox *Vulpes vulpes* may occur.

d) Bats

The assessment of the bat fauna of the study area and the proposed development is based on a review of the structure's design plans, aerial photographs and mapping of the site, existing records of bats in the local area and many years' study experience of these animals including survey and assessment of similar road and bridge projects in relation to bats.

The review of existing records of bat species in the area of the proposed development reveals that five of the ten known Irish species have been observed in the local area. These include common *Pipistrellus pipistrellus* and soprano *P. pygmaeus* pipistrelle, Leisler's *Nyctalus leisleri*, Daubenton's *Myotis daubentonii* and Natterer's *M. Nattereri* bats as shown in Table 7.2.9 below.

Table 7.2.9: Adjudged status of Irish bat species within the study area

Common name	Scientific name	Occurrence	Known roosts
Common pipistrelle	*Pipistrellus pipistrellus*	Present	No
Soprano pipistrelle	*Pipistrellus pygmaeus*	Present	No
Nathusius' pipistrelle	*Pipistrellus nathusii*	Potential – rare	No
Leisler's	*Nyctalus leisleri*	Present	No
Brown long-eared	*Plecotus auritus*	Certain	No
Lesser horseshoe	*Rhinolophus hipposideros*	Absent	No
Daubenton's	*Myotis daubentonii*	Present	No
Natterer's	*Myotis nattereri*	Present	Yes
Whiskered	*Myotis mystacinus*	Potential	No

Table 7.2.9: Adjudged status of Irish bat species within the study area Contd.

Common name	Scientific name	Occurrence	Known roosts
Brandt's	*Myotis brandtii*	Potential – rare	No

Both pipistrelle species are expected to be ubiquitous along hedgerows, tree lines and woodland edge habitats in the study area with the soprano being more active immediately adjacent to the river.

Nathusius' pipistrelle *Pipistrellus nathusii* may occur in the area as its main stronghold on the island of Ireland is the north-east. It is being recorded more often, probably as a result of climate change, with more animals of this highly migratory species arriving from the continent, and with increased use of bat detectors. The species has yet to be recorded in the immediate area of the proposed development but potential exists for its occasional occurrence.

Leisler's bat, which forages over agricultural landscapes, scrub and woodland as well as urban areas, is expected to be common in the local area. Although rare in Britain and mainland Europe, the species is widespread and common throughout the island of Ireland.

The brown long-eared bat *Plecotus auritus*, which roosts in trees and buildings, is a very quiet species which produces very weak echolocation pulses and sometimes hunts without emitting sounds and so can be missed by detector. It is a common species throughout Ireland and is expected to be widespread in the local area.

The lesser horseshoe bat *Rhinolophus hipposideros* is absent from the east of the island. The distribution range of this species is restricted to the west of Ireland.

Daubenton's bat, which forages over open water, is known to be present locally and is certain to occur on the Newry River. This species travels over considerable distances along watercourses and is also found on smaller water bodies such as ponds and pools. It commonly roosts in trees and buildings, including bridges, in close proximity to water.

Natterer's bat has been recorded in the local area and two roosts are known within 10km of the site as shown in Table 7.2.10 below. These records were sourced from BCIreland's National Bat Records Database. This is a woodland species and may be present within the study area due to the presence of mature deciduous trees and woodland.

Whiskered *M. mystacinus* and Brandt's *M. brandtii* bats have not been recorded in the area to date. Both are woodland species and the former, although uncommon, is widespread in Ireland. The latter is the most recent bat species to be found in Ireland being only discovered in 2003 (Mullen, 2007). Records of the species are few to date and, since it cannot be distinguished from the whiskered bat by detector, it is probably often misidentified or overlooked. Due to the area's woodlands, one or both species may occur locally occasionally.

Table 7.2.10: Known bat roosts within or adjacent to the study area

Bat species	Roost	Roost type	Numbers	Distance
Natterer's	Conifer tree, Drumad, Ravensdale, Co. Louth	Night	3	6km west
Natterer's	Flurry Bridge, Jonesborough, Co. Louth	Maternity	10+	6km west

The key features of importance for bats for foraging and commuting within the study area include the watercourse, woodlands, tree lines, individual trees and hedgerows. Older, mature trees in the area with storm damage, hollows or loose bark also offer roosting opportunities for bats. Some of these and indeed younger trees may also have ivy *Hedera helix* cover that may be used by roosting bats on occasion. Buildings such as the castle, Narrow Water Keep and leading light tower may also offer bats summer or winter roosting opportunities.

The proposed bridge development site is therefore situated within or adjacent to highly favourable bat habitats and features.

e) Amphibians and Reptiles

No signs of amphibians were found nor would any be expected as there are no ponds or suitable waterbodies present within the study area. The common lizard *Lacerta vivipara* could be expected along the shoreline habitats but the potential impact on same is considered negligible.

7.2.7 Ecological Impact Assessment

a) Habitats and Flora

<u>Loss and Disturbance of Habitats</u>

Direct and indirect impacts will arise from the construction of the bridge and the associated road. The main impacts will arise during the construction phase and will tail away as the vegetation becomes re-established following completion of the project. There will be loss of habitat and individual plant species along the route and the heaviest impacts will be on the inter-tidal areas on both sides of the river. Most of the vegetation loss will occur on the Co. Louth side as the area adjacent to the roundabout on the Co. Down site consists mostly of already infilled land and embankments. Whilst some salt marsh will be lost on the Co Louth side, this is considered of little significance due to the low quality of the habitat. Further, it is considered that salt-marsh species will rapidly invade the disturbed and increasingly sheltered inter-tidal areas following construction, resulting in a net gain of this potential habitat.

The loss and disturbance of habitats and associated flora is considered an adverse impact of Slight significance (especially if due care is taken to minimise the zone of impact).

<u>Alteration of Habitats</u>

The new embankment on the Co. Down side will result in the adjoining area of intertidal flats (south side) becoming very sheltered which is likely to encourage the colonisation of this area by salt marsh (which already occurs as a fringe along the peninsula – see note 32, Table 7.2.1).

b) Birds

<u>Impacts of Bridge and Link Road on Waterbirds at Narrow Water</u>

Displacement of birds

The location of the proposed bridge,

The location of the proposed bridge is approximately 40m to the north east and above the small salt marsh islet on which c.300 waterbirds roost at high tide. The physical presence of the bridge here will almost certainly displace these birds – without mitigation, such a loss is Significant in the context of the local wetland bird community. Appropriate mitigation would entail the creation of a suitable alternative roosting site nearby.

Disturbance during construction

During the bridge construction phase (which will be over an 18 month period) it is anticipated that construction activities and presence of workers will cause disturbance to feeding and roosting waterbirds at Narrow Water. As the disturbance will be temporary, this impact is considered only of minor significance.

In order to minimise the disturbance of the overwintering waterbirds, the construction of the northern and southern abutments, which will require direct access on to the foreshore, shall be completed outside of the main overwintering period.

Disturbance during operation

The proposed bridge at Narrow Water is unlikely to carry as much traffic as the A2 road at the northern edge of the Newry River Estuary, assuming that much of the current traffic will continue to Newry town. Waterbirds using the estuary at Narrow Water appear to be accustomed to this level and proximity of traffic and continue feeding undisturbed. Therefore it is unlikely that similar traffic crossing the proposed bridge at Narrow Water will disturb the birds, particularly if the vehicles are partly screened from view by the bridge parapets.

Similarly, waterbirds in this area are accustomed to bright road lights at night, so the bridge architectural up-lighting should have no adverse impacts on the birds. The hazard warning light, which will be necessary on top of the high tower supporting the suspension cables, could cause some disturbance to birds flying at night – however, this would be a very localised effect and some habituation would be expected to occur with time (also, there is likely to be existing warning lights elsewhere in the lough associated with port and shipping activities).

Collision Risk

The presence of the new bridge structure, which will cross the usual flight line of moving birds at near right angles, presents some risk of collision to birds commuting along the river above the height of the bridge deck. Whilst the cables will be relatively thick and well spaced (10m at deck to 6m towards top) there is some chance that birds could strike these if not readily visible during daylight and especially during night hours, or during poor weather conditions

In general, the bird species at most risk are those larger species, such as Cormorants, Brent Geese and Shelduck, which generally fly fast and direct and have relatively poor manoeuvrability. Other species, such as gulls, have a buoyant flight and generally do not fly with much momentum and so are at less risk of collision. Large, slow-flying species such as Grey Herons can also get blown off-course by gusts of wind. Whilst the 2009 study recorded Cormorant on a regular basis, the occurrences of Brent Geese and Shelduck were low.

A large proportion (81.7%) of the 9,587 waterbirds observed in January/February 2009 flying up and down the Newry River at Narrow Water did so at **LOW** and **MEDIUM** levels, i.e. at levels below the bridge decking and/or between the bridge decking and the highest point of the bridge structure. Therefore, the proposed new bridge does pose a potential collision hazard for these flying birds.

Those species which consistently flew at **LOW** or **LOW-MEDIUM** altitude were Great Crested Grebe, Oystercatcher, Dunlin, Redshank, Greenshank and Turnstone. Based on observations and experience with waterbird/bridge interactions elsewhere, it is believed that Turnstones are most likely to fly under a new bridge, while the other waders may or may not do so (the clearance to the bridge deck will range from. 6.0 m at normal low tide to 3.0 m at high tide). For example, at the Tain Bridge on the Castletown River at Dundalk, these species have been observed flying both under and over the bridge. Great Crested Grebes generally fly rather infrequently, and then just over the water surface. They may be reluctant to fly under or over a new bridge, but are likely to swim under such a structure (and anyway they are scarce in the Narrow Water area, with no more than 10 recorded in the 2009 surveys).

Grey Herons are partially nocturnal and are likely to fly up and down the Newry River, especially in the vicinity of their breeding colony at the riverside edge of Cillin Wood. Cormorants, which roost on trees by the heron colony, may also fly at night from time to time. These two species, as with other waterbirds active at night, would be exposed to greater risk of collision with the high tower and suspension cables if these were unlit at night (see mitigation measures).

Whilst risk of collision cannot be disregarded, it is expected, based on experience and observations elsewhere, that in normal circumstances where waterbirds are flying in daylight, with good visibility, they will avoid the structure by flying low under the bridge or high above it. Further, it is noted that there are no regular movements of large flocks of species, such as brent geese, dunlin, knot, golden plover or lapwing. However, at night and in foggy conditions, there is a risk of some collisions, though this risk can be reduced to negligible levels by use of lighting and colour to make the bridge structure visible in such conditions (see Mitigation Measures).

It is concluded that with appropriate mitigation, the risk of collision by significant numbers of birds is likely to be negligible to low.

Impacts of Bridge and Link Road on Breeding Birds in Cillin Wood

The most sensitive bird species in Cillin Wood is the Grey Heron, which has a breeding colony (at least 11 nests) in the tall trees on the estuary fringe of the wood. However, the proposed location of the bridge and the link road with the R173 road near Omeath is sufficiently distant from the colony not to cause any significant disturbance to the nesting birds. Furthermore, the Grey Herons are accustomed to movements and noise of heavy traffic a short distance across the river on the A2 dual carriageway between Warrenpoint and Newry. Therefore, the traffic on the new bridge and link road is very unlikely to cause any significant disturbance.

During the construction phase, the most likely cause of disturbance to the Grey Herons and other birds in Cillin Wood would be noise of pile-driving, which has been minimised by the bridge design requiring only three slender in-river piers (see Chapter 11 ‘Construction Phase’ and **Figures 11.2 – 11.7 in Volume 3**).

The risk of collision by Grey Herons with the bridge structure has already been referred to.

It is expected that the other, less sensitive, breeding birds in Cillin Wood will not be affected in any way by the presence of the bridge and link road, or by the traffic movements and noise.

Impacts of Bridge and Link Road on Terrestrial Breeding Bird Community of Fields and Hedgerows Along Link Road Corridor

The construction of the link road between the proposed bridge and the R173 will involve the loss of some habitat for breeding terrestrial birds, mainly those which nest in trees and hedgerows along the road corridor. The land occupied by this link road is undulating and generally slopes upwards from the Newry River Estuary to the R173. Therefore it is anticipated that sections of the road will require cuttings, and this will widen the corridor in places. Linnets are believed to have nested in 2008 in fields/hedgerows dominated by gorse, and removal of such vegetation will deprive them of nesting habitat. Whilst several of the species likely to be affected by construction are Amber listed (starling, house sparrow, linnet), the loss of a small number of potential nest sites is unlikely to have any impact on the populations in the wider area (and mitigation can provide alternative nest sites).

The high tower and suspension cables of the new bridge will be located at the riverside edge of the fields and hedgerows on the south side of the Newry River. This structure *per se* should pose no hazard to flying terrestrial birds during daylight. Most of the terrestrial species are inactive at night, but many of those which are migratory are nocturnal migrants. The tower and suspension cables could be a hazard to these birds in spring and autumn. However, the proposed architectural up-lighting will illuminate the structure and greatly reduce this risk.

c) Mammals

Badgers

Although no badger setts were recorded within the survey corridor, badgers are present and will be negatively impacted as a result of the proposed road development.

Plate 7.2.3 Multiple entrance badger sett in the nearby Cillín Wood

The most notable impact will be the severance of the badger territory and the potential risk of collision as a result of the operation of the link road. However, the installation of mammal underpasses and mammal fencing along the route of the link road will mitigate this impact and reduce it to slight negative.

Badgers will be subject to disturbance as a result of noise and human presence during the construction phase. However, this impact will be temporary in nature and is therefore considered to be a slight negative impact as badgers are nocturnal and will be most active outside of the period during the day when works will be carried out and would be expected to habituate to the disturbance and continue to use the adjacent fields for foraging.

Otters

Otters are present in Carlingford Lough and it is considered highly likely that at times they pass along the shorelines at the bridge location. However no otter holts or field signs were identified within the land take of the project and no holts were located in the immediate vicinity.

Otter movements along the foreshore may be subject to some disturbance during the construction phase. However this will be temporary in nature and will not prevent otters from moving along the shoreline during the night when they are most active. When the bridge is in operation, otters will still be able to pass along the shoreline and will adapt quickly to the presence of traffic above. As such the impact on the otter population is considered to be imperceptible.

d) Bats

The design of the proposed Narrow Water Bridge will, based on mean tide levels, result in the clearances given in Table 7.2.11 below being obtained between it and the water surface of the river beneath.

Table 7.2.11: Clearance levels beneath the constructed Narrow Water Bridge

Tide	Pylon (southern foreshore)	Pier (central channel)	Bascule (northern foreshore)
High	3.4m	4.5m	3.3m
Low	4.9m	6.0m	4.8m

The bridge will, therefore, not present an obstacle or barrier to bats, including Daubenton's, commuting or foraging over the river as there will be ample clearance beneath the structure to allow their free movement. Further the only bridge lighting is the proposed architectural up-lighting. This guarantees that light focuses on the bridge structure and not on the estuarine channel and adjoining habitats and will thus have no impact on bat commuting or foraging movements under the bridge.

Further possible impacts on bats relates to destruction of roosts in buildings / structures or mature trees. The leading light on the foreshore, which is currently operational, is the only structure present and it is possible that it may be used by Daubenton bats. This structure shall be left in situ alongside the bridge. The trees which are present within hedgerows along the route are primarily immature Ash and as such are unlikely to contain the required hollows or crevices which bat species utilise as roost sites. Despite this, all such trees shall be inspected and surveyed by a bat ecologist in the Spring prior to construction to ascertain usage by bats and, where required, any necessary derogation licence shall be requested from NPWS.

Further mitigation measures are recommended with respect to the maintenance of commuting routes. These are based on best practice and the NRA guidelines.

Provided that the recommended mitigation measures given within this report are adopted, it is considered that the impact on bats along the proposed link road route and new bridge will be neutral or imperceptible.

e) Amphibians, Reptiles and Other Fauna

The other fauna species which occur in the area will be affected by loss of habitat but all will continue to occur in the immediate area. Impacts may be considered as Neutral or Slight.

7.2.8 Mitigation Measures and Recommendations

a) Habitats

Shoreline Habitats

While the salt marsh at this site is of low quality and is not a qualifying habitat of Carlingford Shore SAC, salt marsh is an Annex I habitat and therefore care is required to minimise loss and disturbance.

At the commencement of construction, the area required for the works will be identified and marked (by robust fencing) so that incursions by machinery or storage of materials on adjoining areas does not happen.

If entry to the site is required over adjoining intact salt marsh, the salt marsh will be covered with appropriate matting to minimise damage to the surface vegetation.

In general, salt marsh habitats are sensitive to erosion, which can result in slippage and release of sediments to the estuarine waters. Monitoring is required during and after construction in order to establish that no negative impacts in this regard have occurred. If this is the case then some remedial measures would be needed, possibly in the form of bunding or vegetation re-establishment. The salt marsh beneath the footprint of the bridge foundations on the Louth side will be cut out in sods, stored, and later used, as necessary, to repair the disturbed edges of the remaining salt marsh habitat and to encourage salt marsh regeneration. Storage of the sods will be at a nearby location (at an appropriate tidal height) and with vegetation side up.

Hedgerows and Trees

It will be necessary to compensate for the loss of trees and hedgerows through the planting of substitutes. These will be of native shrubs and trees and preferably of those species which have been lost. The specimen oak recorded (see note 20, Table 1) is just outside of the land-take required and shall not be impacted. The following species are recommended for replacement planting:-

- Shrubs: hawthorn, broom, wild cherry, blackthorn
- Trees: sessile oak, rowan (mountain ash), whitebeam, ash, grey willow

(refer Chapter 8 for Landscape Planting detail)

b) Birds

Creation of New High Tide Roost

As the proposed scheme will affect regular roosting sites for wintering waterbirds in this part of the Carlingford system, it is best practice to provide an alternative high tide roost.

In order to encourage the speedy adoption by the waterbirds of the man-made alternative island, it is recommended that the "new" island has the following characteristics:-

- is located within sight of the existing roosts;
- is in relatively sheltered waters, to reduce wave erosion of the substrate and provide roosting birds with protection from strong winds;
- is approximately the same size as the combined existing island and spit;
- is cut off from the mainland shore at high tides (neaps and springs);
- is flat-topped with gently graded edges;
- is constructed with a base of stones and cobbles similar in size to those at the existing island, with a top layer which is silt planted/seeded with similar saltmarsh vegetation (if available removed turves of salt marsh vegetation may be used to assist with the establishment of salt marsh vegetation)..

Furthermore, the constructed island should not occupy intertidal substrates which are themselves of value as feeding areas for waterbirds or of ecological value from a habitats perspective.

Taking into account the above criteria, it is proposed to construct the new roost site on the shore immediately to the south-west of the small beacon (refer to **Figure 7.3**

in Volume 3), and at the landward side of the beacon. This intertidal area is stony, with a partial covering of fucoid seaweed, and was found in the 2008 and 2009 surveys to support few feeding waterbirds. Also, this part of the Newry River estuary is relatively sheltered and is close to and within sight of the existing roost sites. This location is such that the constructed island will be cut off from the mainland at high neap and spring tides.

The elevation of the constructed island should vary between 0.5 and 1.0m above mean high spring tides, so that the waterbirds are not forced to move elsewhere during very high tides. This is the situation present on the existing saltmarsh island – see Plate 7.2.4 & 7.2.5 below.

Plate 7.2.4: Existing saltmarsh island / roost site at high tide

Plate 7.2.5: Existing saltmarsh island / roost site at low tide (Further photos in Appendix 7.6)

To reduce wave and current erosion of the edges of the constructed island, it is recommended that larger stones/cobbles be placed around the perimeter, while smaller material can be used to fill the interior. The new man-made island will be constructed before bridge works commence (ideally one full winter beforehand), so that it is available as an alternative high tide roosting site as and when birds are disturbed from the existing roosting sites.

It is noted that artificial islands for roosting waterbirds have been constructed with success elsewhere in Ireland and the United Kingdom. Examples include:-

- Booterstown Marsh, Co. Dublin: two gravel islands are used by large numbers of waders (notably Black-tailed Godwit, Redshank, Knot and Dunlin, and also Greenshank, Little Egret and Grey Heron) as a high tide roost in autumn, winter and spring.
- Belfast Harbour, Co. Down: at the reserve of the Royal Society for the Protection of Birds, constructed islands are used by breeding terns in summer and by roosting waders during the rest of the year.

Disturbance During Construction

It is inevitable that some disturbance will be caused to birds during the construction period. It is considered that the nesting Grey Herons are the most sensitive species – to minimise the risk of significant disturbance to the herons and indeed the other breeding birds in Cillin Wood any necessary pile-driving operations will be carried out outside the early breeding season of the Grey Herons (March - May).

In order to minimise the disturbance of the overwintering waterbirds the construction of the northern and southern abutments, which will require direct access on to the foreshore, shall be completed outside of the main overwintering period.

Removal of Vegetation

To comply with the Wildlife Acts 1976 & 2000 (and the Wildlife (NI) Order 1985), clearance of vegetation in fields and hedgerows which would disturb breeding birds and destroy nests, eggs and chicks, will be carried out outside of the nesting season (1st March to 31st August).

Landscaping

Suitable native trees and shrubs shall be planted close to the link road to provide compensatory nesting, feeding and sheltering habitat for birds displaced by vegetation clearance. This planting shall be co-ordinated with the bat and landscaping mitigation measures.

Minimisation of Collision Risk

To reduce the risk to waterbirds (and other species) from collision with the bridge itself, and the towers, suspension cables and other fittings associated with the bridge, the entire structure will be lit at night (refer Chapter 3, Section 3.5.5) so that all elements of the structure are clearly visible to nocturnal flying birds. This will be provided in the form of architectural up-lighting which will be focused on the bridge structure and away from the river and adjoining areas of vegetation.

To minimise the potential collision risk to flying birds posed by the suspension cables during daylight, the cables will be light in colour (off-white) so that they are visible to flying birds.

Provision should be made to alter the lighting arrangements and/or add cable markers, should casualties be reported due to collisions.

c) Mammals

Mammal underpasses

Badgers typically follow the same pathways between setts, feeding areas and latrines. In most cases these pathways occur along features such as hedgerows, treelines, woodland edges and watercourses. To avoid unnecessary badger road casualties mammal underpasses will be constructed adjacent to regular crossing points on the proposed link road (refer **Figure 7.3** in Volume 3). Underpasses will be constructed in accordance with the NRA *Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes (2006)*

Badger/mammal fencing

Mammal resistant fencing will be required to guide badgers and other mammals to passage facilities and to prevent animals crossing the new link road. The specification for mammal resistant fencing is given in the NRA *Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes (*2006*)*. The location of the mammal resistant fencing required is shown on **Figure 7.3** in Volume 3. Fencing will be recessed and tied into culvert and mammal underpass locations to guide badgers and other mammals safely under the road and prevent them accessing the road carriageway.

Additional specific measures are not deemed required for otters.

d) Bats

The trees which are present within hedgerows along the route are primarily immature Ash and as such are unlikely to contain the required hollows or crevices which bat species utilise as roost sites. Despite this, all such trees shall be inspected and surveyed by a bat ecologist in the Spring prior to construction to ascertain usage by bats and, where required, any necessary derogation licence shall be requested from NPWS and the licence conditions adhered to.

Linear features such as hedgerows and tree lines serve as commuting corridors for bats and the severance of such features by a new road can prevent movement of these animals between roosts or between roosts and foraging areas. As the planned link road will present a barrier between any bats in the southeast and the large woodland in the northwest, which is an obvious foraging area, both road sides shall be planted with hedgerows/tree lines and woodland copses (refer Chapter 8 for Landscape Planting detail). One area of planting will be allowed to develop to a minimum height of 4m to act as a ‘fly-over’ to ensure that commuting bats can cross high over the road avoiding collisions with traffic (refer to Figure 7.3 and Plate 7.2.6 below).

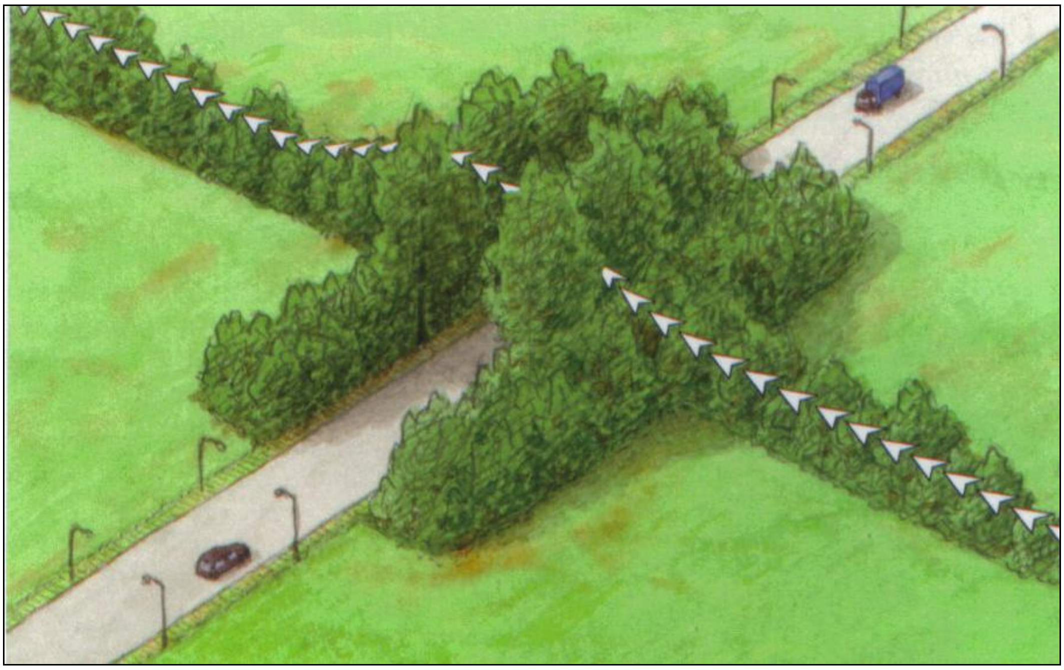

Plate 7.2.6 Example graphic of recommended bat fly-over on proposed link road

e) Monitoring

As the works will affect habitats and species that are within an area designated for nature conservation and/or are listed in the EU Habitats Directive, monitoring is required both during and after construction.

Construction Phase Monitoring

A project ecologist shall be appointed to oversee the works during construction. At the commencement of works, the ecologist shall walk the site with the Project Engineer to highlight the conservation issues and to discuss implementation of the mitigation measures contained within the EIS.

The ecologist will visit the site, as considered necessary, when works are in progress. The main purpose of this will be to ensure that adjoining habitats are not being affected by the works.

A site survey will be carried out by the ecologist when works are near completion. Attention will be given to adjoining salt marsh areas to check for disturbance etc. – if necessary, remedial measures will be undertaken at this stage.

A report should be prepared by the ecologist to record the state of the site after works are complete.

Operation Phase

Habitats

The project ecologist shall inspect the site twice a year for 3 years period to determine the success of the mitigation measures and direct additional planting and maintenance as required. This shall be included for in the construction contract. Particular attention shall be given to recovery of shoreline vegetation and establishment of new plantings (as required).

Birds

The success of the new roost site shall be monitored for 3 years following construction. This shall involve two high tide counts per year to coincide with the review of the success of planting measures. If necessary, adjustments will be made to the design/construction of the roost to ensure it is serving its purpose.

Any reports of bird strikes with the bridge structure should be followed up and if these are regular, then remedial measures will be necessary and will be directed by a qualified ornithologist.

Badgers

The success of the mitigation measures for badgers will be monitored for a period after construction, and measures taken to enhance use of underpasses where required. Quarterly monitoring will be carried out to determine the success of the measures employed. Monitoring shall be continued for two years after construction ceases, in accordance with the *NRA Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes*.

In order to ensure that the long term effectiveness of badger resistant fencing and underpasses, these will require periodic maintenance in accordance with the *NRA Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes.*

Liaison with Statutory Bodies

NPWS and NIEA will be notified when works are due to commence and shall be informed if any unexpected issues arise during the course of the works. An annual monitoring report will be issued to both bodies with respect to the success of the mitigation measures and any further actions taken.

7.2.9 Remedial Impacts

Despite the important conservation interests associated with the Narrow Water channel and the wider Carlingford Lough system, it is considered that the proposed bridge development would not have significant adverse ecological impacts providing the various mitigation measures and recommendations are implemented. In particular, the qualifying interests of the various Natura 2000 sites in Carlingford Lough will not be adversely affected.

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Five year summary for Carlingford Lough
Table1: Total Counts - All Species Combined.

Peak monthly total = maximum of the sum of the counts of all species within each month.
Seasonal peaks = sum of the maximum counts of all species within each season.

Year	Peak Monthly Total		Autumn Peak	Winter Peak	Spring Peak
01/02	8181	(JAN)	3476	9325	N/C
02/03	7189	(NOV)	5183	10115	1346
03/04	8286	(JAN)	4925	10130	N/C
04/05	7856	(DEC)	7015	10719	2688
05/06	7541	(JAN)	6339	9625	N/C
MEAN			5388	9983	2017

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For some species (e.g. wintering geese) data collected by other surveys may be more appropriate for the purpose of site assessment.
Missing or unexpectedly low counts for gulls and terns should be treated with caution - counting these groups is optional and determination of count effort not always possible.

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Table2: Five-year average monthly counts of each species.

Figure in parentheses give number of complete and incomplete counts upon which the average is based.
Incomplete counts are excluded from calculation where, if included, they would depress the mean.

Species	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mute Swan		0(3,.)	17(4,1)	21(4,1)	19(4,1)	26(4,1)	6(4,1)	4(4,1)	0(2,3)	0(2,.)		
Whooper Swan		0(3,.)	0(5,.)	0(4,1)	1(4,1)	0(3,2)	0(5,.)	0(5,.)	0(5,.)	0(2,.)		
Light-bellied Brent Goose (East Canadian high Arctic population)		0(3,.)	3(5,.)	132(4,1)	222(3,2)	325(3,2)	287(4,1)	346(4,1)	452(3,2)	327(2,.)		
Shelduck		11(3,.)	5(4,1)	22(4,1)	87(4,1)	224(4,1)	424(5,.)	386(4,1)	288(3,2)	169(1,1)		
Wigeon		0(3,.)	17(5,.)	196(5,.)	330(3,2)	303(3,2)	210(4,1)	194(4,1)	219(3,2)	5(2,.)		
Gadwall		0(3,.)	0(5,.)	0(5,.)	0(5,.)	0(5,.)	0(5,.)	0(4,1)	1(3,2)	0(2,.)		
Teal		0(3,.)	136(4,1)	306(4,1)	375(4,1)	401(4,1)	523(5,.)	476(4,1)	402(3,2)	286(1,1)		
Mallard		105(3,.)	91(5,.)	78(4,1)	91(3,2)	117(3,2)	110(4,1)	30(4,1)	17(3,2)	22(1,1)		
Pintail		0(3,.)	0(5,.)	0(5,.)	0(5,.)	0(5,.)	0(4,1)	1(4,1)	0(3,2)	0(2,.)		
Shoveler		0(3,.)	0(5,.)	0(5,.)	0(5,.)	0(3,2)	0(4,1)	0(4,1)	0(5,.)	0(2,.)		
Pochard		0(3,.)	0(5,.)	1(4,1)	0(3,2)	1(4,1)	1(4,1)	2(5,.)	0(4,1)	0(2,.)		
Scaup		0(3,.)	0(4,1)	0(5,.)	28(4,1)	189(5,.)	310(4,1)	100(5,.)	24(4,1)	0(1,1)		
Eider		0(3,.)	0(5,.)	1(5,.)	0(2,3)	0(5,.)	0(5,.)	0(5,.)	0(5,.)	0(2,.)		
Long-tailed Duck		0(3,.)	0(5,.)	0(5,.)	0(5,.)	0(5,.)	1(4,1)	1(5,.)	2(4,1)	0(2,.)		
Goldeneye		0(3,.)	0(5,.)	0(5,.)	28(4,1)	63(4,1)	70(4,1)	70(4,1)	34(3,2)	0(1,1)		
Red-breasted Merganser		126(3,.)	32(5,.)	22(4,1)	19(3,2)	23(4,1)	20(4,1)	18(4,1)	31(3,2)	30(1,1)		
Red-throated Diver		0(3,.)	0(5,.)	0(5,.)	4(3,2)	4(3,2)	6(4,1)	3(4,1)	4(4,1)	11(2,.)		
Great Northern Diver		0(3,.)	0(5,.)	0(5,.)	14(3,2)	1(4,1)	2(4,1)	1(5,.)	2(4,1)	0(2,.)		
Little Grebe		0(3,.)	0(5,.)	0(4,1)	1(3,2)	3(3,2)	2(4,1)	1(4,1)	0(4,1)	0(2,.)		
Great Crested Grebe		59(2,1)	99(5,.)	160(5,.)	198(4,1)	137(5,.)	137(4,1)	81(5,.)	139(4,1)	20(1,1)		
Cormorant		181(3,.)	169(5,.)	136(4,1)	98(3,2)	86(3,2)	99(4,1)	65(4,1)	52(2,3)	31(1,1)		
Shag		8(3,.)	27(5,.)	7(4,1)	30(3,2)	33(3,2)	90(4,1)	13(4,1)	17(3,2)	5(2,.)		
Unidentified Cormorant/Shag		0(3,.)	129(5,.)	203(4,1)	170(4,1)	106(3,2)	48(4,1)	54(4,1)	0(3,2)	20(2,.)		
Little Egret		2(3,.)	1(5,.)	0(4,1)	1(4,1)	2(3,2)	1(4,1)	2(4,1)	2(3,2)	2(2,.)		
Grey Heron		25(3,.)	27(4,1)	22(4,1)	12(3,2)	16(4,1)	22(4,1)	9(4,1)	5(3,2)	9(1,1)		
Moorhen		0(3,.)	0(5,.)	1(5,.)	0(4,1)	1(4,1)	0(5,.)	1(4,1)	0(5,.)	1(2,.)		
Oystercatcher		1105(2,1)	1301(5,.)	1298(4,1)	1188(2,3)	1187(4,1)	1148(4,1)	1039(4,1)	685(3,2)	369(1,1)		
Ringed Plover		153(2,1)	144(5,.)	270(4,1)	196(3,2)	143(3,2)	104(4,1)	102(4,1)	24(3,2)	23(1,1)		
Golden Plover		0(3,.)	41(5,.)	80(4,1)	128(3,2)	0(4,1)	127(4,1)	0(4,1)	0(4,1)	0(2,.)		
Grey Plover		0(3,.)	0(5,.)	9(4,1)	31(4,1)	30(3,2)	49(4,1)	47(4,1)	16(3,2)	1(2,.)		
Lapwing		35(3,.)	57(5,.)	110(4,1)	336(3,2)	475(3,2)	564(4,1)	207(4,1)	4(3,2)	0(2,.)		
Knot		10(3,.)	1(5,.)	4(5,.)	2(4,1)	10(4,1)	13(5,.)	30(5,.)	4(4,1)	0(2,.)		
Sanderling		0(3,.)	0(5,.)	0(5,.)	0(5,.)	0(5,.)	0(5,.)	0(5,.)	0(5,.)	1(2,.)		
Curlew Sandpiper		0(3,.)	0(5,.)	0(5,.)	0(5,.)	0(5,.)	0(5,.)	0(5,.)	0(5,.)	0(2,.)		
Dunlin		18(3,.)	14(5,.)	190(4,1)	1236(2,3)	1645(3,2)	1758(4,1)	1400(4,1)	888(3,2)	1(1,1)		
Jack Snipe		0(3,.)	0(5,.)	0(4,1)	0(3,2)	0(3,2)	0(5,.)	0(5,.)	0(5,.)	0(2,.)		
Snipe		0(3,.)	0(4,1)	0(4,1)	4(3,2)	4(3,2)	1(4,1)	0(4,1)	0(5,.)	0(2,.)		
Black-tailed Godwit		36(3,.)	29(5,.)	32(4,1)	22(4,1)	14(4,1)	3(5,.)	3(4,1)	15(4,1)	2(1,1)		

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Table2: Five-year average monthly counts of each species.

Figure in parentheses give number of complete and incomplete counts upon which the average is based.
Incomplete counts are excluded from calculation where, if included, they would depress the mean.

Species	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Bar-tailed Godwit		19(3,.)	8(5,.)	29(4,1)	4(3,2)	37(3,2)	62(4,1)	64(4,1)	26(3,2)	31(2,.)		
Whimbrel		4(3,.)	1(4,1)	1(4,1)	0(4,1)	0(5,.)	0(4,1)	0(5,.)	0(3,2)	5(2,.)		
Curlew		487(3,.)	500(5,.)	576(4,1)	455(3,2)	353(3,2)	430(4,1)	560(4,1)	492(2,3)	66(2,.)		
Common Sandpiper		6(3,.)	2(4,1)	0(4,1)	0(4,1)	0(4,1)	0(5,.)	0(4,1)	0(5,.)	0(2,.)		
Greenshank		15(3,.)	24(5,.)	22(5,.)	18(4,1)	12(4,1)	15(4,1)	18(4,1)	12(4,1)	1(1,1)		
Redshank		484(3,.)	930(4,1)	1121(4,1)	1210(4,1)	1204(4,1)	1045(5,.)	931(4,1)	955(3,2)	745(1,1)		
Turnstone		169(2,1)	207(5,.)	225(5,.)	207(3,2)	134(4,1)	161(4,1)	212(4,1)	288(4,1)	368(1,1)		
Black-headed Gull			5(1,.)			0(2,.)				3(1,.)		
Common Gull			114(1,.)			0(2,.)				0(1,.)		
Herring Gull			6(1,.)			0(2,.)				1(1,.)		
Great Black-backed Gull			93(1,.)			84(2,.)				109(1,.)		
Sandwich Tern			43(1,1)	0(.,1)	0(1,.)	0(1,.)	0(1,.)	0(1,.)	1(.,2)	121(1,.)		
Common Tern			0(2,.)	0(1,.)	0(1,.)	0(1,.)	0(1,.)	0(1,.)	0(2,.)	2(1,.)		
Kingfisher		0(3,.)	0(5,.)	0(5,.)	0(5,.)	0(4,1)	0(5,.)	0(4,1)	0(5,.)	0(2,.)		

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Table3: Five-year peak monthly counts of each species.

Species	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mute Swan		1	26	37	41	50	17	13	0	0		
Whooper Swan		0	0	0	2	0	0	0	0	0		
Light-bellied Brent Goose (East Canadian high Arctic population)		1	10	273	389	470	408	472	570	538		
Shelduck		21	10	63	166	268	560	493	359	169		
Wigeon		0	24	358	534	441	292	285	286	8		
Gadwall		0	0	0	0	0	0	0	2	0		
Teal		0	195	443	647	529	710	708	457	286		
Mallard		168	139	102	94	149	180	39	27	22		
Pintail		0	0	0	0	0	0	2	0	0		
Shoveler		0	0	0	0	0	1	0	0	0		
Pochard		0	0	4	0	2	3	9	0	0		
Scaup		0	2	1	51	428	618	163	53	0		
Eider		1	1	3	0	0	0	0	2	0		
Long-tailed Duck		0	0	0	0	2	4	3	6	0		
Goldeneye		0	0	1	49	73	102	103	52	0		
Red-breasted Merganser		154	75	52	32	34	43	24	62	30		
Red-throated Diver		0	0	0	6	6	15	8	10	19		
Great Northern Diver		0	0	0	25	3	2	3	8	0		
Little Grebe		0	0	1	3	6	5	2	0	0		
Great Crested Grebe		69	137	196	284	246	177	166	215	20		
Cormorant		221	238	169	137	100	196	92	74	31		
Shag		23	48	15	60	42	294	42	37	6		
Unidentified Cormorant/Shag		0	292	300	350	136	160	127	0	40		
Little Egret		4	2	0	3	5	3	5	4	3		
Grey Heron		32	41	33	22	24	40	12	7	9		
Moorhen		0	1	3	1	3	1	1	0	1		
Oystercatcher		1215	1489	1525	1246	1410	1442	1285	765	369		
Ringed Plover		170	167	467	247	223	189	139	28	34		
Golden Plover		0	125	147	346	1	505	0	0	0		
Grey Plover		0	0	28	50	33	61	100	21	1		
Lapwing		57	115	168	470	563	801	458	12	0		
Knot		30	3	19	8	25	65	140	10	0		
Sanderling		0	0	0	0	0	0	0	0	2		
Curlew Sandpiper		0	1	0	0	0	0	0	0	0		
Dunlin		25	31	552	2872	1805	2339	1801	1282	1		
Jack Snipe		0	0	0	1	0	0	0	0	0		
Snipe		0	1	1	9	7	2	0	0	0		
Black-tailed Godwit		100	79	63	56	55	10	6	27	2		
Bar-tailed Godwit		33	15	40	15	51	117	92	40	62		
Whimbrel		6	1	4	0	0	0	1	0	9		

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Table3: Five-year peak monthly counts of each species.

Species	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Curlew		614	643	631	577	461	647	684	732	105		
Common Sandpiper		11	4	0	1	0	1	1	0	0		
Greenshank		24	39	26	23	21	22	23	19	1		
Redshank		634	1213	1554	1525	1488	1272	1114	1266	745		
Turnstone		250	356	302	275	193	247	325	624	368		
Black-headed Gull			5			0				3		
Common Gull			114			0				0		
Herring Gull			6			0				1		
Great Black-backed Gull			93			120				109		
Sandwich Tern			43	0	0	0	0	0	2	121		
Common Tern			0	0	0	0	0	0	0	2		
Kingfisher		1	0	0	0	0	1	0	0	0		

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Table4a: Five-year autumn peak counts, and month in which this was recorded, of each species.

Where a count is enclosed by parentheses this indicates that it was considered incomplete i.e. those parts of the site not visited typically holds at least 25% of the species in question. Incomplete counts are excluded from calculation where, if included, they would depress the mean. When all counts are considered to be incomplete the maximum replaces the mean.

Species	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006	Mean Peak
Mute Swan	(2) (SEP)	37 (OCT)	31 (OCT)	17 (SEP)	5 (OCT)	23
Light-bellied Brent Goose (East Canadian high Arctic population)	(22) (OCT)	9 (OCT)	24 (OCT)	223 (OCT)	273 (OCT)	132
Shelduck	(0)	10 (SEP)	7 (SEP)	63 (OCT)	13 (OCT)	23
Wigeon	117 (OCT)	182 (OCT)	85 (OCT)	358 (OCT)	240 (OCT)	196
Teal	(10) (OCT)	247 (OCT)	207 (OCT)	328 (OCT)	443 (OCT)	306
Mallard	(71) (OCT)	168 (AUG)	139 (SEP)	92 (SEP)	102 (OCT)	125
Pochard	(3) (OCT)	0	4 (OCT)	0	0	1
Scaup	(2) (SEP)	1 (OCT)	0	0	0	1
Eider	0	1 (AUG)	0	0	3 (OCT)	1
Goldeneye	0	0	0	1 (OCT)	1 (OCT)	0
Red-breasted Merganser	24 (SEP)	106 (AUG)	40 (SEP)	154 (AUG)	118 (AUG)	88
Little Grebe	0	1 (OCT)	0	0	0	0
Great Crested Grebe	168 (OCT)	152 (OCT)	184 (OCT)	196 (OCT)	137 (SEP)	167
Cormorant	208 (SEP)	206 (AUG)	154 (OCT)	221 (AUG)	238 (SEP)	205
Shag	41 (SEP)	48 (SEP)	8 (OCT)	15 (OCT)	44 (SEP)	31
Unidentified Cormorant/Shag	(130) (OCT)	131 (OCT)	234 (OCT)	300 (OCT)	292 (SEP)	239
Little Egret	0	0	0	4 (AUG)	1 (AUG)	1
Grey Heron	(16) (OCT)	20 (OCT)	23 (SEP)	30 (SEP)	41 (SEP)	29
Moorhen	0	1 (OCT)	0	3 (OCT)	1 (SEP)	1
Oystercatcher	(1170) (OCT)	1489 (SEP)	1525 (OCT)	1419 (SEP)	1342 (SEP)	1444
Ringed Plover	(305) (OCT)	467 (OCT)	165 (SEP)	251 (OCT)	180 (OCT)	274
Golden Plover	(5) (OCT)	81 (OCT)	125 (SEP)	147 (OCT)	72 (SEP)	106
Grey Plover	(1) (OCT)	0	2 (OCT)	28 (OCT)	5 (OCT)	9
Lapwing	(36) (OCT)	78 (OCT)	127 (OCT)	115 (SEP)	168 (OCT)	122
Knot	0	1 (SEP)	0	0	30 (AUG)	6
Curlew Sandpiper	0	0	0	1 (SEP)	0	0
Dunlin	(37) (OCT)	90 (OCT)	14 (SEP)	552 (OCT)	107 (OCT)	191
Snipe	(0)	0	1 (SEP)	1 (OCT)	0	1
Black-tailed Godwit	0	0	63 (OCT)	100 (AUG)	16 (OCT)	36
Bar-tailed Godwit	7 (SEP)	33 (AUG)	31 (OCT)	15 (AUG)	40 (OCT)	25
Whimbrel	(0)	6 (AUG)	1 (SEP)	4 (OCT)	3 (AUG)	4
Curlew	(430) (OCT)	631 (OCT)	643 (SEP)	614 (AUG)	463 (AUG)	588
Common Sandpiper	(0)	4 (AUG)	2 (SEP)	4 (AUG)	11 (AUG)	5
Greenshank	18 (OCT)	24 (OCT)	34 (SEP)	26 (OCT)	39 (SEP)	28
Redshank	(266) (SEP)	753 (OCT)	812 (SEP)	1471 (OCT)	1554 (OCT)	1148
Turnstone	126 (OCT)	206 (OCT)	230 (OCT)	262 (OCT)	356 (SEP)	236

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Missing or unexpectedly low counts for gulls and terns should be treated with caution - counting these groups is optional and determination of count effort not always possible.*

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Table4a: Five-year autumn peak counts, and month in which this was recorded, of each species.

Where a count is enclosed by parentheses this indicates that it was considered incomplete i.e. those parts of the site not visited typically holds at least 25% of the species in question. Incomplete counts are excluded from calculation where, if included, they would depress the mean. When all counts are considered to be incomplete the maximum replaces the mean.

Species	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006	Mean Peak
Black-headed Gull	5 (SEP)	N/C	N/C	N/C	N/C	5
Common Gull	114 (SEP)	N/C	N/C	N/C	N/C	114
Herring Gull	6 (SEP)	N/C	N/C	N/C	N/C	6
Great Black-backed Gull	93 (SEP)	N/C	N/C	N/C	N/C	93
Sandwich Tern	43 (SEP)	N/C	(10) (SEP)	N/C	N/C	43
Kingfisher	0	0	0	0	1 (AUG)	0

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Table4b: Five-year winter peak counts, and month in which this was recorded, of each species.

Where a count is enclosed by parentheses this indicates that it was considered incomplete i.e. those parts of the site not visited typically holds at least 25% of the species in question. Incomplete counts are excluded from calculation where, if included, they would depress the mean. When all counts are considered to be incomplete the maximum replaces the mean.

Species	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006	Mean Peak
Mute Swan	16 (NOV)	(36) (NOV)	50 (DEC)	2 (DEC)	25 (DEC)	26
Whooper Swan	(0)	0	0	2 (NOV)	0	1
Light-bellied Brent Goose (East Canadian high Arctic population)	(259) (FEB)	319 (MAR)	(570) (MAR)	470 (DEC)	508 (MAR)	467
Shelduck	(365) (FEB)	493 (FEB)	423 (JAN)	452 (JAN)	560 (JAN)	482
Wigeon	235 (JAN)	292 (JAN)	534 (NOV)	350 (DEC)	215 (MAR)	325
Gadwall	0	0	0	0	2 (MAR)	0
Teal	450 (JAN)	352 (JAN)	498 (JAN)	647 (NOV)	710 (JAN)	531
Mallard	71 (JAN)	180 (JAN)	(149) (DEC)	107 (JAN)	89 (NOV)	119
Pintail	0	0	0	0	2 (FEB)	0
Shoveler	0	0	0	1 (JAN)	0	0
Pochard	0	9 (FEB)	2 (DEC)	3 (JAN)	1 (DEC)	3
Scaup	618 (JAN)	168 (JAN)	(158) (JAN)	233 (JAN)	222 (JAN)	310
Eider	(0)	(0)	(0)	0	2 (MAR)	1
Long-tailed Duck	2 (DEC)	6 (MAR)	0	1 (FEB)	4 (JAN)	3
Goldeneye	(68) (DEC)	103 (FEB)	68 (DEC)	102 (JAN)	78 (JAN)	88
Red-breasted Merganser	(21) (FEB)	19 (JAN)	(32) (NOV)	28 (DEC)	62 (MAR)	36
Red-throated Diver	5 (JAN)	8 (FEB)	(4) (DEC)	4 (DEC)	15 (JAN)	8
Great Northern Diver	3 (FEB)	(15) (NOV)	25 (NOV)	2 (JAN)	17 (NOV)	12
Little Grebe	(6) (DEC)	(3) (NOV)	2 (FEB)	3 (DEC)	3 (DEC)	3
Great Crested Grebe	284 (NOV)	174 (JAN)	172 (MAR)	232 (NOV)	246 (DEC)	222
Cormorant	196 (JAN)	(137) (NOV)	(82) (DEC)	126 (NOV)	100 (DEC)	141
Shag	294 (JAN)	30 (DEC)	(37) (MAR)	60 (NOV)	55 (JAN)	110
Unidentified Cormorant/Shag	(170) (NOV)	160 (JAN)	133 (NOV)	350 (NOV)	128 (NOV)	193
Little Egret	(0)	0	0	3 (NOV)	5 (DEC)	2
Grey Heron	(15) (DEC)	12 (JAN)	(23) (JAN)	22 (NOV)	40 (JAN)	25
Moorhen	0	1 (JAN)	0	1 (FEB)	3 (DEC)	1
Oystercatcher	(986) (NOV)	1289 (DEC)	(1414) (JAN)	1410 (DEC)	1442 (JAN)	1389
Ringed Plover	(203) (NOV)	(240) (NOV)	161 (NOV)	223 (DEC)	247 (NOV)	218
Golden Plover	1 (JAN)	505 (JAN)	346 (NOV)	8 (NOV)	30 (NOV)	178
Grey Plover	45 (JAN)	52 (JAN)	(57) (JAN)	33 (DEC)	100 (FEB)	58
Lapwing	801 (JAN)	(470) (NOV)	(785) (JAN)	563 (DEC)	789 (JAN)	735
Knot	9 (FEB)	(0)	2 (DEC)	65 (JAN)	140 (FEB)	54
Dunlin	2090 (JAN)	(2872) (NOV)	(2339) (JAN)	2238 (JAN)	1573 (DEC)	2222
Jack Snipe	(0)	(1) (NOV)	0	0	1 (NOV)	1
Snipe	(0)	(2) (NOV)	(7) (DEC)	3 (DEC)	9 (NOV)	6
Black-tailed Godwit	(10) (DEC)	1 (FEB)	55 (DEC)	56 (NOV)	15 (MAR)	32

Table4b: Five-year winter peak counts, and month in which this was recorded, of each species.

Where a count is enclosed by parentheses this indicates that it was considered incomplete i.e. those parts of the site not visited typically holds at least 25% of the species in question. Incomplete counts are excluded from calculation where, if included, they would depress the mean. When all counts are considered to be incomplete the maximum replaces the mean.

Species	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006	Mean Peak
Bar-tailed Godwit	117 (JAN)	89 (FEB)	92 (FEB)	98 (JAN)	35 (FEB)	86
Whimbrel	0	(0)	0	0	1 (FEB)	0
Curlew	(301) (NOV)	647 (JAN)	684 (FEB)	732 (MAR)	576 (FEB)	660
Common Sandpiper	1 (NOV)	1 (JAN)	0	0	0	0
Greenshank	18 (NOV)	14 (FEB)	16 (FEB)	21 (DEC)	23 (NOV)	18
Redshank	1525 (NOV)	1211 (DEC)	1027 (NOV)	1324 (NOV)	1197 (DEC)	1257
Turnstone	140 (NOV)	157 (JAN)	181 (FEB)	624 (MAR)	354 (MAR)	291
Great Black-backed Gull	N/C	47 (DEC)	N/C	120 (DEC)	N/C	84
Sandwich Tern	0	N/C	(2) (MAR)	N/C	N/C	1
Kingfisher	0	0	0	0	1 (JAN)	0

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Table4c: Five-year spring peak counts, and month in which this was recorded, of each species.

Where a count is enclosed by parentheses this indicates that it was considered incomplete i.e. those parts of the site not visited typically holds at least 25% of the species in question. Incomplete counts are excluded from calculation where, if included, they would depress the mean. When all counts are considered to be incomplete the maximum replaces the mean.

Species	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006	Mean Peak
Light-bellied Brent Goose (East Canadian high Arctic population)	N/C	115 (APR)	N/C	538 (APR)	N/C	327
Shelduck	N/C	(27) (APR)	N/C	169 (APR)	N/C	169
Wigeon	N/C	1 (APR)	N/C	8 (APR)	N/C	5
Teal	N/C	(12) (APR)	N/C	286 (APR)	N/C	286
Mallard	N/C	(4) (APR)	N/C	22 (APR)	N/C	22
Red-breasted Merganser	N/C	(15) (APR)	N/C	30 (APR)	N/C	30
Red-throated Diver	N/C	19 (APR)	N/C	2 (APR)	N/C	11
Great Crested Grebe	N/C	(1) (APR)	N/C	20 (APR)	N/C	20
Cormorant	N/C	(16) (APR)	N/C	31 (APR)	N/C	31
Shag	N/C	4 (APR)	N/C	6 (APR)	N/C	5
Unidentified Cormorant/Shag	N/C	0	N/C	40 (APR)	N/C	20
Little Egret	N/C	0	N/C	3 (APR)	N/C	2
Grey Heron	N/C	(0)	N/C	9 (APR)	N/C	9
Moorhen	N/C	0	N/C	1 (APR)	N/C	1
Oystercatcher	N/C	(355) (APR)	N/C	369 (APR)	N/C	369
Ringed Plover	N/C	(34) (APR)	N/C	11 (APR)	N/C	23
Grey Plover	N/C	1 (APR)	N/C	0	N/C	1
Sanderling	N/C	2 (APR)	N/C	0	N/C	1
Dunlin	N/C	(0)	N/C	1 (APR)	N/C	1
Black-tailed Godwit	N/C	(0)	N/C	2 (APR)	N/C	2
Bar-tailed Godwit	N/C	62 (APR)	N/C	0	N/C	31
Whimbrel	N/C	9 (APR)	N/C	0	N/C	5
Curlew	N/C	105 (APR)	N/C	26 (APR)	N/C	66
Greenshank	N/C	(0)	N/C	1 (APR)	N/C	1
Redshank	N/C	(168) (APR)	N/C	745 (APR)	N/C	745
Turnstone	N/C	(160) (APR)	N/C	368 (APR)	N/C	368
Black-headed Gull	N/C	3 (APR)	N/C	N/C	N/C	3
Herring Gull	N/C	1 (APR)	N/C	N/C	N/C	1
Great Black-backed Gull	N/C	109 (APR)	N/C	N/C	N/C	109
Sandwich Tern	N/C	121 (APR)	N/C	N/C	N/C	121
Common Tern	N/C	2 (APR)	N/C	N/C	N/C	2

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Table5: National and International importance of the site for each species.

Figures given indicate the percentage of the relevant qualifying level represented by the five year mean peak count for the species in question e.g. 50% indicates that the five year mean peak count is half that required for the site to qualify as nationally or internationally important as appropriate for the species in question. Where a count is enclosed by parentheses this indicates that it was considered incomplete i.e. those parts of the site not visited typically holds at least 25% of the species in question. Asterisks indicate that the percentage presented has been derived using a value of 1% of the national population that is less than 50 (50 is normally used as a minimum threshold for designation of sites).

Species	Autumn cf National Threshold	Winter cf National Threshold	Spring cf National Threshold	Autumn cf International Threshold	Winter cf International Threshold	Spring cf International Threshold	Autumn 5yr mean of peaks	Winter 5yr mean of peaks	Spring 5yr mean of peaks
Mute Swan	23%	26%	0%	23%	26%	0%	23	26	0
Whooper Swan	0%	1%	0%	0%	0%	0%	0	1	0
Light-bellied Brent Goose (East Canadian high Arctic population)	66%	234%	164%	51%	180%	126%	132	467	327
Shelduck	33%	689%	241%	1%	16%	6%	23	482	169
Wigeon	16%	26%	0%	1%	2%	0%	196	325	5
Teal	47%	82%	44%	6%	11%	6%	306	531	286
Mallard	25%	24%	4%	1%	1%	0%	125	119	22
Pochard	0%	1%	0%	0%	0%	0%	1	3	0
Scaup	*3%	*1033%	*0%	0%	10%	0%	1	310	0
Eider	*5%	*5%	*0%	0%	0%	0%	1	1	0
Long-tailed Duck	N/A	N/A	N/A	0%	0%	0%	0	3	0
Goldeneye	0%	80%	0%	0%	1%	0%	0	88	0
Red-breasted Merganser	*440%	*180%	*150%	5%	2%	2%	88	36	30
Red-throated Diver	*0%	*80%	*110%	0%	0%	0%	0	8	11
Great Northern Diver	N/A	N/A	N/A	0%	24%	0%	0	12	0
Little Grebe	N/A	N/A	N/A	0%	0%	0%	0	3	0
Great Crested Grebe	*557%	*740%	*67%	5%	6%	1%	167	222	20
Cormorant	N/A	N/A	N/A	17%	12%	3%	205	141	31
Shag	N/A	N/A	N/A	2%	6%	0%	31	110	5
Unidentified Cormorant/Shag	N/A	N/A	N/A	N/A	N/A	N/A	239	193	20
Little Egret	N/A	N/A	N/A	0%	0%	0%	1	2	2
Grey Heron	N/A	N/A	N/A	1%	1%	0%	29	25	9
Moorhen	N/A	N/A	N/A	0%	0%	0%	1	1	1
Oystercatcher	289%	278%	74%	14%	14%	4%	1444	1389	369
Ringed Plover	219%	174%	18%	38%	30%	3%	274	218	23
Golden Plover	5%	9%	0%	1%	2%	0%	106	178	0
Grey Plover	*23%	*145%	*3%	0%	2%	0%	9	58	1
Lapwing	5%	29%	0%	1%	4%	0%	122	735	0
Knot	2%	14%	0%	0%	1%	0%	6	54	0
Sanderling	*0%	*0%	*3%	0%	0%	0%	0	0	1
Dunlin	15%	178%	0%	1%	17%	0%	191	2222	1
Jack Snipe	0%	0%	0%	N/A	N/A	N/A	0	1	0

Table5: National and International importance of the site for each species.

Figures given indicate the percentage of the relevant qualifying level represented by the five year mean peak count for the species in question e.g. 50% indicates that the five year mean peak count is half that required for the site to qualify as nationally or internationally important as appropriate for the species in question. Where a count is enclosed by parentheses this indicates that it was considered incomplete i.e. those parts of the site not visited typically holds at least 25% of the species in question. Asterisks indicate that the percentage presented has been derived using a value of 1% of the national population that is less than 50 (50 is normally used as a minimum threshold for designation of sites).

Species	Autumn cf National Threshold	Winter cf National Threshold	Spring cf National Threshold	Autumn cf International Threshold	Winter cf International Threshold	Spring cf International Threshold	Autumn 5yr mean of peaks	Winter 5yr mean of peaks	Spring 5yr mean of peaks
Snipe	N/A	N/A	N/A	0%	0%	0%	1	6	0
Black-tailed Godwit	40%	36%	2%	8%	7%	0%	36	32	2
Bar-tailed Godwit	14%	49%	18%	2%	7%	3%	25	86	31
Whimbrel	N/A	N/A	N/A	0%	0%	0%	4	0	5
Curlew	67%	75%	8%	7%	8%	1%	588	660	66
Common Sandpiper	N/A	N/A	N/A	0%	0%	0%	5	0	0
Greenshank	*311%	*200%	*11%	1%	1%	0%	28	18	1
Redshank	469%	513%	304%	41%	45%	27%	1148	1257	745
Turnstone	105%	129%	164%	16%	19%	25%	236	291	368
Black-headed Gull	N/A	N/A	N/A	0%	0%	0%	5	0	3
Common Gull	N/A	N/A	N/A	1%	0%	0%	114	0	0
Herring Gull	N/A	N/A	N/A	0%	0%	0%	6	0	1
Great Black-backed Gull	N/A	N/A	N/A	2%	2%	2%	93	84	109
Sandwich Tern	N/A	N/A	N/A	3%	0%	7%	43	1	121
Common Tern	N/A	N/A	N/A	0%	0%	0%	0	0	2

Five year summary for Warren Point to Newry

Table1: Total Counts - All Species Combined.

Peak monthly total = maximum of the sum of the counts of all species within each month.
Seasonal peaks = sum of the maximum counts of all species within each season.

Year	Peak Monthly Total		Autumn Peak	Winter Peak	Spring Peak
01/02	3509	(DEC)	N/C	4108	N/C
02/03	1715	(JAN)	1079	2069	N/C
03/04	1696	(JAN)	1004	2212	N/C
04/05	2054	(JAN)	1703	2417	1170
05/06	2059	(JAN)	2042	3166	N/C
MEAN			1457	2794	1170

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Table2: Five-year average monthly counts of each species.

Figure in parentheses give number of complete and incomplete counts upon which the average is based.
Incomplete counts are excluded from calculation where, if included, they would depress the mean.

Species	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mute Swan		0(3,.)	17(4,.)	21(4,.)	19(4,1)	24(4,1)	4(5,.)	4(4,1)	0(3,.)	0(1,.)		
Light-bellied Brent Goose (East Canadian high Arctic population)		0(3,.)	0(4,.)	0(4,.)	0(4,1)	10(4,1)	8(5,.)	6(4,1)	7(3,.)	41(1,.)		
Shelduck		11(3,.)	4(4,.)	20(4,.)	78(4,1)	214(4,1)	394(5,.)	338(4,1)	205(3,.)	111(1,.)		
Teal		0(3,.)	134(4,.)	301(4,.)	351(4,1)	380(4,1)	501(5,.)	465(4,1)	396(3,.)	286(1,.)		
Mallard		7(3,.)	32(4,.)	17(4,.)	15(4,1)	11(4,1)	14(5,.)	9(4,1)	3(3,.)	6(1,.)		
Scaup		0(3,.)	0(4,.)	0(4,.)	0(4,1)	1(4,1)	0(5,.)	0(5,.)	0(3,.)	0(1,.)		
Goldeneye		0(3,.)	0(4,.)	0(4,.)	0(4,1)	0(4,1)	0(5,.)	0(4,1)	0(3,.)	0(1,.)		
Red-breasted Merganser		0(3,.)	0(4,.)	0(4,.)	0(4,1)	0(4,1)	0(5,.)	1(4,1)	0(3,.)	0(1,.)		
Great Crested Grebe		0(3,.)	0(4,.)	0(4,.)	1(4,1)	2(4,1)	2(5,.)	1(4,1)	0(3,.)	0(1,.)		
Cormorant		26(3,.)	39(4,.)	35(4,.)	39(4,1)	33(4,1)	26(5,.)	28(4,1)	22(3,.)	14(1,.)		
Grey Heron		10(3,.)	11(4,.)	8(4,.)	7(4,1)	7(4,1)	11(5,.)	6(4,1)	3(3,.)	7(1,.)		
Moorhen		0(3,.)	0(4,.)	1(4,.)	0(4,1)	1(4,1)	0(5,.)	1(4,1)	0(3,.)	1(1,.)		
Oystercatcher		57(3,.)	93(4,.)	88(4,.)	64(4,1)	23(4,1)	62(5,.)	44(4,1)	80(3,.)	74(1,.)		
Lapwing		2(3,.)	3(4,.)	4(4,.)	54(4,1)	41(4,1)	39(5,.)	7(4,1)	0(3,.)	0(1,.)		
Curlew Sandpiper		0(3,.)	0(4,.)	0(4,.)	0(5,.)	0(5,.)	0(5,.)	0(5,.)	0(3,.)	0(1,.)		
Dunlin		5(3,.)	0(4,.)	0(4,.)	0(4,1)	308(4,1)	20(5,.)	26(4,1)	177(3,.)	0(1,.)		
Snipe		0(3,.)	0(4,.)	0(4,.)	0(4,1)	0(5,.)	0(5,.)	0(5,.)	0(3,.)	0(1,.)		
Black-tailed Godwit		36(3,.)	37(4,.)	32(4,.)	22(4,1)	14(4,1)	3(5,.)	3(4,1)	20(3,.)	1(1,.)		
Bar-tailed Godwit		0(3,.)	0(4,.)	3(4,.)	0(4,1)	0(4,1)	3(5,.)	0(4,1)	0(3,.)	0(1,.)		
Whimbrel		3(3,.)	1(4,.)	0(4,.)	0(5,.)	0(5,.)	0(5,.)	0(5,.)	0(3,.)	0(1,.)		
Curlew		129(3,.)	107(4,.)	141(4,.)	93(4,1)	74(4,1)	112(5,.)	87(4,1)	61(3,.)	14(1,.)		
Common Sandpiper		4(3,.)	2(4,.)	0(4,.)	0(4,1)	0(4,1)	0(5,.)	0(4,1)	0(3,.)	0(1,.)		
Greenshank		0(3,.)	1(4,.)	0(4,.)	0(4,1)	0(4,1)	0(5,.)	1(4,1)	0(3,.)	0(1,.)		
Redshank		253(3,.)	490(4,.)	668(4,.)	891(4,1)	947(4,1)	740(5,.)	577(4,1)	536(3,.)	610(1,.)		
Turnstone		0(3,.)	0(4,.)	1(4,.)	2(4,1)	1(4,1)	0(5,.)	1(4,1)	1(3,.)	5(1,.)		
Kingfisher		0(3,.)	0(4,.)	0(4,.)	0(5,.)	0(4,1)	0(5,.)	0(4,1)	0(3,.)	0(1,.)		

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Table3: Five-year peak monthly counts of each species.

Species	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mute Swan		1	26	37	41	50	17	13	0	0		
Light-bellied Brent Goose (East Canadian high Arctic population)		0	0	0	0	22	22	14	20	41		
Shelduck		21	10	63	137	256	533	431	267	111		
Teal		0	195	437	614	520	687	698	457	286		
Mallard		15	43	36	31	16	21	12	5	6		
Scaup		0	0	1	0	2	0	0	0	0		
Goldeneye		0	0	0	0	1	0	0	0	0		
Red-breasted Merganser		0	0	0	0	0	1	2	0	0		
Great Crested Grebe		0	0	0	3	2	3	2	1	0		
Cormorant		39	59	45	53	45	49	47	42	14		
Grey Heron		15	13	15	20	14	18	9	4	7		
Moorhen		0	1	3	1	3	1	1	0	1		
Oystercatcher		102	115	108	81	64	107	68	121	74		
Lapwing		7	12	16	91	70	90	23	1	0		
Curlew Sandpiper		0	1	0	0	0	0	0	0	0		
Dunlin		15	0	0	0	1500	100	100	500	0		
Snipe		0	0	1	0	0	0	0	0	0		
Black-tailed Godwit		100	79	63	56	55	10	6	27	1		
Bar-tailed Godwit		0	0	10	0	0	15	0	0	0		
Whimbrel		6	1	0	0	0	0	0	0	0		
Curlew		142	143	201	116	188	200	106	89	14		
Common Sandpiper		6	4	0	1	0	1	1	0	0		
Greenshank		0	1	0	0	0	1	2	0	0		
Redshank		364	653	1118	1120	1368	1200	1063	689	610		
Turnstone		0	1	2	4	2	2	2	2	5		
Kingfisher		1	0	0	0	0	1	0	0	0		

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Table4a: Five-year autumn peak counts, and month in which this was recorded, of each species.

Where a count is enclosed by parentheses this indicates that it was considered incomplete i.e. those parts of the site not visited typically holds at least 25% of the species in question. Incomplete counts are excluded from calculation where, if included, they would depress the mean. When all counts are considered to be incomplete the maximum replaces the mean.

Species	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006	Mean Peak
Mute Swan	N/C	37 (OCT)	31 (OCT)	17 (SEP)	5 (OCT)	23
Shelduck	N/C	10 (SEP)	4 (SEP)	63 (OCT)	11 (AUG)	22
Teal	N/C	247 (OCT)	207 (OCT)	313 (OCT)	437 (OCT)	301
Mallard	N/C	43 (SEP)	33 (SEP)	20 (SEP)	36 (OCT)	33
Scaup	N/C	1 (OCT)	0	0	0	0
Cormorant	N/C	37 (OCT)	38 (SEP)	37 (AUG)	59 (SEP)	43
Grey Heron	N/C	10 (SEP)	12 (SEP)	13 (AUG)	15 (AUG)	13
Moorhen	N/C	1 (OCT)	0	3 (OCT)	1 (SEP)	1
Oystercatcher	N/C	104 (SEP)	113 (SEP)	108 (OCT)	115 (SEP)	110
Lapwing	N/C	1 (OCT)	16 (OCT)	12 (SEP)	1 (SEP)	8
Curlew Sandpiper	N/C	0	0	1 (SEP)	0	0
Dunlin	N/C	0	0	0	15 (AUG)	4
Snipe	N/C	0	0	1 (OCT)	0	0
Black-tailed Godwit	N/C	0	63 (OCT)	100 (AUG)	16 (OCT)	45
Bar-tailed Godwit	N/C	0	10 (OCT)	0	0	3
Whimbrel	N/C	6 (AUG)	0	2 (AUG)	2 (AUG)	3
Curlew	N/C	180 (OCT)	143 (SEP)	142 (AUG)	201 (OCT)	167
Common Sandpiper	N/C	4 (SEP)	1 (SEP)	3 (AUG)	6 (AUG)	4
Greenshank	N/C	1 (SEP)	1 (SEP)	1 (SEP)	1 (SEP)	1
Redshank	N/C	397 (OCT)	332 (SEP)	866 (OCT)	1118 (OCT)	678
Turnstone	N/C	0	0	1 (SEP)	2 (OCT)	1
Kingfisher	N/C	0	0	0	1 (AUG)	0

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Table4b: Five-year winter peak counts, and month in which this was recorded, of each species.

Where a count is enclosed by parentheses this indicates that it was considered incomplete i.e. those parts of the site not visited typically holds at least 25% of the species in question. Incomplete counts are excluded from calculation where, if included, they would depress the mean. When all counts are considered to be incomplete the maximum replaces the mean.

Species	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006	Mean Peak
Mute Swan	16 (NOV)	(36) (NOV)	50 (DEC)	2 (DEC)	20 (DEC)	25
Light-bellied Brent Goose (East Canadian high Arctic population)	(22) (DEC)	13 (DEC)	17 (JAN)	20 (MAR)	15 (DEC)	17
Shelduck	(363) (FEB)	471 (JAN)	370 (JAN)	405 (JAN)	533 (JAN)	445
Teal	450 (JAN)	339 (JAN)	461 (FEB)	614 (NOV)	698 (FEB)	512
Mallard	31 (NOV)	21 (JAN)	12 (DEC)	17 (JAN)	16 (NOV)	19
Scaup	0	(0)	0	0	2 (DEC)	1
Goldeneye	0	(0)	1 (DEC)	0	0	0
Red-breasted Merganser	(2) (FEB)	1 (JAN)	0	2 (FEB)	0	1
Great Crested Grebe	2 (JAN)	(3) (NOV)	3 (JAN)	2 (JAN)	3 (NOV)	3
Cormorant	50 (NOV)	(49) (NOV)	32 (FEB)	53 (NOV)	45 (NOV)	46
Grey Heron	(14) (DEC)	11 (JAN)	18 (JAN)	20 (NOV)	8 (DEC)	14
Moorhen	0	1 (JAN)	0	1 (FEB)	3 (DEC)	1
Oystercatcher	91 (JAN)	64 (DEC)	121 (MAR)	67 (NOV)	107 (JAN)	90
Lapwing	91 (NOV)	(21) (NOV)	49 (NOV)	70 (DEC)	79 (JAN)	72
Dunlin	(1500) (DEC)	30 (DEC)	10 (DEC)	30 (MAR)	500 (MAR)	414
Black-tailed Godwit	(10) (DEC)	1 (FEB)	55 (DEC)	56 (NOV)	15 (MAR)	32
Bar-tailed Godwit	15 (JAN)	(0)	0	0	0	4
Curlew	82 (JAN)	75 (DEC)	188 (DEC)	116 (NOV)	200 (JAN)	132
Common Sandpiper	1 (NOV)	1 (JAN)	0	0	0	0
Greenshank	0	(0)	2 (FEB)	0	1 (JAN)	1
Redshank	(1368) (DEC)	(932) (NOV)	820 (NOV)	942 (NOV)	916 (DEC)	996
Turnstone	0	(0)	3 (NOV)	0	4 (NOV)	2
Kingfisher	0	0	0	0	1 (JAN)	0

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Table4c: Five-year spring peak counts, and month in which this was recorded, of each species.

Where a count is enclosed by parentheses this indicates that it was considered incomplete i.e. those parts of the site not visited typically holds at least 25% of the species in question. Incomplete counts are excluded from calculation where, if included, they would depress the mean. When all counts are considered to be incomplete the maximum replaces the mean.

Species	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006	Mean Peak
Light-bellied Brent Goose (East Canadian high Arctic population)	N/C	N/C	N/C	41 (APR)	N/C	41
Shelduck	N/C	N/C	N/C	111 (APR)	N/C	111
Teal	N/C	N/C	N/C	286 (APR)	N/C	286
Mallard	N/C	N/C	N/C	6 (APR)	N/C	6
Cormorant	N/C	N/C	N/C	14 (APR)	N/C	14
Grey Heron	N/C	N/C	N/C	7 (APR)	N/C	7
Moorhen	N/C	N/C	N/C	1 (APR)	N/C	1
Oystercatcher	N/C	N/C	N/C	74 (APR)	N/C	74
Black-tailed Godwit	N/C	N/C	N/C	1 (APR)	N/C	1
Curlew	N/C	N/C	N/C	14 (APR)	N/C	14
Redshank	N/C	N/C	N/C	610 (APR)	N/C	610
Turnstone	N/C	N/C	N/C	5 (APR)	N/C	5

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Table5: National and International importance of the site for each species.

Figures given indicate the percentage of the relevant qualifying level represented by the five year mean peak count for the species in question e.g. 50% indicates that the five year mean peak count is half that required for the site to qualify as nationally or internationally important as appropriate for the species in question. Where a count is enclosed by parentheses this indicates that it was considered incomplete i.e. those parts of the site not visited typically holds at least 25% of the species in question. Asterisks indicate that the percentage presented has been derived using a value of 1% of the national population that is less than 50 (50 is normally used as a minimum threshold for designation of sites).

Species	Autumn cf National Threshold	Winter cf National Threshold	Spring cf National Threshold	Autumn cf International Threshold	Winter cf International Threshold	Spring cf International Threshold	Autumn 5yr mean of peaks	Winter 5yr mean of peaks	Spring 5yr mean of peaks
Mute Swan	23%	25%	0%	23%	25%	0%	23	25	0
Light-bellied Brent Goose (East Canadian high Arctic population)	0%	9%	21%	0%	7%	16%	0	17	41
Shelduck	31%	636%	159%	1%	15%	4%	22	445	111
Teal	46%	79%	44%	6%	10%	6%	301	512	286
Mallard	7%	4%	1%	0%	0%	0%	33	19	6
Scaup	*0%	*3%	*0%	0%	0%	0%	0	1	0
Red-breasted Merganser	*0%	*5%	*0%	0%	0%	0%	0	1	0
Great Crested Grebe	*0%	*10%	*0%	0%	0%	0%	0	3	0
Cormorant	N/A	N/A	N/A	4%	4%	1%	43	46	14
Grey Heron	N/A	N/A	N/A	0%	1%	0%	13	14	7
Moorhen	N/A	N/A	N/A	0%	0%	0%	1	1	1
Oystercatcher	22%	18%	15%	1%	1%	1%	110	90	74
Lapwing	0%	3%	0%	0%	0%	0%	8	72	0
Dunlin	0%	33%	0%	0%	3%	0%	4	414	0
Black-tailed Godwit	50%	36%	1%	10%	7%	0%	45	32	1
Bar-tailed Godwit	2%	2%	0%	0%	0%	0%	3	4	0
Whimbrel	N/A	N/A	N/A	0%	0%	0%	3	0	0
Curlew	19%	15%	2%	2%	2%	0%	167	132	14
Common Sandpiper	N/A	N/A	N/A	0%	0%	0%	4	0	0
Greenshank	*11%	*11%	*0%	0%	0%	0%	1	1	0
Redshank	277%	407%	249%	24%	36%	22%	678	996	610
Turnstone	0%	1%	2%	0%	0%	0%	1	2	5

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APPENDIX 7.3
Schematic Distribution of Waterbirds in Narrow Water Study Area (Section F), 30th January to 18th May 2008

The Narrow Water Study Area was divided into four sub-sections, which are represented as boxes in Table 1 as follows:-

Top left box: South side of Narrow Water, between the beacons.
Top right box: South side of Narrow Water, edge of Cillin Wood.
Bottom left box: North side of Narrow Water, between roundabout and industrial zone.
Bottom right box: North side of Narrow Water, between roundabout and castle.

Species are indicated by WeBS/I-WeBS codes as follows:
CA-Cormorant H.-Grey Heron PB-Light-bellied Brent Goose SU-Shelduck
T.-Teal OC-Oystercatcher GV-Grey Plover L.-Lapwing CU-Curlew
RK-Redshank GK-Greenshank TT-Turnstone MU-Mediterranean Gull
BH-Black-headed Gull CM-Common Gull HG-Herring Gull GB-Great Black-backed Gull

30th January 2008

Small beacon Tall beacon Cillin Wood

T.2 OC12 CU13 RK6 GK1 TT1 BH8 CM2	OC4 RK4 CM2
BH3	CU4 RK6 BH5

Industrial zone Roundabout Castle

6th February 2008

Small beacon Tall beacon Cillin Wood

T.9 OC44 L.39 CU11 TT2 BH25 CM6	

Industrial zone Roundabout Castle

14th February 2008

Small beacon Tall beacon Cillin Wood

SU2 OC3 CU1 RK1 CM2	OC20 RK2 BH22 CM11
TT2 BH49	

Industrial zone Roundabout Castle

20th February 2008

Small beacon Tall beacon Cillin Wood

PB9 SU4 T.10 GV2 L.30 CU1 RK20 TT3	CA1 H.1
	BH20

Industrial zone Roundabout Castle

27th February 2008

Small beacon Tall beacon Cillin Wood

SU2 OC6 RK2 BH8	OC6 RK1 BH7 CM4 HG1
BH8	T.2 RK5 BH12 CM2

Industrial zone Roundabout Castle

5th March 2008

Small beacon Tall beacon Cillin Wood

SU10 OC47 L.2 CU2 RK9 TT3	SU2
T.22 BH10	PB8 T.2 BH10

Industrial zone Roundabout Castle

13th March 2008

Small beacon Tall beacon Cillin Wood

OC3 BH5	OC4 BH2
RK2 BH4	T.4 RK4 BH20

Industrial zone Roundabout Castle

19th March 2008

Small beacon Tall beacon Cillin Wood

PB16 SU11 T.12 OC18 CU8 RK62 GK1 TT1 MU1	CA6 H.3 SU2
T.12 RK1	RK1 BH38

Industrial zone Roundabout Castle

26th March 2008

Small beacon Tall beacon Cillin Wood

SU8 OC4 BH3 CM2 HG2	SU1 OC3 RK2 BH7 HG1
RK2 TT1 BH13	CA1 OC1 BH2

Industrial zone Roundabout Castle

16th April 2008

Small beacon Tall beacon Cillin Wood

SU10 OC4 RK6	
	SU2 OC5 BH2 HG2

Industrial zone Roundabout Castle

18th May 2008

Small beacon Tall beacon Cillin Wood

SU18 OC51 CU2 HG2 GB6	BH20 CM2 HG7

Industrial zone Roundabout Castle

APPENDIX 7.4
WATERBIRD COUNTS, NEWRY RIVER ESTUARY - 2008

Table 1
WATERBIRD COUNTS AT NARROW WATER, NEWRY RIVER ESTUARY, 30.1.08 to 26.3.08

Date Species	30.1.08	6.2.08	14.2.08	20.2.08	27.2.08	5.3.08	13.3.08	19.3.08	26.3.08
Great Cormorant	0	0	0	1	0	0	2	6	1
Grey Heron	0	10	1	0	1	0	0	3	0
Brent Goose	0	0	0	0	0	0	0	16	0
Shelduck	2	1	2	0	0	5	0	13	9
Teal	3	0	3	0	8	0	0	24	0
Oystercatcher	15	22	8	14	17	29	28	18	8
Lapwing	58	51	6	26	1	0	0	0	0
Curlew	6	3	6	21	3	7	0	8	0
Redshank	4	7	5	3	12	0	3	64	4
Greenshank	1	1	0	0	0	0	0	1	0
Turnstone	0	1	0	0	0	0	1	1	1
Mediterranean Gull	0	0	0	0	0	0	0	1	0
Black-headed Gull	0	43	86	80	47	51	70	38	25
Common Gull	0	5	2	5	0	1	8	0	2
Herring Gull	0	2	3	2	5	0	15	0	3
Bird totals	89	146	122	152	94	93	127	193	53

Table 2
WATERBIRD COUNTS AT NEWRY RIVER ESTUARY, 30.1.08 to 26.3.08

Count date: 30.1.08 Count time: 08.35-10.40 HT 04.30, 16.58, 4.4m LT 10.45

Section / Species	A*	B	C	D	E	F	G	Total
Great Crested Grebe		0	0	0	0	0	1	1
Cormorant		6	14	4	0	0	1	25
Little Egret		0	0	0	0	0	0	0
Grey Heron		1	0	3	0	0	0	4
Brent Goose		0	0	0	0	0	0	0
Shelduck		36	106	14	0	2	0	158
Teal		163	108	42	0	3	0	316
Mallard		0	0	0	0	0	0	0
Moorhen		0	0	0	0	0	0	0
Oystercatcher		0	3	4	0	15	18	40
Lapwing		0	0	0	0	58	0	58
Dunlin		0	0	0	0	0	0	0
Black-tailed Godwit		0	3	0	0	0	0	3
Curlew		7	20	69	0	6	20	122
Redshank		87	5	101	0	4	10	207
Greenshank		1	0	0	0	1	0	2
Turnstone		0	0	0	0	0	3	3
Mediterranean Gull		0	0	0	0	0	0	0
Black-headed Gull		45	163	39	0	0	35	282
Common Gull		0	0	0	0	0	45	45
Lesser Black-backed Gull		0	0	0	0	0	0	0
Herring Gull		0	0	0	0	0	90	90
Great Black-backed Gull		0	0	0	0	0	0	0
Kingfisher		0	0	0	0	0	0	0

* Section not counted on this date

Count date: 6.2.08 Count time: 0805-10.20 HT 10.50, 4.9m LT 17.15

Section Species	A	B	C	D	E	F	G	Total
Great Crested Grebe	0	0	0	0	0	0	1	1
Cormorant	2	16	7	1	1	0	2	29
Little Egret	0	0	0	0	0	0	0	0
Grey Heron	0	0	0	0	1	10	0	11
Brent Goose	0	0	0	0	0	0	0	0
Shelduck	26	30	127	114	2	1	0	300
Teal	72	29	163	144	2	0	0	412
Mallard	2	0	0	0	0	0	0	2
Moorhen	2	0	0	0	0	0	0	2
Oystercatcher	0	0	4	0	2	22	25	53
Lapwing	0	0	0	0	0	51	0	51
Dunlin	205	46	0	0	0	0	0	251
Black-tailed Godwit	0	0	0	0	8	0	0	8
Curlew	1	71	7	1	1	3	4	88
Redshank	211	358	102	32	42	7	1	753
Greenshank	0	0	0	0	0	1	0	1
Turnstone	0	0	0	0	0	1	0	1
Mediterranean Gull	0	0	0	0	0	0	0	0
Black-headed Gull	156	185	52	239	62	43	90	827
Common Gull	2	0	0	0	0	5	0	7
Lesser Black-backed Gull	0	0	0	0	0	0	0	0
Herring Gull	0	0	0	0	0	2	20	22
Great Black-backed Gull	0	0	0	0	0	0	0	0
Kingfisher	0	0	0	0	0	0	0	0

Count date: 14.2.08 Count time: 07.58-10.10 HT 04.12, 16.38, 4.7m LT 12.26

Section Species	A	B	C	D	E	F	G	Total
Great Crested Grebe	0	0	0	0	0	0	0	0
Cormorant	0	0	3	5	2	0	5	15
Little Egret	0	0	0	0	0	0	0	0
Grey Heron	0	0	1	2	0	1	0	4
Brent Goose	0	0	0	0	0	0	0	0
Shelduck	0	79	60	8	5	2	2	156
Teal	2	0	72	115	42	3	0	234
Mallard	0	0	0	0	0	0	0	0
Moorhen	0	0	0	0	0	0	0	0
Oystercatcher	0	0	1	0	8	8	57	74
Lapwing	0	0	0	0	0	6	0	6
Dunlin	665	0	0	0	0	0	0	665
Black-tailed Godwit	0	0	0	0	0	0	0	0
Curlew	12	2	3	0	3	6	7	33
Redshank	8	6	77	206	98	5	4	404
Greenshank	0	0	0	0	0	0	0	0
Turnstone	0	0	0	0	0	0	0	0
Mediterranean Gull	0	0	0	0	0	0	0	0
Black-headed Gull	0	20	0	55	64	86	125	350
Common Gull	0	0	0	0	0	2	18	20
Lesser Black-backed Gull	0	0	0	0	0	0	0	0
Herring Gull	0	0	0	0	0	3	44	47
Great Black-backed Gull	0	0	0	0	0	0	0	0
Kingfisher	0	0	0	0	0	0	0	0

Count date: 20.2.08 Count time: 07.40-10.00 HT 10.56, 5.1m LT17.15

Section Species	A	B	C	D	E	F	G	Total
Great Crested Grebe	0	0	0	0	0	0	0	0
Cormorant	1	0	0	3	0	1	2	7
Little Egret	0	0	0	0	0	0	0	0
Grey Heron	0	0	1	0	0	0	0	1
Brent Goose	0	0	0	0	0	0	0	0
Shelduck	35	25	63	137	2	0	0	262
Teal	49	15	60	86	5	0	0	215
Mallard	0	2	0	0	0	0	0	2
Moorhen	0	0	0	0	0	0	0	0
Oystercatcher	0	0	8	0	0	14	29	51
Lapwing	0	3	0	0	0	26	0	29
Dunlin	765	0	0	10	0	0	0	775
Black-tailed Godwit	0	0	0	4	0	0	0	4
Curlew	1	1	4	6	6	21	4	43
Redshank	191	131	71	128	20	3	2	546
Greenshank	0	0	0	0	0	0	0	0
Turnstone	0	0	0	0	0	0	0	0
Mediterranean Gull	0	0	0	0	0	0	0	0
Black-headed Gull	163	86	116	21	5	80	34	505
Common Gull	0	0	0	0	0	5	2	7
Lesser Black-backed Gull	0	0	0	0	0	0	0	0
Herring Gull	0	0	0	0	0	2	46	48
Great Black-backed Gull	0	0	0	0	0	0	0	0
Kingfisher	0	0	0	0	0	0	0	0

Count date: 27.2.08 Count time: 08.25-11.15 HT 15.12, 4.5m LT 08.55

Section Species	A	B	C	D	E	F	G	Total
Great Crested Grebe	0	0	0	0	0	0	0	0
Cormorant	0	0	2	1	5	0	2	10
Little Egret	0	0	0	0	0	0	0	0
Grey Heron	0	0	0	0	0	1	0	1
Brent Goose	0	0	0	0	0	0	0	0
Shelduck	4	0	98	67	7	0	0	176
Teal	0	0	81	127	23	8	0	239
Mallard	0	0	0	0	0	0	0	0
Moorhen	0	0	0	0	0	0	0	0
Oystercatcher	0	0	0	0	7	17	36	60
Lapwing	0	0	0	0	0	1	0	1
Dunlin	1	0	0	625	76	0	0	702
Black-tailed Godwit	0	0	0	9	2	0	0	11
Curlew	1	5	6	6	1	3	2	24
Redshank	9	72	102	148	115	12	1	459
Greenshank	0	0	0	0	0	0	1	1
Turnstone	0	0	0	0	0	0	0	0
Mediterranean Gull	0	0	0	0	0	0	0	0
Black-headed Gull	47	20	17	18	38	47	23	210
Common Gull	0	0	0	0	4	0	6	10
Lesser Black-backed Gull	0	0	0	0	0	0	0	0
Herring Gull	0	0	0	0	2	5	41	48
Great Black-backed Gull	0	0	0	0	0	0	1	1
Kingfisher	0	0	0	0	0	0	0	0

Count date: 5.3.08 Count time: 08.20-10.45 HT 10.48, 4.7m LT 17.04

Section Species	A	B	C	D	E	F	G	Total
Great Crested Grebe	0	0	0	0	0	0	0	0
Cormorant	4	16	0	1	1	0	0	22
Little Egret	0	0	0	0	0	0	0	0
Grey Heron	0	0	0	0	0	1	0	1
Brent Goose	0	0	0	0	0	0	8	8
Shelduck	22	50	205	26	5	5	0	313
Teal	77	22	131	0	0	0	0	230
Mallard	0	0	0	0	0	0	0	0
Moorhen	0	0	0	0	0	0	0	0
Oystercatcher	0	11	0	0	0	29	8	48
Lapwing	0	0	0	0	0	0	0	0
Dunlin	0	730	0	0	0	0	0	730
Black-tailed Godwit	0	0	13	0	0	0	0	13
Curlew	2	17	2	1	1	7	0	30
Redshank	97	270	90	0	52	0	1	510
Greenshank	0	0	0	0	0	0	0	0
Turnstone	0	0	0	0	0	0	0	0
Mediterranean Gull	0	0	0	0	0	0	0	0
Black-headed Gull	213	28	40	4	9	51	11	356
Common Gull	0	0	0	0	0	1	0	1
Lesser Black-backed Gull	0	0	0	0	0	0	0	0
Herring Gull	0	0	0	0	0	0	0	0
Great Black-backed Gull	0	0	0	0	0	0	0	0
Kingfisher	0	0	1	0	0	0	0	1

Count date: 13.3.08 Count time: 08.10-10.20 HT 1620, 4.8m LT 10.04

Section **Species**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**Total**
Great Crested Grebe	0	0	0	0	0	0	1	1
Cormorant	0	2	0	0	18	2	5	27
Little Egret	0	0	0	0	0	0	0	0
Grey Heron	0	0	0	0	1	0	1	2
Brent Goose	0	0	0	0	0	0	5	5
Shelduck	20	26	87	60	11	0	0	204
Teal	0	30	70	95	24	0	0	219
Mallard	0	0	0	0	2	0	0	2
Moorhen	0	0	0	0	0	0	0	0
Oystercatcher	0	0	0	0	19	28	27	74
Lapwing	0	0	0	0	0	0	0	0
Dunlin	1	0	440	0	0	0	0	441
Black-tailed Godwit	0	0	10	0	0	0	0	10
Curlew	1	0	4	1	1	0	0	7
Redshank	26	67	99	106	69	3	3	373
Greenshank	0	0	0	0	0	0	0	0
Turnstone	0	0	0	0	0	1	0	1
Mediterranean Gull	0	0	0	0	0	0	0	0
Black-headed Gull	26	54	3	34	47	70	34	268
Common Gull	0	0	0	0	1	8	4	13
Lesser Black-backed Gull	0	0	0	0	1	0	0	1
Herring Gull	0	0	0	0	5	15	13	33
Great Black-backed Gull	0	0	0	0	0	0	0	0
Kingfisher	0	0	0	0	0	0	0	0

Count date: 19.3.08 Count time: 08.05-09.35 HT 10.58, 0.0m LT 17.14

Section / Species	A	B	C	D	E	F	G	Total
Great Crested Grebe	0	0	0	0	0	0	1	1
Cormorant	0	12	1	0	0	6	2	21
Little Egret	0	1	0	0	0	0	0	1
Grey Heron	0	0	0	0	0	3	0	3
Brent Goose	0	0	0	0	0	16	0	16
Shelduck	4	32	66	0	2	13	2	119
Teal	36	41	128	4	0	24	0	233
Mallard	1	0	0	0	0	0	0	1
Moorhen	0	0	0	0	0	0	0	0
Oystercatcher	0	0	0	0	0	18	0	18
Lapwing	0	0	0	0	0	0	0	0
Dunlin	0	149	0	0	0	0	0	149
Black-tailed Godwit	0	9	0	0	0	0	0	9
Curlew	2	3	0	0	0	8	0	13
Redshank	69	420	74	2	0	64	0	629
Greenshank	0	0	0	0	0	1	0	1
Turnstone	0	0	0	0	0	1	0	1
Mediterranean Gull	0	0	0	0	0	1	0	1
Black-headed Gull	135	76	7	18	3	38	2	279
Common Gull	1	0	0	0	0	0	0	1
Lesser Black-backed Gull	0	0	0	0	0	0	0	0
Herring Gull	0	0	0	0	0	0	0	0
Great Black-backed Gull	0	0	0	0	0	0	0	0
Kingfisher	0	0	0	0	0	0	0	0

Count date: 26.3.08 Count time: 08.50-10.35 HT 15.00, 4.6m LT 08.44

Section Species	A	B	C	D	E	F	G	Total
Great Crested Grebe	0	0	0	0	0	0	0	0
Cormorant	0	0	0	0	0	0	0	20
Little Egret	0	0	0	7	6	1	6	0
Grey Heron	0	0	0	0	0	0	1	1
Brent Goose	0	0	0	0	0	0	7	7
Shelduck	31	4	48	69	2	9	0	163
Teal	26	1	81	121	3	0	0	232
Mallard	0	0	0	0	0	0	0	0
Moorhen	0	0	0	0	0	0	0	0
Oystercatcher	0	0	0	0	3	8	28	39
Lapwing	0	0	0	0	0	0	0	0
Dunlin	0	0	0	12	0	0	0	12
Black-tailed Godwit	0	0	0	9	22	0	0	31
Curlew	0	5	0	0	0	0	0	5
Redshank	8	15	83	134	171	4	2	417
Greenshank	0	0	0	0	0	0	1	1
Turnstone	0	0	0	0	0	1	0	1
Mediterranean Gull	0	0	0	0	0	0	0	0
Black-headed Gull	7	3	4	29	7	25	3	78
Common Gull	0	2	0	0	2	2	1	7
Lesser Black-backed Gull	0	0	0	0	1	0	0	1
Herring Gull	0	0	0	1	4	3	5	13
Great Black-backed Gull	0	0	0	0	0	0	0	0
Kingfisher	0	0	0	0	0	0	0	0

APPENDIX 7.5
Scientific Names of Bird Species Mentioned in Text

Red-throated Diver	*Gavia stellata*
Black-throated Diver	*Gavia arctica*
Great Northern Diver	*Gavia immer*
Great Crested Grebe	*Podiceps cristatus*
Slavonian Grebe	*Podiceps auritus*
Great Cormorant	*Phalacrocorax carbo*
Little Egret	E*gretta garzetta*
Grey Heron	*Ardea cinerea*
Mute Swan	*Cygnus olor*
Light-bellied Brent Goose	*Branta bernicla hrota*
Shelduck	*Tadorna tadorna*
Wigeon	*Anas penelope*
Teal	*Anas crecca*
Mallard	*Anas platyrhynchos*
Pochard	*Aythya ferina*
Scaup	*Aythya marila*
Long-tailed Duck	*Clangula hyemalis*
Common Eider	*Somateria mollissima*
Common Scoter	*Melanitta nigra*
Goldeneye	*Bucephala clangula*
Red-breasted Merganser	*Mergus serrator*
Goshawk	*Accipiter gentilis*
Moorhen	*Gallinula chloropus*
Oystercatcher	*Haematopus ostralegus*
Ringed Plover	*Charadrius hiaticula*
Golden Plover	*Pluvialis apricaria*
Grey Plover	*Pluvialis squatarola*
Lapwing	*Vanellus vanellus*
Knot	*Calidris canutus*
Curlew Sandpiper	*Calidris ferruginea*
Dunlin	*Calidris alpina*
Snipe	*Gallinago gallinago*
Black-tailed Godwit	*Limosa limosa*
Bar-tailed Godwit	*Limosa lapponica*
Whimbrel	*Numenius phaeopus*
Curlew	*Numenius arquata*
Redshank	*Tringa totanus*
Greenshank	*Tringa nebularia*
Common Sandpiper	*Actitis hypoleucos*
Turnstone	*Arenaria interpres*
Mediterranean Gull	*Larus melanocephalus*

Black-headed Gull	*Larus ridibundus*
Common Gull	*Larus canus*
Lesser Black-backed Gull	*Larus fuscus*
Herring Gull	*Larus argentatus*
Great Black-backed Gull	*Larus marinus*
Sandwich Tern	*Sterna sandvicensis*
Common Tern	*Sterna hirundo*
Arctic Tern	*Sterna paradisaea*
Woodpigeon	*Columba palumbus*
Kingfisher	*Alcedo atthis*
Sand Martin	*Riparia riparia*
Swallow	*Hirundo rustica*
Meadow Pipit	*Anthus pratensis*
Grey Wagtail	*Motacilla cinerea*
Pied Wagtail	*Motacilla alba yarellii*
Wren	*Troglodytes troglodytes*
Dunnock	*Prunella modularis*
Robin	*Erithacus rubecula*
Blackbird	*Turdus merula*
Song Thrush	*Turdus philomelos*
Mistle Thrush	*Turdus viscivorous*
Whitethroat	*Sylvia borin*
Blackcap	*Sylvia atricapilla*
Chiffchaff	*Phylloscopus collybita*
Willow Warbler	*Phylloscopus trochilus*
Goldcrest	*Regulus regulus*
Long-tailed Tit	*Aegithalos caudatus*
Coal Tit	*Parus ater*
Blue Tit	*Parus caeruleus*
Great Tit	Parus *major*
Magpie	*Pica pica*
Jackdaw	*Corvus monedula*
Rook	*Corvus frugilegus*
Hooded Crow	*Corvus corax*
Starling	*Sturnus vulgaris*
House Sparrow	*Passer domesticus*
Chaffinch	*Fringilla coelebs*
Greenfinch	*Carduelis chloris*
Goldfinch	*Carduelis carduelis*
Siskin	*Carduelis spinus*
Linnet	*Carduelis cannabina*
Lesser Redpoll	*Carduelis cabaret*
Bullfinch	*Pyrrhula pyrrhula*
Reed Bunting	*Emberiza schoeniclus*

APPENDIX 7.6
Site Photographs Highlighting Ecological Issues

Plate 7.2.7 General view of shoreline with salt marsh on Louth side. Looking eastwards towards Northern Ireland.

Plate 7.2.8 Area of salt marsh on Louth side looking SE along Newry River. This area is used as a high tide roost by waterbirds.

Plate 7.2.9 View of Cillin Wood, looking north-west.

Plate 7.2.10 The route of the link road to the bridge will pass through this field of dry grassland just above the shoreline.

Plate 7.2.11 On the Down side, the shoreline is already artificially banked.

Plate 7.2.12 This area of mudflat will become very sheltered due to the presence of the proposed embankment, potentially resulting in the development of salt marsh vegetation. Looking north-east towards the A2.

7.3 Marine Modelling and Aquatic Ecology

7.3.1 Marine Modelling

Early consultations with the Loughs Agency and Warrenpoint Harbour Authority highlighted the importance of minimising the release of sediment during both the construction and operation of the bridge.

The presence of commercially licensed aquaculture beds (mussels and oysters) within Carlingford Lough directed the Loughs Agency to advise of the requirement to ensure that these commercial interests were not impacted by the release of either sediment or contaminants into the water body.

Warrenpoint Harbour Authority made it clear that any release of sediment could impact their dredging contract which is required to maintain the deep water channel and turning circle serving the harbour.

As a consequence of the above substantial constraints AQUAFACT International Services Ltd. were commissioned to develop a computer model to assess the hydrodynamics of Newry River Estuary and to assess the effects of the proposed bridge options on the water circulation patterns of the estuary. This hydrodynamic modelling exercise (methodology, model development and outcome) is discussed in detail in Chapter 4, Section 4.5. 'Bridge Design Options', in particular Section 4.5.3. Section 4.5 exhaustively details the bridge option selection process, in which the hydrodynamic modelling played a significant role. With respect to Aquatic Ecology it is considered pertinent to re-examine the results of this modelling exercise and the potential impact of the chosen bridge design.

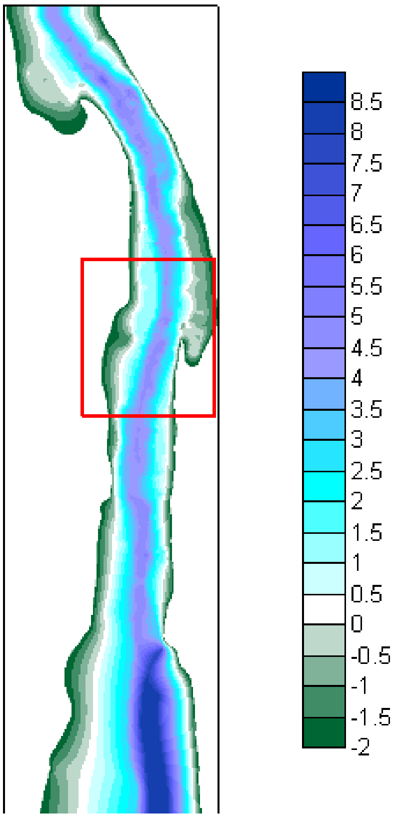

Plate 7.3.1: Bathymetry plot of Newry River Estuary with the area of interest outlined

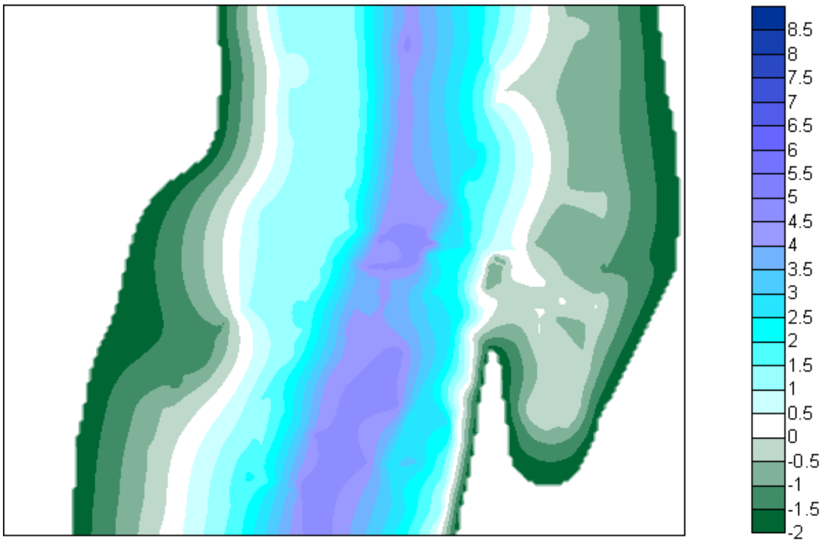

Plate 7.3.2: Bathymetry plot of the area of interest in the vicinity of the proposed bridge site

Hydrodynamic Modelling Results

Plates 7.3.3 – 7.3.10 present snapshots of water velocity during various tidal conditions at the study site in the Newry River while Plates 7.3.11 – 7.3.14 present the snapshots with the introduction of the bridge structure to the river.

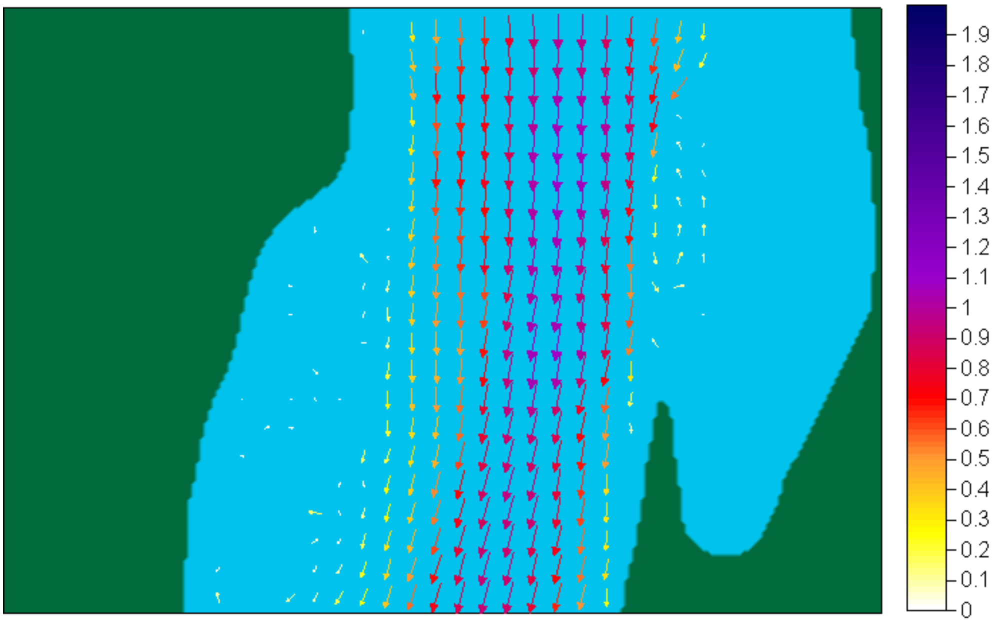

Plate 7.3.3: Snapshot of current velocity vectors within Newry River Estuary at mid-ebb during a spring tidal cycle

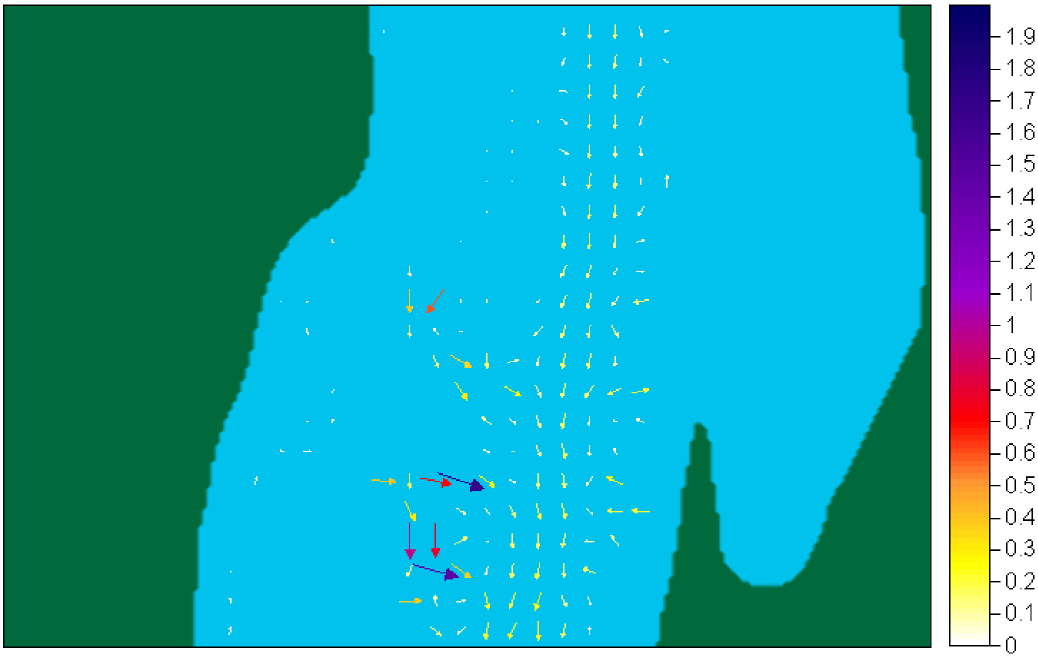

Plate 7.3.4.: Snapshot of current velocity vectors within Newry River Estuary at low water during a spring tidal cycle

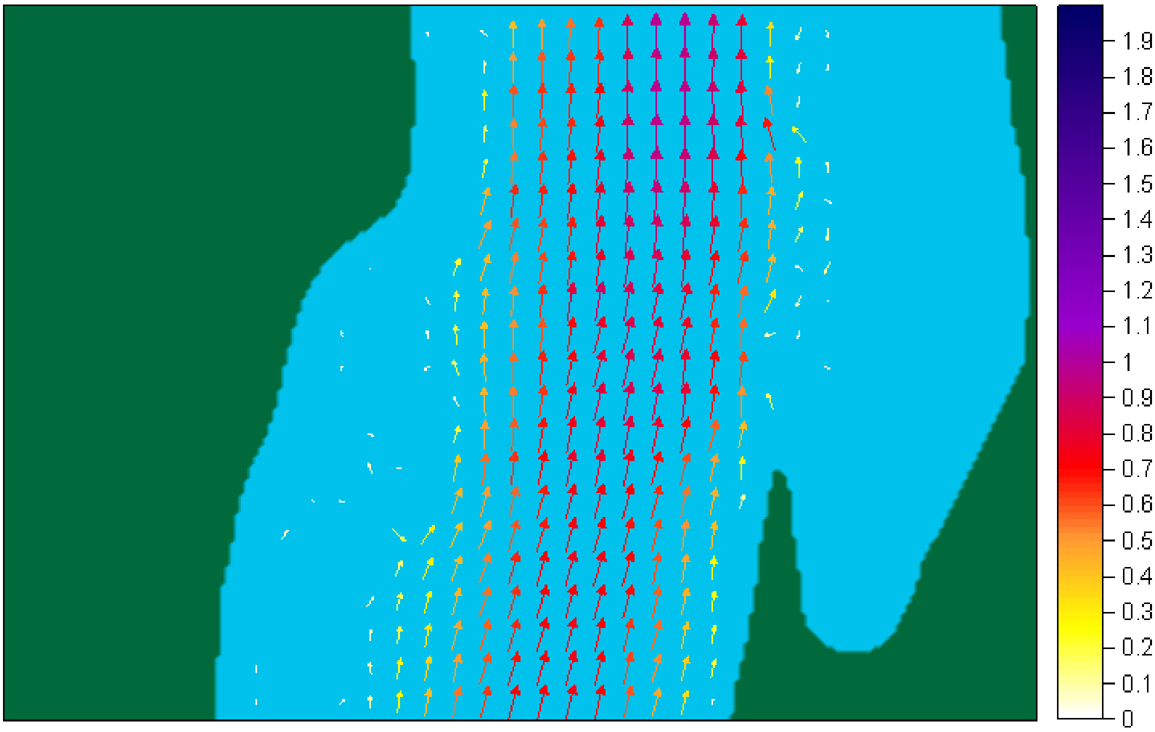

Plate 7.3.5.: Snapshot of current velocity vectors within Newry River Estuary at mid-flood during a spring tidal cycle

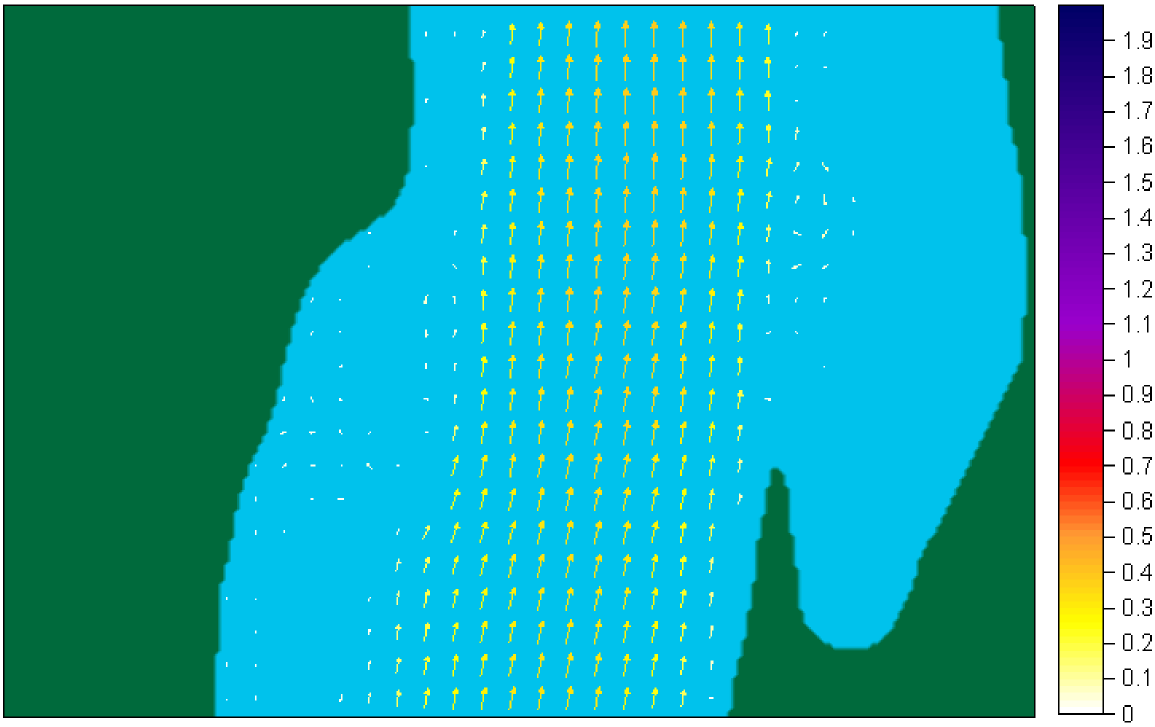

Plate 7.3.6: Snapshot of current velocity vectors within Newry River Estuary at high water during a spring tidal cycle

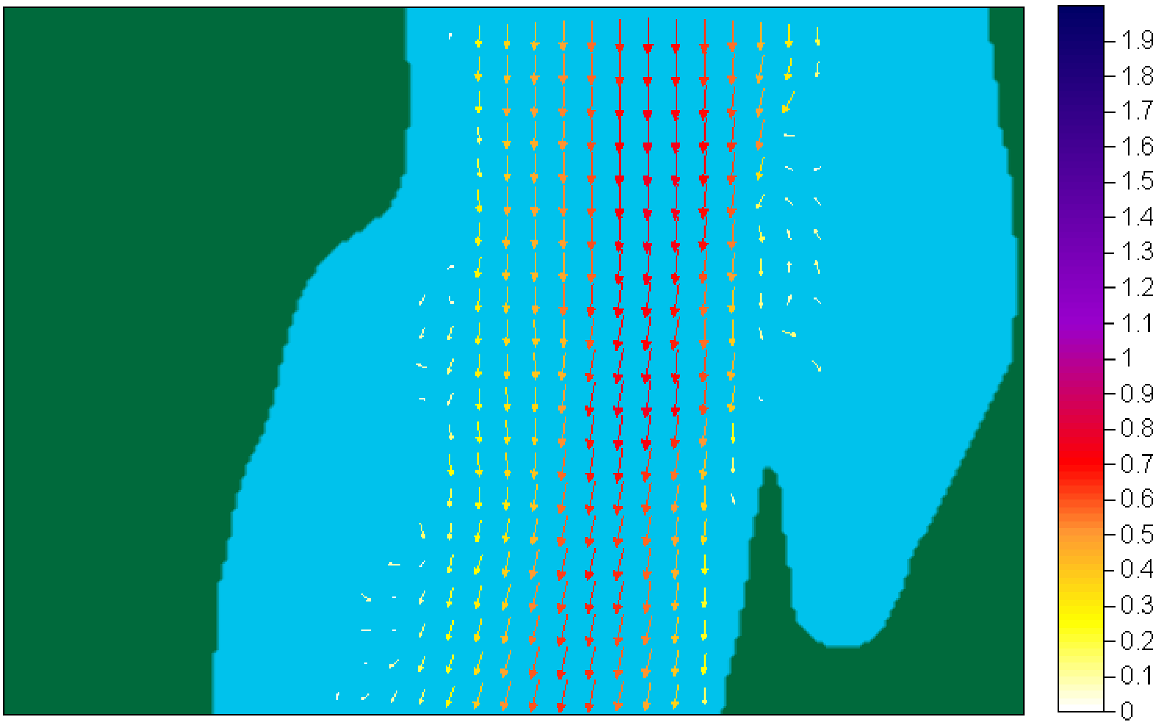

Plate 7.3.7: Snapshot of current velocity vectors within Newry River Estuary at mid-ebb during a neap tidal cycle

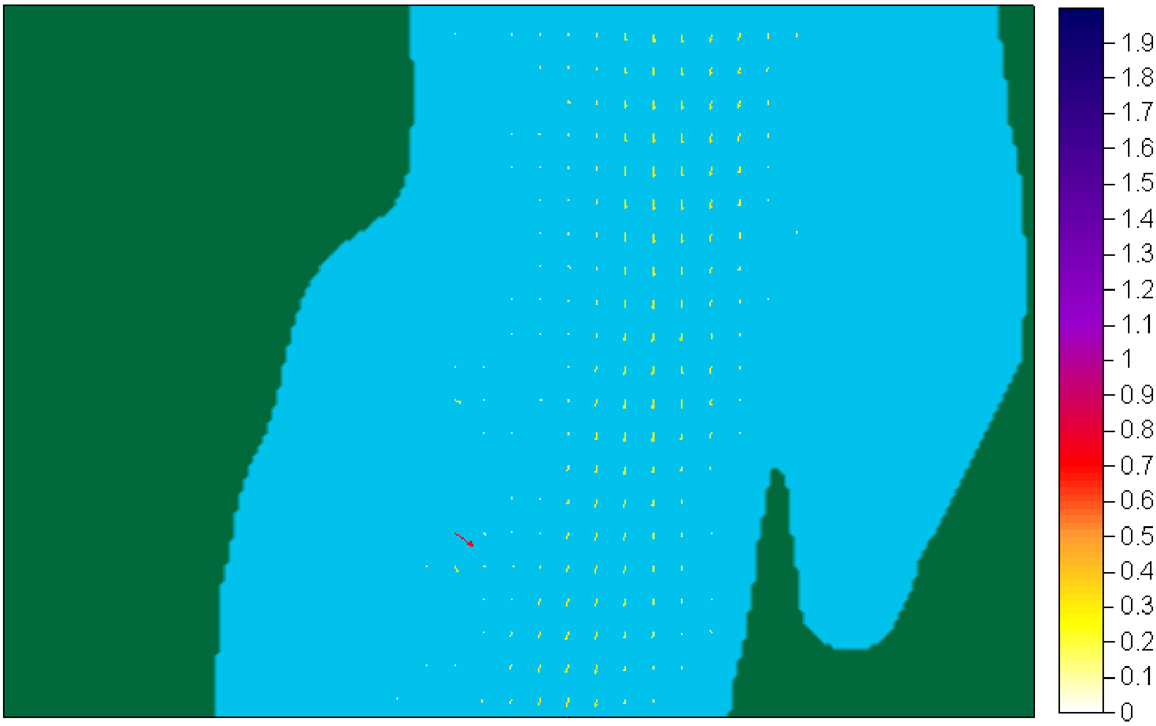

Plate 7.3.8: **Snapshot of current velocity vectors within Newry River Estuary at low water during a neap tidal cycle**

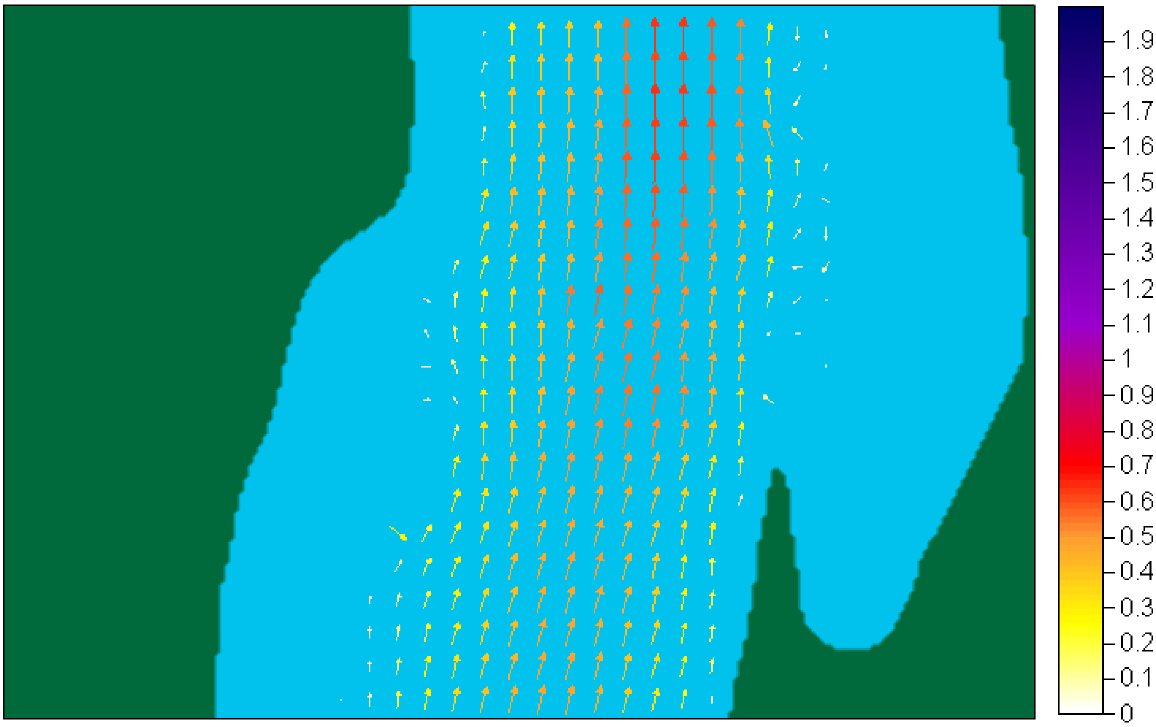

Plate 7.3.9: **Snapshot of current velocity vectors within Newry River Estuary at mid-flood during a neap tidal cycle**

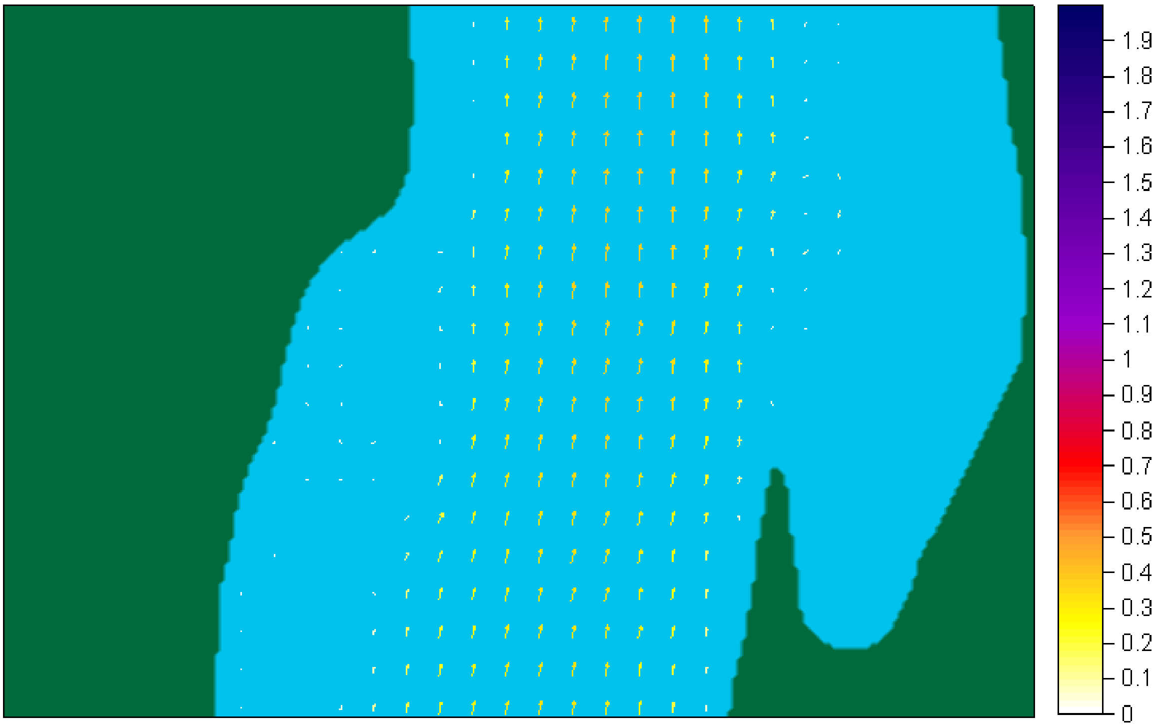

Plate 7.3.10: Snapshot of current velocity vectors within Newry River Estuary at high water during a neap tidal cycle

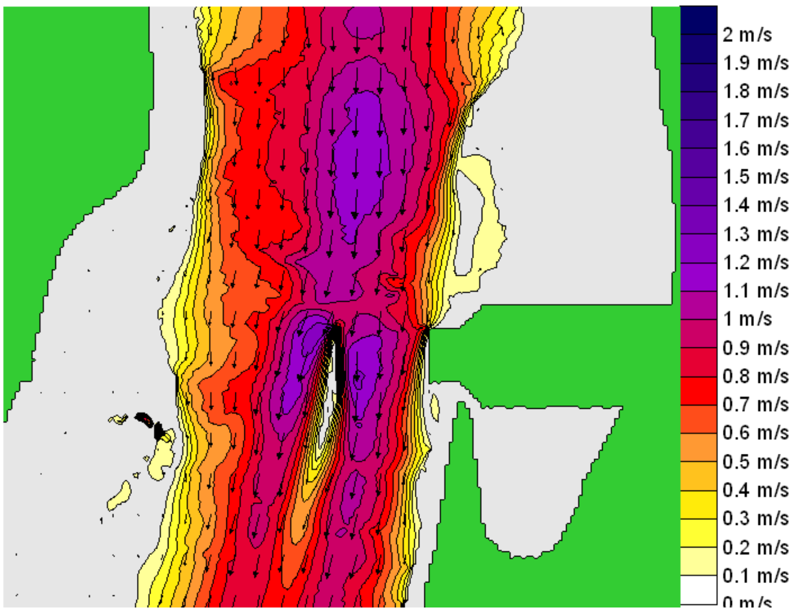

Plate 7.3.11: Snapshot of current velocity vectors within Newry River Estuary at mid-ebb during a spring tidal cycle with proposed structure present.

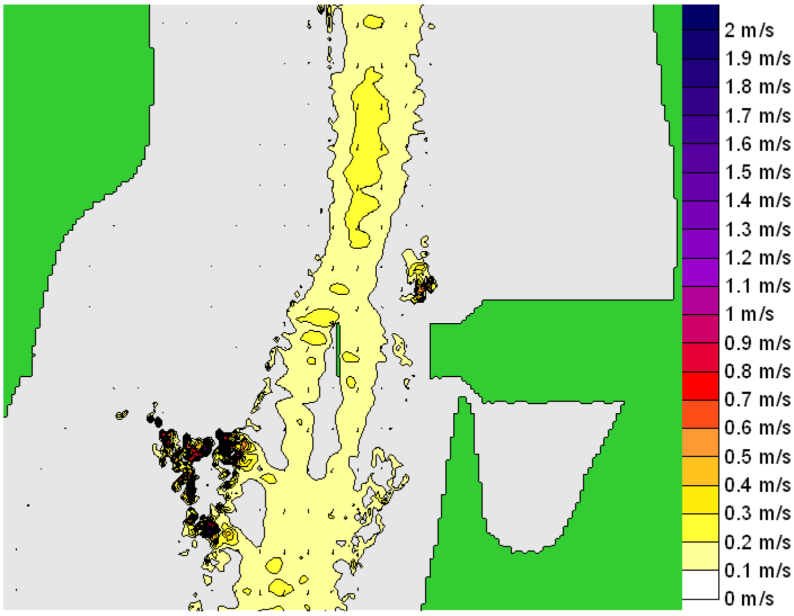

Plate 7.3.12: Snapshot of current velocity vectors within Newry River Estuary at low-water during a spring tidal cycle with proposed structure present.

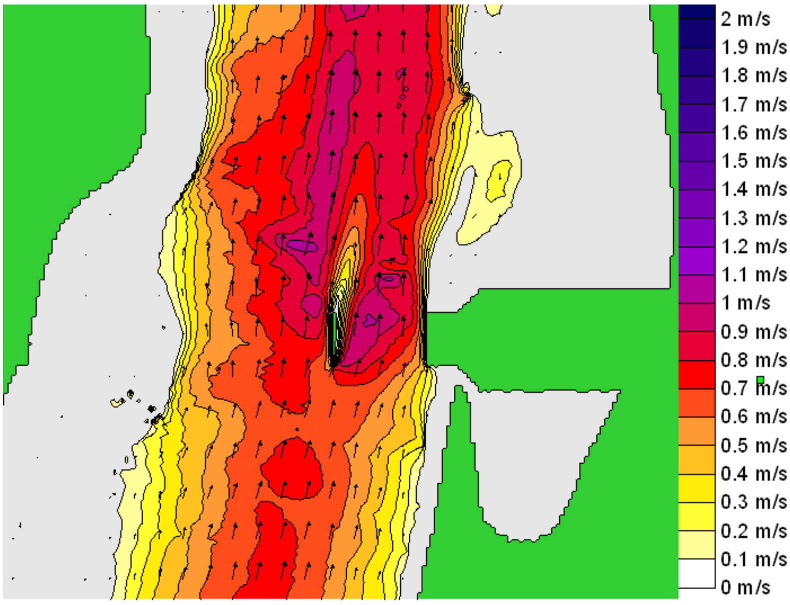

Plate 7.3.13: Snapshot of current velocity vectors within Newry River Estuary at mid-flood during a spring tidal cycle with proposed Final Option structure present.

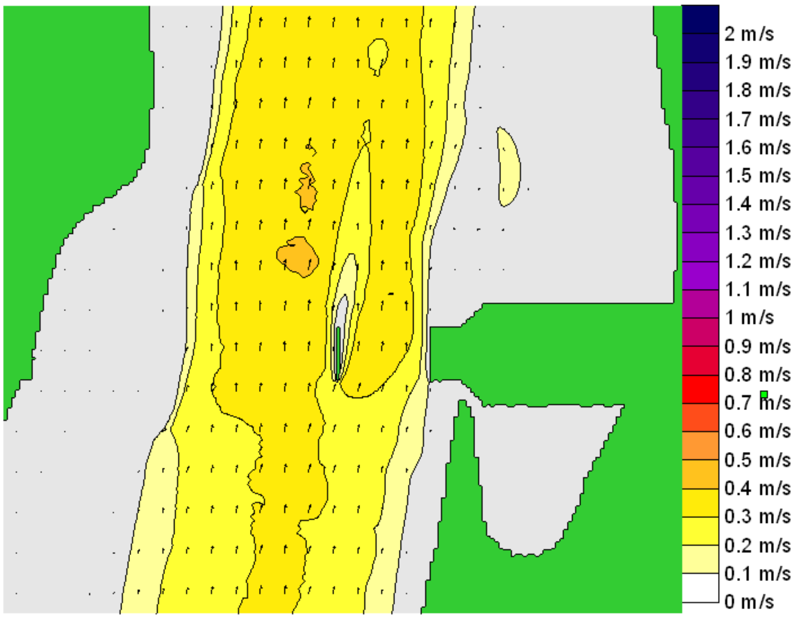

Plate 7.3.14: Snapshot of current velocity vectors within Newry River Estuary at high-water during a spring tidal cycle with proposed Final Option structure present.

Interpretation of Results

With the proposed Cable-stayed structure in place, the model predicted the water currents to be approximately 0.81 m/s during flood tides and 1.11m/s during ebb tides on a spring tide. The regions of high velocity are located either side of the central pier. This represents no change in water current velocities on a flood tide and a decrease of 10% on an ebbing tide.

In the immediate vicinity of the piers, the predicted changes in current velocity indicates that there will be some scouring effect around the base of the piers, which will lead to mobilisation of sediments upstream and downstream of the structures.

The scouring effects occur at the north face of the piers during an ebbing tide with regions of slack water occurring in the wake region to the south of the structure. The inverse occurs during flooding tides when the scouring effects is in evidence on the south face of the piers with regions of slack water occurring in the wake region of the piers to the north of the proposed structures.

It is unlikely that the scoured material would be deposited in the wake region on the opposite side of the piers given the magnitude of the current velocities as the water passes around the bridge piers and the associated transport distance of the entrained sediments. It is more likely that the sediments on the ebb tide will be exported eastwards into the main body of Carlingford Lough and deposit when velocities fall to ca 0.1m/s. The opposite pattern will occur on the flood tide *i.e.* re-suspended sediments will be transported up stream. This mobilisation and deposition of sediment will occur only as a short term impact. In the longer term a renewed stable situation will be reached.

Conclusion

Plates 7.3.11 to 7.3.14 clearly identify that the bridge will have minimal impact on the existing marine hydrodynamics and therefore on sediment transport and the ecological functioning of the estuary. In fact, based on Aquafact International's 30 years experience and taking account of the existing highly turbid nature of the estuarine waters and the very low effect on current velocity and sediment mobilisation, it is considered that the bridge will a have negligible, imperceptible impact on the ecological functioning of the estuary.

Design Review

Since the completion of the hydrodynamic modelling further design reviews of the proposed cable stayed option have been completed. This has resulted in the bridge abutment on the County Down foreshore being further limited in size such that it no longer extends into the river channel (refer to Plates7.3.11 to 7.3.14). The outcome of this design amendment is to further reduce the impact on the existing hydrodynamic situation.

7.3.2 Aquatic Ecology

Introduction

An assessment of the impact on the aquatic environment was completed by Aquafact International. This assessment was based on a field survey of the intertidal and subtidal habitats and species. The study site lies within at the entrance to Carlingford Lough which is covered by a number of nature conservation designations (Refer **Section 7.2.5** and **Figure 7.1** in Volume 3). The lough also supports a well established aquaculture industry with managed bottom cultivation of mussels in the inner western part and trestle cultivation of pacific oysters. The area within and up-stream of the bridge site is a registered ‘wild (mussel) fishery’ which is locally exploited by dredging. The Newry River is a known salmonid river and eels also pass through the area. It is also likely that the Annex II Lamprey spp. move up the Newry River. Carlingford Lough is a designated shell fish production site and is covered by S.I. 268 of 2006 (EC (Quality of Shellfish Waters) Regulations 2006).

Methodology

Intertidal

The intertidal sites along the northern and southern banks where the proposed bridge is to be located were assessed on the 12th March 2008. All habitat types in the area were documented.

Subtidal

A dive survey was carried out in the area of the proposed development on the 10th March 2008. All habitat types, sediment type and species observed were documented.

Survey Results

Intertidal Habitat

Intertidal sediments on both foreshores are characterised by muddy sand and gravel with shell debris generated from clumps of intertidal mussels. Given the variable salinity of the overlying water and the water velocities, the infaunal species diversity of the sea bed in this location was low. The reputed frequency of mussel dredging which occurs within this ‘wild (mussel) fishery’ will also have contributed to the low faunal diversity.

Species recorded include the green algae *Enteromorhpa* and *Ulva,* the oligochaete *Tubificoides benedeni*, the polychaetes *Perinereis diversicolor*, *Spio filicornis* and *Arenicola marina*, the amphipod *Corpohium volutator*, the bivalve *Scrobicularia plana* and mussels, *Mytilus edulis* some of which had the calcareous epifaunal polychaete, *Pomatoceros* sp. growing on the shell. Eel grass (*Zostera*) was not recorded.

Plate 7.3.1: Muddy sand of northern inter-tidal zone

Sub-tidal Habitat

The sub-tidal sediments in the vicinity are muddy sand and gravel with both live and dead mussel shell. Although salinities do fluctuate, they do so less than in the intertidal habitat. Algae were not recorded. Infaunal species include the oligochaete *Tubificoides benedeni*, the polychaetes *Harmothoe* sp., *Anaitides mucosa, Nepthys hombergii, Perinereis diversicolor*, *Spio filicornis* and *Ampharete* sp., the amphipods *Corpohium volutator* and *Chaetogammarus* and mussels, *Mytilus edulis.*

The sub-tidal habitat is considered to be of low ecological value and it is considered likely that this relates to the regular disturbance which occurs as a result of the mussel dredging operations within this ‘wild (mussel) fishery’.

Migratory Fish

Atlantic salmon *Salmo salar* and European eel *Anguilla Anguilla* are reputed to migrate up the Newry River.

Atlantic salmon spawn far upstream in freshwater, usually in November and December. They migrate upstream predominantly between June and early October. Movement of adult Salmon (*Salmo salar)* through the freshwater element of the Newry River has been recorded via a counter on a fish pass since 2007 (Loughs Agency) with peak numbers in these three years noted as being between September and November.

Salmon lay their eggs in a nest hollowed out in the gravel by the female, which hatch out in April and May. The parr may spend up to 3 years in this river before migrating out to sea (March to June). After 3 or 4 years (although in some cases only 1 to 2 years) the salmon return to their spawning grounds. Many die after spawning, but some will survive the downstream journey to spawn a second or third time.

European eel are widespread in Ireland, occurring throughout the country and have been recorded from every river running into Carlingford Lough. Eels in the form of glass eels or elvers arrive on the Irish coast primarily in the spring, with Glass eels recorded returning to their mother river in April/May and moving upstream. Some will remain in estuarine habitats where they continue to grow to maturity while others will continue their migration in to freshwater. Their lifecycle is complex and little understood, although it is suspected that they spawn in the Sargasso Sea.

Both sea lamprey and river lamprey spend their adult lives at sea, returning to spawn in freshwater during the spring. Following hatching, the young lamprey (known as ammocoetes) burrow into soft sediments and undergo a passive downstream migration over a period of up to seven years in the case of sea lamprey. Lamprey species have been recorded in the Clanrye River, although it is expected that they are widespread. Being parasitic on salmonids it is considered that their occurrence will follow the same periodicity as salmon.

Predicted Impacts

Intertidal Habitat

The intertidal habitat has been defined as muddy sand and gravel with low faunal diversity. The bridge design and associated Construction Methodology (refer Chapter 11, Section 11.3.3 and **Figures 11.2 to 11.7** in Volume 3) will result in very limited impact on the inter-tidal habitats. The cantilever method of construction for the proposed bridge is readily suitable for construction across such an environmentally sensitive area. This form of construction permits deck segments to be erected and supported from above rather than from below, thus minimising any impact on the areas of foreshore over which the bridge will travel.

The only impacts are the need for an abutment on a small area of sheltered inter-tidal mudflat on the northern shore and access over a small section of foreshore on the southern side. The proposed mitigation measures highlighted in Section 7.2 will ensure that these impacts are negligible.

Sub-tidal Habitat and Aquaculture

Sub-tidal habitat

The sub-tidal area over which the bridge will lie is classified as a Wild (Mussel) Fishery and is regularly dredged. This dredging has resulted in the sub-tidal zone being of very limited ecological value and as such the impact is considered negligible and no mitigation measures are deemed necessary in this instance.

Impact on Aquaculture

Commercial aquaculture beds occur within Carlingford Lough and are not present in the immediate vicinity of the proposed bridge. A Wild (Mussel) Fishery is present. The hydrodynamic modelling exercise has shown clearly that sediment release will be minimal and temporary. Mussels naturally occur in estuaries where high levels of suspended sediments occur, as is the case at Narrow Water, and are therefore well adapted to existing in areas with variable sediment loadings. Based on this it is considered highly unlikely that a negative impact on the commercial mussel production within Carlingford Lough will arise as a consequence of sediment mobilisation. It is considered more likely that the loss of access to the trawling area and the introduction of navigation hazards will result in compensation issues with respect to access to the Wild Fishery. (*This issue is considered beyond the remit of this Environmental Impact Assessment.)*

Migratory Fish

During their life cycle, salmon and eel pass through estuaries on their way upstream or downstream, depending on what part of their life cycle they are going through. It is considered very unlikely that either species would be negatively impacted by temporary increases in sediment loads. The required in-river piling has the potential to act as a barrier to fish movement, although this will be limited to normal working hours and as such free movement will be available for at least half of the 24hour tidal cycle. Despite this, in order to limit this impact it is proposed to construct the required coffer dam and undertake the in-river piling outside the main fishery migration period.

With respect to the operational phase, the chosen bridge design has minimal impact on the aquatic environment and as such will not create a barrier to fishery movements. Bridge lighting will be architectural uplighting only and as such, similarly, will not hinder fish movements.

Water Quality

During the operational phase there will be no impact on water quality. With respect to the link road and bridge the drainage will use SuDS methods and run-off will pass through swales, attenuation ponds and petrol interceptors before entering the estuary (refer Chapter 3). There will be a temporary mobilisation of sediment. However the hydrodynamic modelling has shown that this will have a negligible impact on water quality.

The construction method (refer Chapter 11) includes for the installation of temporary coffer dams around the sites of the anchorage abutments on both shores. Therefore, during construction the only potential impact on water quality will occur when the coffer dams are being constructed and removed and for a short time afterwards when the sediment is being redistributed by tidal and river velocities. Turbidity levels will increase during these periods but as the estuary is naturally a turbid environment, these temporary changes in water quality are not seen as being significant in terms of the functioning of the ecosystem.

7.3.3 Mitigation Measures

Fishery Migration

The issue in this instance is the requirement to avoid preventing salmonids, eels or lamprey species migrating upstream. The sheet piling which is necessary in coffer dam construction could prevent this migratory movement. These operations will only be undertaken during normal working hours and as such will allow fish movement during at least half of the 24 hour tidal cycle. However in order to minimise any impact on fish movements, the construction and removal of the coffer dam and necessary in-river piling shall be undertaken outside of the main migratory periods. With respect to this, the contractor shall be required to submit their methodology and timing to and receive the agreement of the Loughs Agency.

Mitigation Measures

The following mitigation measures are proposed to prevent the occurrence of any pollution incidents:

- Throughout all stages of the construction phase of the project the contractor shall ensure that good housekeeping is maintained at all times and that all site personnel are made aware of the importance of the associated aquatic environment and the requirement to avoid pollution of all types.
- The storage of oils, hydraulic fluids, etc will be undertaken in accordance with current best practice for oil storage.
- Oil interceptors will be provided in order to prevent runoff of pollutants to river.
- An emergency plan to deal with accidental spills will be drafted.
- Any land drains or pipes served along the route will be connected into new pipes or ditches.
- The pouring of concrete, sealing of joints, application of water-proofing paint or protective systems, curing agents, etc will be completed in the dry to avoid pollution of the freshwater environment.
- All machinery operating in-stream will be steam-cleaned in advance of works and routinely checked to ensure no leakage of oils or lubricants occurs. All fuelling of machinery will be undertaken within the site compound. Steam cleaning will also ensure no accidental spread of invasive species into the river system or Carlingford Lough.
- The timing of In-stream works (construction of the central pier) shall be agreed with the Loughs Agency and will be arranged to avoid impacting on the main estuarine migratory movements of salmon and lamprey (main upstream movement through the estuary considered as being June through October).
- Dredged spoil will be removed off site and disposed of under appropriate licence or permissions to an authorised spoil depository location.

7.3.4 Conclusions

Given the very low effect of the chosen bridge design on the estuary hydrodynamics and therefore sediment mobilisation, and the requirement for only very slim piers within the aquatic environment, the proposed bridge is considered to have negligible impact on the ecological functioning of the estuary.

7.3.5 References

Moriarty, C. 1999. Strategy for the development of the eel fishery in Ireland. Fisheries Bulletin No. 19. Marine Institute.

Wheeler, A. 1978. Key to the fishes of Northern Europe. Frederick Warne & Co. Ltd., London, 380 pages.

7.4 Noise and Vibration

7.4.1 Introduction

This section seeks to determine the existing noise environment around the proposed Narrow Water bridge and link road. This assessment includes the prediction of any potential noise impact from traffic activity along the link road and recommends mitigation measures where deemed necessary.

The assessment of noise levels within Co Down and within Co Louth have been assessed separately and concurrently.

7.4.2 Methodology

As the development is a cross-border link road it is necessary to assess the impact with regard to both the UK and Republic of Ireland regulations for traffic noise and associated guideline documents.

Within Northern Ireland it is normal practice to assess the potential noise impact from proposed road schemes, at this design stage, with regard to the *Design Manual for Roads and Bridges* (DMRB, 2008) document with particular reference to Section 3, Part 7 and in line with a 'Detailed' assessment methodology.

For those properties within Co Louth, the potential impact of traffic noise has been assessed for all properties within 300m of the preferred route option, following the methodology of the *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* 2004 (GTNV).

In addition, there is the potential impact of construction works associated with the proposed development although this will be temporary in nature. This involves preparation of the route, supply of materials, construction of roads and bridges, and landscaping, and has been assessed in line with BS5228 (1997) *Noise and Vibration Control on Construction and Open Sites* and the NRA's *GTNV (2004)* document.

Co Down DMRB Assessment Methodology

DMRB, 1994 has recently been superseded by DMRB 2008. The assessment will follow the methodology and requirements set out in DMRB 2008 for a 'Detailed Assessment'. *The Design Manual for Roads and Bridges* is the standard document for use in the UK for the assessment of impact from road schemes.

The 'Detailed Assessment' involves more detailed assessment of noise and vibration impact at dwellings and other receptors. It is typically necessary to calculate noise levels within 600m as in the 'simple assessment'. In addition the calculations are to be carried out at 1.5m and at 4m (for dwellings with a 1st floor) within the baseline/opening and future/15th year for the Do-Min and Do-Something scenarios.

The proposed link road will experience relatively low predicted traffic flows. The existing A2 dual carriageway currently experiences relatively high traffic flows. Due to these factors it has been decided that an assessment range of 300m from any works will be used as a basis for this assessment within Northern Ireland (DMRB). This allows conformity with the GTNV assessment which is based on a 300m range.

In general the noise assessment is used to predict the noise impact on the properties close to the preferred route and to compare this impact with existing noise levels at these locations in terms of a change in noise level and potential nuisance. This is then compared to the effects of not proceeding with the proposed road - the ‘Do Minimum’ option - in terms of ongoing noise impact on properties close to the existing route.

The DMRB methodology considers noise levels with regard to the $L_{A10,18h}$ index. This value is the noise level exceeded for 10% of the time, averaged over a period between 06:00-24:00, and is widely considered to best represent the perceived traffic noise impact at a location. Some guidance documents refer to the L_{Aeq} index, which is used to describe a variety of noise sources. With reference to BS8233 Section 6.2.3, an approximate relationship for moderate and heavy traffic flows is that $L_{Aeq,16h} \approx L_{A10,18h} - 2$. Under low flow conditions, such as rural settings, there is no consistent relationship and L_{Aeq} values can be higher than equivalent L_{A10} values. In this assessment, the $L_{A10,18h}$ index is used in the prediction and assessment of traffic noise, while the L_{Aeq} index is used in the prediction and assessment of construction noise. Explanations of noise terms used in this assessment are presented in **Appendix 7.7** at the end of this chapter.

As it has been decided that a 300m calculation range will be sufficient for this assessment, all properties and noise sensitive locations within 300m of the existing and proposed routes have been identified.

Because of the small number of properties directly affected by the proposed route, the specific properties have been identified and used to determine the specific noise impact of the proposed route. The property locations are presented in **Figure 7.4** in Volume 3. Each property has been assigned an identification number.

Location 11 is the only receptor location considered for the DMRB assessment in Co Down. A planning application has been made for housing at this site. A receptor location has been selected within this site as detailed in **Figure 7.4** in Volume 3. This will allow for a consideration of the noise impact on any future development at this location.

Co Louth GTNV Assessment Methodology

GTNV recommends that the predicted noise level of the proposed road scheme should be calculated using the methodology of the *Calculation of Road Traffic Noise (CRTN)* document (DOT, 1988). This complies with the requirements for the DMRB assessment.

GTNV noise assessment is used to predict the noise impact on the properties within the 300m band of the preferred route and to compare this impact with existing noise levels at these locations in terms of a change in noise level. This is then compared to the effects of not proceeding with the proposed road - the ‘Do Minimum’ option - in terms of ongoing noise impact on properties close to the existing route. In this regard it is considered appropriate for use as the basis of a noise assessment as part of an Environmental Impact Statement / Environmental Statement.

GTNV considers the noise impact from new road schemes with reference to L_{den}, and indicator that is a composite of long term L_{Aeq} values for day, evening and night (termed L_{day}, $L_{evening}$ and L_{night}). The document presents a design target for new road schemes of 60 dB L_{den}, free field, over which mitigation measures should be provided to reduce the potential noise impact of the road noise on the existing residential units. However, as stated in the document, this design target is for new road schemes and mitigation measures are only deemed necessary when the following three conditions are satisfied at noise sensitive receptors:

(i) the combined expected maximum traffic noise levels, i.e. the relevant noise level, from the proposed road scheme together with other traffic in the vicinity is greater than the design goal;

(ii) the relevant noise level is at least 1 dB more than the expected noise level without the proposed road scheme in place;

(iii) the contribution to the increase in the relevant noise level from the proposed road scheme is at least 1 dB.

These conditions will ensure that mitigation measures arising out of this process are based upon the impact of the scheme under consideration.

The recommended method for predicting the L_{den} value is to use CRTN to predict the $L_{A10,18hr}$, or $L_{A10,1hr}$, and convert the resulting value using one of the stated methodologies.

All properties and noise sensitive locations within 300m of the existing and proposed routes have been identified within three 100 m wide bands.

Measurements and predictions are presented for locations adjacent to the proposed road scheme as ‘worst case’ positions. It is submitted that all remaining properties are located at greater distances and/or screened from the road by intervening properties, such that the predicted impact will be lower, and within the proposed target level.

7.4.3 Existing Environment

During the site surveys, the predominant noise source at each identified location was determined in line with the methodology of GTNV and DMRB. Where a location was determined to be presently impacted by traffic, the existing traffic noise levels have been calculated to assess the change in impact. The existing noise level at the most proximate noise sensitive receptor (‘Location 1’) has been measured over a 24 hr period (see **Figure 7.5** in Volume 3)

This determination method reflects the greater potential impact at a location which, prior to road construction, would not have been exposed to traffic noise levels as compared with a location already subject to traffic impact. The proposed route impacts on noise sensitive locations within both of these broad classifications.

It is noted in the document that the accuracy of measurements is partially dependent on weather conditions (ref: DMRB Paragraph 5.8). Consequently, measurements were taken when weather conditions were favourable, with all readings being recorded in dry conditions and low to moderate wind speeds. The details and results of the measurements are given in Table 7.4.1.

The measurement location is presented in **Figure 7.5** in Volume 3. All measurements presented in this report were obtained using Type 1 instrumentation, calibrated as required to the appropriate international standards.

Table 7.4.1 Measurement Results at location '1'. (24 Hr monitoring 23rd – 24th September 2008)

Hour	L_{Aeq}	L_{AMax}	L_{A10}	L_{A50}	L_{A90}
12:00 noon	54.9	81.6	50.2	46.8	44.5
13:00	47.8	58.7	49.9	47.5	45.2
14:00	48.4	64.7	50.6	48.1	45.5
15:00	48.8	60.7	50.8	48.5	46.3
16:00	54.8	82.1	51.7	47.2	46.5
17:00	51.0	67.0	52.4	50.2	48.4
18:00	50.9	73.5	52.6	50.2	48.2
19:00	51.5	68.0	53.3	49.8	47.1
20:00	50.2	62.2	53.1	49.2	45.3
21:00	58.4	62.7	51.7	46.7	42.7
22:00	46.3	63.5	49.4	44.0	39.0
23:00	43.7	62.8	47.0	40.1	31.9
00:00 midnight	41.1	59.4	44.4	35.4	28.6
01:00	36.1	52.0	39.7	31.7	27.9
02:00	37.5	57.0	40.9	32.2	27.6
03:00	37.7	59.2	39.1	31.1	27.1
04:00	39.3	58.0	42.5	34.5	28.4
05:00	43.2	60.0	45.6	40.6	33.9
06:00	48.7	67.4	51.5	47.6	43.7
07:00	51.0	64.3	53.9	50.1	46.2
08:00	51.7	71.2	54.0	51.0	48.4
09:00	49.4	60.5	51.9	48.6	45.9
10:00	48.7	62.1	51.6	47.3	44.0
11:00	47.8	55.2	51.9	46.6	43.2

7.4.4 Impact Assessment

Prediction of Traffic Noise Impact

It is necessary in assessing the change in noise level and potential nuisance, to predict the traffic noise levels due to the proposed road in the assumed year of opening (baseline) and in the future assessment year (15th year). The prediction of noise levels has been calculated using the Datakustik Cadna/A proprietary acoustic modelling software. The Cadna/A application calculation system complies with the *Calculation of Road Traffic Noise* methodology (DOT, 1988) and is also in accordance with DMRB.

There are 14 sensitive locations which have been identified as shown in **Figure 7.4** in Volume 3. Location 10 has been incorporated within the assessment. Although the property is more than 300m away from the edge of the scheme it is on the edge of the assessment limits and it was agreed to include this property within the assessment.

The traffic flows used in the assessment have been based on those provided in the Traffic Impact Assessment ensuring that a worst case scenario has been assessed. Results are summarised in Table 7.4.2 for the baseline year and future assessment year respectively.

Predicted Noise Levels

The noise level at each of the identified locations has been predicted. The predicted noise levels at each receptor, in the baseline year and future assessment years, in the do-minimum and do-something scenarios are presented in Table 7.4.2**.**

Table 7.4.2: Summary of noise impact at identified locations in the assumed year of opening (BASELINE YEAR), and the future assessment year (15th YEAR), Do-Minimum and Do-Something (Free Field)

Location Number (Co Louth unless otherwise stated)	Do-Minimum				Do-Something			
	Baseline Year		Future Assessment Year		Baseline Year		Future Assessment Year	
	1.5m	4m	1.5m	4m	1.5m	4m	1.5m	4m
1	54.1	54.8	54.8	55.4	58.4	59.8	59.2	60.5
2	60.7	62.9	61.7	63.9	62.4	64.5	63.1	65.2
3	55.7	57.6	56.5	58.4	56.8	58.7	57.6	59.4
4	57.9	59.7	59.0	60.8	59.5	61.5	60.2	62.3
5	68.7	70.6	69.6	71.5	68.0	69.9	68.7	70.6
6	62.4	65.5	63.4	66.5	62.3	65.4	63.0	66.1
7	63.6	65.1	64.5	66.0	62.9	64.4	63.6	65.1
8	56.5	58.4	56.6	58.4	57.0	58.8	57.7	59.6
9	59.2	61.7	59.9	62.5	60.1	62.7	60.9	63.4
10	63.2	65.4	64.3	66.5	64.5	66.7	65.2	67.4
11 (Co Down)	63.2	65.2	64.9	67.0	64.5	66.5	65.3	67.3
12	49.5	50.3	50.5	51.3	51.4	52.1	52.1	52.8
13	49.2	50.4	50.2	51.4	50.8	51.9	51.5	52.6
14	50.4	51.3	51.4	52.3	52.2	52.9	52.9	53.6

It is necessary to apply a +2.5 dB facade correction to the predicted noise values which will be incorporated within the DMRB assessment. Only one location within Co Down will be assessed within the DMRB assessment. The corrected predicted noise levels are presented in Table 7.4.3.

Table 7.4.3: Summary of noise impact at Location11 in the assumed year of opening (BASELINE YEAR), and the future assessment year (15th YEAR), Do-Minimum and Do-Something

Location Number	Do-Minimum				Do-Something				
	Baseline Year		Future Assessment Year		Baseline Year		Future Assessment Year		
	1.5m	4m	1.5m	4m	1.5m	4m	1.5m	4m	
P11 (Co Down)	63.2	65.2	64.9	67.0	64.5	66.5	65.3	67.3	Free Field
P11 (Co Down)	65.7	67.7	67.4	69.5	67.0	69.0	67.8	69.8	Including Façade Correction

Impact at Properties Close to Roundabouts and other Junctions

The *Calculation of Road Traffic Noise* document excludes the prediction of noise from a junction. Rather, it states that noise levels should be predicted by considering free flowing traffic on either side of the junction with no reduction in mean traffic speed (ref: CRTN Paragraph 33 and Annex 16). Therefore, any effect from the proposed new junction at the southern end of the scheme would be neglected in the DMRB assessment, and the noise impact would be as assessed for the free-flowing carriageways. The proposed new link road/bridge will tie into the existing roundabout.

The differences between free-flow conditions and restricted flow at roundabouts and other junctions can be demonstrated by reference to recorded work on the assessment of the effects of the Corr's Corner roundabout on the predicted noise impact from the A8 Belfast-Larne road. Noise measurements using the CRTN Shortened Measurement Procedure were conducted on 17 March 2000 under appropriate conditions (ref. CRTN, Paragraphs 39-41). Two measurement locations were chosen: firstly, at equal distances to traffic on the roundabout, on a minor approach road and exit traffic towards Larne; and secondly, approach traffic from Larne and traffic on the roundabout.

Calculations in line with CRTN were made using the measured levels and data available for this section of road such that a comparison could be made of predicted levels of free-flowing traffic against measured levels at the roundabout.

The measurements and calculations indicate that:

- measured levels and resulting change in impact are consistent at both locations;
- the assumption of free-flowing traffic at locations close to a roundabout will tend to overestimate the noise impact by circa 2.5 dB;
- the equivalent reduction in mean traffic speed to obtain this reduction in noise level has been calculated as -26 km/h.

Therefore, it is considered that the assessed noise impact at any property close to the proposed junction would tend to overestimate the level at that property, due to an effective reduction in mean traffic speed on approach to the junction.

7.4.5 Co Down Noise Assessment (DMRB)

Noise Assessment Comparisons

Location 11 is the only property assessment location within Co Down which will be assessed according to DMRB.

The following comparisons have been completed based on the predicted noise levels and are presented in **Appendix 7.8** at the end of this chapter**.**

(i) **Table A1.** Change in Noise Level at Identified Locations Do minimum in the Baseline year against Do something condition in the Baseline Year.

(ii) **Table A2.** Relative Change in Noise Level at Identified Locations Do minimum in the Baseline year against Do something condition in the Future Assessment Year.

(iii) **Table A3.** Change in Noise Level at Identified Locations Do minimum in the Baseline year against Do minimum condition in the Future Assessment Year.

A simple assessment table has been produced for each of the comparisons required by DMRB. The number of properties which will experience a positive or negative change in level within the range of '0', '0.1 – 0.9', '1 - 2.9', '3 – 4.9' and 5 + dB are presented. The counts are presented in Tables 7.4.4 and 7.4.5.

Baseline Year

Table 7.4.4. Simple Assessment Table, Do minimum in the Baseline year against Do something condition in the Baseline Year

Option/Comparison: Do minimum in the Baseline year against Do something condition in the Baseline Year.				
Change in noise level, $L_{A10,18h}$ dB	**Number of dwellings subject to a change in noise level**		**Number of other sensitive receptors subject to a change in noise level**	
	Increase in noise level	**Decrease in noise level**	**Increase in noise level**	**Decrease in noise level**
0	-	-	-	-
0.1 – 0.9	-	-	-	-
1 – 2.	1	-	-	-
3 – 4.9	-	-	-	-
5 +	-	-	-	-
Total	1	-	-	-

It can be seen from **Table 7.4.5** that within the baseline year no major impacts are predicted. Location 11 will experience a 1.3 dB increase in noise levels which can be described as a 'Minor' impact.

Future Assessment Year

Table 7.4.5 Simple Assessment Table, Do minimum in the Baseline year against Do something condition in the Future Assessment Year.

Option/Comparison: Do minimum in the Baseline year against Do something condition in the Future Assessment Year.				
Change in noise level, $L_{A10,18h}$ dB	**Number of dwellings subject to a change in noise level**		**Number of other sensitive receptors subject to a change in noise level**	
	Increase in noise level	**Decrease in noise level**	**Increase in noise level**	**Decrease in noise level**
0	-	-	-	-
0.1 – 0.9	-	-	-	-
1 – 2.9	1	-	-	-
3 – 4.9	-	-	-	-
5 +	-	-	-	-
Total	-	-	-	-

It can be seen from **Table 7.4.5** that within the future assessment year no major impacts are predicted. Location 11 will experience a 2.1 dB increase in noise levels which can be described as a 'Minor' impact.

Assessment of Traffic Noise Impact

The introduction of the new link road will result in an increase in the number of vehicles on the surrounding link roads.

The noise levels at existing location which are currently exposed to noise will see a relative increase due to the presence of the bridge and the associated link road. The proposed route will create a perceptible increase in noise levels at locations that are currently not exposed to high levels of transportation noise due to their semi/rural location.

Following the Noise Insulation Guidelines, if a property is exposed to a noise impact level greater than 68 dB $L_{A10,\ 18hr}$, and is subject to an increase of more than 1 dB, then the property is eligible for Noise Insulation. It is predicted that the noise level at location 11 will be increased to 69 dB $_{LA10,\ 18hr}$ within the baseline year under the Do-Something scenario. It should be noted that the increase is 1.3 dB which would be classified as a 'Minor' impact according to table 3.1 of DMRB 2008.

Mitigation Measures for Traffic Noise

As stated previously, it is predicted that there is one location where the noise level will be increased to more than 68 dB $L_{A10,18hr}$ within the baseline year. The opening of the road will create an immediate impact at this location. It is important to note that the do minimum impact in the future assessment year will be in excess of 68 dB $L_{A10,18hr}$. It has been determined that this location meets the criterion for the determination of statutory sound insulation eligibility. Following the Noise Insulation Guidelines, if a property is exposed to a noise impact level greater than 68 dB $L_{A10,\ 18hr}$, and is subject to an increase of more than 1 dB, then the property is eligible for Noise Insulation.

However, in this instance it considered that mitigation is not required under the noise insulation regulations for location 11. As stated previously there is currently a planning application lodged for residential development at this site. This application is at outline planning stage and no detailed layout is currently available.

However due to the existing high traffic noise levels generated by the Newry Rd (A2 dual carriageway) the applicant will have to provide mitigation at the nearest properties to ensure that suitable noise levels are achieved internally. This negates the need for any mitigation at the road, should the properties, due to the final location, be eligible for noise insulation.

Despite this, it is proposed to use a low noise road surface throughout to reduce the noise impact. The low noise road surface will reduce the noise levels by between 3 and 5 dB, therefore below the 68 dB $L_{A10,\ 18hr}$ level or to within 1 dB of the noise impact level under the 'Do Minimum' scenario. The noise levels at this location will be reduced to within the predicted noise levels for the do-minimum scenario.

These measures are in line with the guidance of DMRB Paragraph 7.2 and are appropriate for consideration at this stage of the design.

7.4.6 Co Louth Noise Assessment (GTNV)

Determination of L_{den}

It would be typical when assessing the change in noise level to predict the traffic noise levels due to the proposed road in the year of opening and in the steady state (the design year, 15th year). Therefore, these figures will be used to predict the potential noise impact of the proposed route.

The prediction of noise levels has been calculated using CADNA noise modelling software, following the methodology of the *Calculation of Road Traffic Noise* document (DOT, 1990) in accordance with GTNV. The software was used to predict a $L_{A10,18hr}$ noise level and converted to LDEN using Method B in GTNV, due to the proposed low traffic flows on the bypass.

The L_{den} value is then converted using the following methodology (ref. Method B – GTNV):

$$\mathbf{L_{den} = 0.86 \times L_{A10,18hr} + 9.86\ dB}$$

It is submitted that Method B is the most appropriate method for predicting the L_{den} due to the low traffic flows on the proposed road scheme

The potential noise impact of the proposed road is compared to the ongoing noise impact of traffic on the existing noise environment.

13 locations have been identified within Co Louth as shown in **Figure 7.4** in Volume 3. Results are presented in Table 7.4.7.

Property Counts

The receptor counts for each band are presented in Table 7.4.6.

Table 7.4.6: Numbers of residential properties within 300m of the proposed route within Co Louth

Distance Bands	0-100 m	100-200 m	200-300 m	Total
Proposed Route	5	3	4	12

NB: Measured from the edge of the carriageway.

Determination of Mitigation Eligibility

The predicted noise levels have been used to determine the eligibility for mitigation at each of the locations. The eligibility of a property is based on the meeting of 3 criterion presented in section 2.3.1 (Operational Noise) of the GTNV document.

As stated in the document, this design target is for new road schemes and that mitigation measures are only deemed necessary when the following three conditions are satisfied at noise sensitive receptors:

(i) the combined expected maximum traffic noise levels, i.e. the relevant noise level, from the proposed road scheme together with other traffic in the vicinity is greater than the design goal;

(ii) the relevant noise level is at least 1 dB more than the expected noise level without the proposed road scheme in place;

(iii) the contribution to the increase in the relevant noise level from the proposed road scheme is at least 1 dB.

The document presents a design target for new road schemes of 60 dB L_{den}, free field, over which mitigation measures should be provided to reduce the potential noise impact of the road noise at existing residential units.

The level comparisons and the details of locations requiring mitigation are presented in Table 7.4.7.

Table 7.4.7: Requirements for noise mitigation, Opening and Design Year, (Based on 4m calculation height)

Location	Opening Year (Baseline)				Design Year (Future Assessment)			
	Predicted Noise Levels		Level Difference	Mitigation Required?	Predicted Noise Levels		Level Difference	Mitigation Required?
	Do-Minimum	Do-Something			Do-Minimum	Do-Something		
	dB L_{den}	*dB L_{den}*	*dB*		*dB L_{den}*	*dB L_{den}*	*dB*	
1	55.6	59.9	4.3	*No*	56.1	60.5	4.4	***Yes***
2	62.6	63.9	1.3	*No*	63.4	64.6	1.2	*No*
3	58.0	59.0	1	*No*	58.7	59.6	0.9	*No*
4	59.8	61.4	1.6	***Yes***	60.8	62.1	1.3	*No*
5	69.2	68.6	-0.6	*No*	70.0	69.2	-0.8	*No*
6	64.8	64.7	-0.1	*No*	65.7	65.3	-0.4	*No*
7	64.5	63.9	-0.6	*No*	65.2	64.5	-0.7	*No*
8	58.7	59.0	0.3	*No*	58.7	59.7	1	*No*
9	61.5	62.4	0.9	*No*	62.2	63.0	0.8	*No*
10	64.7	65.8	1.1	*No*	65.7	66.4	0.7	*No*

Table 7.4.7: Requirements for noise mitigation, Opening and Design Year, (Based on 4m calculation height) Contd.

Location	Opening Year (Baseline)				Design Year (Future Assessment)			
	Predicted Noise Levels		Level Difference	Mitigation Required?	Predicted Noise Levels		Level Difference	Mitigation Required?
	Do-Minimum	Do-Something			Do-Minimum	Do-Something		
	dB L_{den}	*dB L_{den}*	*dB*		*dB L_{den}*	*dB L_{den}*	*dB*	
12	51.7	53.3	1.6	*No*	52.6	53.9	1.3	*No*
13	51.8	53.1	1.3	*No*	52.7	53.7	1	*No*
14	52.6	54.0	1.4	*No*	53.5	54.6	1.1	*No*

Assessment of Traffic Noise Impact

The assessment has predicted that there will be an increase in traffic noise levels at two existing residential properties located adjacent to the proposed new link road.

The level at the closest residential property (Location 1) will be increased to over 60 dB L_{den} in the design year (15th year). This property will experience a 4.4 dB increase in noise levels within the design year due to the introduction of the scheme.

The noise level at location 4 will be increased to over 60 dB L_{den} within the opening year and within the design year.

The introduction of the proposed scheme will cause the design target level to be exceeded within these scenarios. It is necessary to incorporate mitigation measures within the design of the road to reduce the noise levels at the identified properties.

Mitigation Measures for Traffic Noise

It has been identified that the noise levels at two properties will meet the criterion for mitigation.

It is proposed to use a low noise road surface to reduce the noise impact at the majority of these locations. The low noise road surface will reduce the noise levels by between 3 and 5 dB, therefore below the 60 dB L_{den} or to within 1 dB of the noise impact level under the 'Do Minimum' scenario.

Considering a 3 dB reduction in the predicted noise levels, the level at location 1 will be reduced to 57.5 dB L_{den} during the design year and within the 60 dB L_{den} criterion.

A 3dB reduction in noise levels at location 4 will reduce the noise level to 58.4 dB L_{den} and within the 60 dB L_{den} criterion.

The use of a low noise road surface is a standard mitigation method and may be considered as appropriate for consideration at this design stage.

7.4.7 Comment on Potential Vibration Impact

The assessment of vibration impact and disturbance is detailed in Chapter 6 of DMRB Section 3, Part 7. It is considered likely that the reference source of this chapter is research work by the Transport Research Laboratory (TRL) and particularly Report 246 “Traffic Induced Vibrations in Buildings”. The DMRB chapter makes a number of points:

- vibration levels from traffic are low, even in properties close to heavily trafficked roads, and normal use of the building often generates much higher vibration levels.
- extensive research has shown that traffic induced vibrations do not cause significant damage to buildings.
- the highest levels of traffic induced vibration are generated by irregularities in the road, and this is unlikely to be an important consideration for new roads. However, as road conditions may be improved during maintenance work, it should not be presented as a benefit of a new scheme. (The TRL Report 246 presents a prediction method for traffic vibration in which the depth/height of an irregular surface is a main component in the assessment of peak particle velocity effects. As this value approaches 0, the induced vibration also approaches 0. Thus a new surface has limited potential for vibration impact).
- notwithstanding the TRL report, DMRB concludes that ground-borne vibration levels depend on many factors and are difficult to accurately predict.
- airborne vibration is more likely to cause disturbance than ground-borne vibration, but both sources of vibration will cause less disturbance than noise, and are applicable within a shorter distance from the road.

Other empirical matters, relating to traffic induced vibrations, have been monitored and noted by this consultancy (FR Mark and Associates). Some general guidance on the effect of vibrations is contained in BS6472 (1992), “Guide to Evaluation of Human Exposure to Vibration in Buildings” and BS7385 (1990 and 1993), “Evaluation and Measurement for Vibration in Buildings”.

Vibration associated with heavy impact activities, such as piling, on other construction sites have been measured as less than 0.5 mm/s at 20m. Vibration from HGV road traffic has also been measured at less than 0.5mm/s at 15m in other locations with good road conditions.

Empirical data, as detailed above, suggests that vibration levels will be less than 0.5mm/s at all properties and structures. With reference to BS6472, it is considered that this represents a “low probability of adverse comment” by residents. With reference to BS7385 and allowing for normal circumstances, this vibration level is not of a severity that might cause any structural damage to property. Despite this vibration monitoring will be undertaken during the initial pile driving exercise to ensure that there will be no structural damage to any property or protected structure in the vicinity.

7.4.8 Prediction of Short-term Construction Noise Impact

There is a potential for noise impact from construction works associated with the proposed development although this is short-term in nature, and a temporary impact at any single property.

It will ultimately be the responsibility of the nominated contractor to specify the plant to be used and the most efficient methodology. However, there are types of plant and activities which are typical for these construction works, and ‘worst case’ levels have been compiled from BS5228 and presented in Table 7.4.8. Further, the prediction of noise levels due to combined activity has been calculated for each significant stage of work using the individual plant noise levels, and the resulting impacts at varying distances from the activity are shown in Table 7.4.9.

Due to the linear nature of the road construction, the duration of activity at any property near to the works will only be temporary. There may be occasions where work is extended in one location or it may be the contractor's preference to carry out different stages of works at different times.

Table 7.4.8: Noise Levels for Construction Plant and Activities (ref: BS5228)

Plant / Activity	dB L_{Aeq} at 10 m
Haulage lorries	70
30 tonne excavator	87
D6 dozer	86
Wheeled dozer	80
2 dump trucks (combined)	81
Pumping/dewatering	81
Demolition (rock breaking)	90
Compacting fill (vibrating roller)	78
Road surfacing (asphalt work)	75-80
Road roller (finishing)	80

Table 7.4.9: Typical Combined Construction Noise Levels

	dB				
Activity	L_{Aeq} at 10m	L_{Aeq} at 50m	L_{Aeq} at 100m	L_{Aeq} at 200m	L_{Aeq} at 400m
Site clearance and preparation of working width	87	73	67	61	55
Preparation of access	90	76	70	64	58
Topsoil stripping	89	75	69	63	57
Route excavation and preparation	85	75	65	59	54
Road works	91	77	71	65	59
Landscaping	75	61	55	49	43
HGV movements (up to 3 units together)					
Pile Driving					
assume driven precast (worst case)	91	77	71	65	59
Sheet Piling (Kring/Ice Hammer)	90	76	70	64	58

NB: No correction for absorbent ground is applied to this data

Assessment of Short-term Construction Noise Impact

Based on the predicted impact levels, it is anticipated that construction noise levels will exceed the existing ambient noise level at properties closest to the site. The extent of this impact at any property will vary – depending on the specific plant being used, the distance or range of distances to the property, the "on time" of each activity, and any localised screening.

However, it is recognised that construction activity is typically temporary in nature, with a requirement to use plant with high noise levels at specific locations. Therefore, the ability to control construction noise levels relates primarily to the duration and time of construction activity in any one day. In this regard, Environmental Health Departments in Northern Ireland typically recommend maximum allowable noise and vibration levels at a construction site, as follows.

Airborne Noise Guideline Levels

Monday to Friday	Maximum at Measurement Points
07:00 - 19:00	75 dB $L_{Aeq,12h}$
19:00 - 22:00	65 dB $L_{Aeq,1h}$
22:00 - 07:00	No noise audible

Saturday	Maximum at Measurement Points
08:00 - 13:00	75 dB $L_{Aeq,12h}$
13:00 - 22:00	65 dB $L_{Aeq,1h}$
22:00 - 07:00	No noise audible

Sunday
No Operations

Vibration Guideline levels

Maximum continuous PPV 2.5 mm/s

Mitigation measures are presented to aid contractors in the appropriate control of construction noise to within these target levels.

Mitigation Measures for Construction Noise and Vibration

There are a number of mitigation measures which are considered appropriate and of good working practice for all construction contracts. These measures are detailed in BS5228 (1997), *Noise and Vibration Control on Construction and Open Sites*, and are summarised below. These guidelines should form the basis of control and limiting of potential impact to noise sensitive locations.

Choice of Plant

The contractor should take note of the control measures for relevant plant listed in BS5228 and apply the appropriate measures where practicable. These measures should include:

- Positioning of static plant as far as possible from residential properties, and utilising available screening by temporary structures, stock piles, etc.
- Use of well maintained plant, and where possible new plant manufactured under more strict EC guidelines for manufacturers.
- Substitution of unsuitable plant.
- Maintenance of silencers and moving components.

Screening

Temporary screening using sandbags, 20mm plywood sheeting or similar dense boarding may be required to reduce impact of static machinery or extensive works close to noise sensitive locations. Such measures can be best assessed during the contract by monitoring.

Monitoring

It would be appropriate to conduct noise monitoring of construction during noisy or extensive works at locations close to residential properties. Where the permitted noise levels are exceeded the appropriate screening will be put in place.

Measurements should be conducted using a Type 2 or better sound level meter to check on the continuing impact of the works.

With regard to vibration, vibration levels will be monitored at the beginning of the pile driving process to ensure that levels at the most proximate properties and structures does not cause damage.

Appointment of a Responsible Person

It is recommended that the contractor should appoint or delegate a 'responsible person' who will be present on site and who will be willing to answer and act upon queries from the local public.

Night Works

It is not anticipated that the contract will require any construction works to take place outside normal hours. However there may be items of plant (e.g. dewatering pumps and similar) in use during night-time hours. They should be chosen, sited and enclosed such that levels at the nearest properties do not exceed 45 dB L_{Aeq}. This level is based on the World Health Organisation criteria for undisturbed sleep, and assumes a resident may have a partially open window.

7.4.9 Conclusions

The potential noise impact of the proposed road scheme has been predicted for the assumed year of opening (baseline year), and the design year (15th, future assessment year), following an application of the procedures outlined in DMRB for those properties within Co Down and GTNV for those properties within Co Louth.

The potential impact of the proposed new link road has been assessed utilising the proposed traffic flows and computer based modelling. The proposed link road will generate noise at a number of locations not usually exposed to high levels of traffic noise.

The assessment has predicted that there will be an increase in traffic noise levels at the existing residential properties located adjacent to the proposed link road. This will be most significant in the centre section of the link road, where the properties are currently located at a distance from existing roads.

It is predicted that use of a low noise road surface will reduce the potential noise impact of the proposed road scheme to within the GTNV target noise level and meet the requirements set out in DMRB.

The potential noise impact of temporary construction noise has been assessed and a number of mitigation measures and best practice guidelines have been provided to minimise the noise impact.

APPENDIX 7.7
Explanation of Noise Terms

Definitions of environmental noise terms are detailed in ISO1996 (BS7445), *Description and Measurement of Environmental Noise*.

The following explanations of the terms used in this assessment are meant to clarify the nature and use of each term and are made with reference to the glossary of terms in PPG24 (*Planning and Noise*).

L_A A-weighted sound pressure level (in decibels, dB)

The measured sound level incorporating a logarithmic base and weighting system to approximate the manner in which humans perceive sound. An increase in 10 dB is approximately equivalent to a perceived doubling of loudness.

$L_{Aeq, T}$ Equivalent continuous A-weighted sound pressure level (in decibels, dB), over a given time interval An average of the energy associated with the noise at a location over a given time interval. Where a time interval is not given it is typically considered as a continuous level. Indicates the activity noise level of a source. Typical source descriptions include “ambient noise”, “specific noise” and “residual noise” as defined in BS4142.

$L_{A10,T}$ A-weighted sound pressure level (in decibels, dB) obtained using “Fast” time-weighting that is exceeded for 10% of the given time interval. Indicates the upper limit of a fluctuating noise source such as that from road traffic. For road traffic, it is typically expressed for peak hour, or as the arithmetic average of hourly L_{A10} values over an 18 hour day (06:00-24:00).

$L_{A90,T}$ A-weighted sound pressure level (in decibels, dB) obtained using “Fast” time-weighting that is exceeded for 90% of the given time interval. Defined as the background noise level at a location in BS4142.

$L_{A\ max}$ The highest A-weighted sound pressure level (in decibels, dB) recorded during a measurement event. May be obtained using either “Slow” time-weighting (as incorporated in PPG24) or “Fast” time-weighting (as incorporated in WHO *Guidelines for Community Noise* and BS8233)

L_{den} Day, Evening and Night. The level indicator adopted by some EU countries for the purposes of assessing annoyance. An ‘A’ weighted long term average sound level.

APPENDIX 7.8
Noise Assessment Tables

Table A1. Change in Noise Level at Identified Locations Do minimum in the Baseline year against Do something condition in the Baseline Year. (*proposed development)

Location	Predicted Noise Level Baseline Year, Do-Minimum $L_{A10,18h}$ dB (1.5m)	Predicted Noise Level Baseline Year, Do Something $L_{A10,18h}$ dB (1.5m)	Change dB
1	54.1	58.4	4.3
2	60.7	62.4	1.7
3	55.7	56.8	1.1
4	57.9	59.5	1.6
5	68.7	68.0	-0.7
6	62.4	62.3	-0.1
7	63.6	62.9	-0.7
8	56.5	57.0	0.5
9	59.2	60.1	0.9
10	63.2	64.5	1.3
11* (Co Down)	63.2	64.5	1.3
12	49.5	51.4	1.9
13	49.2	50.8	1.6
14	50.4	52.2	1.8

Table A2. Relative Change in Noise Level at Identified Locations Do minimum in the Baseline year against Do something condition in the Future Assessment Year. (*proposed development)

Location	Predicted Noise Level Baseline Year, Do-Minimum $L_{A10,18h}$ dB (1.5m)	Predicted Noise Level Future Assessment Year, Do Something $L_{A10,18h}$ dB (1.5m)	Change dB
1	54.1	59.2	5.1
2	60.7	63.1	2.4
3	55.7	57.6	1.9
4	57.9	60.2	2.3
5	68.7	68.7	0
6	62.4	63.0	0.6
7	63.6	63.6	0
8	56.5	57.7	1.2
9	59.2	60.9	1.7
10	63.2	65.2	2
11* (Co Down)	63.2	65.3	2.1
12	49.5	52.1	2.6
13	49.2	51.5	2.3
14	50.4	52.9	2.5

Table A3. Change in Noise Level at Identified Locations Do minimum in the Baseline year against Do minimum condition in the Future Assessment Year. (*proposed development)

Location	Predicted Noise Level Baseline Year, Do-Minimum $L_{A10,18h}$ dB (1.5m)	Predicted Noise Level Future Assessment Year, Do Minimum $L_{A10,18h}$ dB (1.5m)	Change dB
1	54.1	54.8	0.7
2	60.7	61.7	1
3	55.7	56.5	0.8
4	57.9	59.0	1.1
5	68.7	69.6	0.9
6	62.4	63.4	1
7	63.6	64.5	0.9
8	56.5	56.6	0.1
9	59.2	59.9	0.7
10	63.2	64.3	1.1
11* (Co Down)	63.2	64.9	1.7
12	49.5	50.5	1
13	49.2	50.2	1
14	50.4	51.4	1

Table A4: Predicted dB L_{A10} and L_{den} noise levels at identified locations in the assumed year of opening (BASELINE YEAR), and the future assessment year (15th YEAR), Do-Minimum and Do-Something.

Property Number (Co Louth unless otherwise stated)	Do-Minimum				Do-Something			
	Baseline Year		Future Assessment Year		Baseline Year		Future Assessment Year	
	1.5m	4m	1.5m	4m	1.5m	4m	1.5m	4m
P1	54.1	54.8	54.8	55.4	58.4	59.8	59.2	60.5
P2	60.7	62.9	61.7	63.9	62.4	64.5	63.1	65.2
P3	55.7	57.6	56.5	58.4	56.8	58.7	57.6	59.4
P4	57.9	59.7	59.0	60.8	59.5	61.5	60.2	62.3
P5	68.7	70.6	69.6	71.5	68.0	69.9	68.7	70.6
P6	62.4	65.5	63.4	66.5	62.3	65.4	63.0	66.1
P7	63.6	65.1	64.5	66.0	62.9	64.4	63.6	65.1
P8	56.5	58.4	56.6	58.4	57.0	58.8	57.7	59.6
P9	59.2	61.7	59.9	62.5	60.1	62.7	60.9	63.4
P10	63.2	65.4	64.3	66.5	64.5	66.7	65.2	67.4
P12	49.5	50.3	50.5	51.3	51.4	52.1	52.1	52.8
P13	49.2	50.4	50.2	51.4	50.8	51.9	51.5	52.6
P14	50.4	51.3	51.4	52.3	52.2	52.9	52.9	53.6

Table A5: Conversion of dB $L_{A10,18hr}$ to L_{den} (Baseline 'Opening' year, 4m Height, Free Field)

Location	Opening (Baseline) Do-Minimum (dB $L_{10,18hr}$)	Opening (Baseline) Do-Minimum (dB L_{den})	Opening (Baseline) Do-Some (dB $L_{10,18hr}$)	Opening (Baseline) Do-Some (dB L_{den})
1	54.8	55.6	59.8	59.9
2	62.9	62.6	64.5	63.9
3	57.6	58.0	58.7	59.0
4	59.7	59.8	61.5	61.4
5	70.6	69.2	69.9	68.6
6	65.5	64.8	65.4	64.7
7	65.1	64.5	64.4	63.9
8	58.4	58.7	58.8	59.0
9	61.7	61.5	62.7	62.4
10	65.4	64.7	66.7	65.8
12	50.3	51.7	52.1	53.3
13	50.4	51.8	51.9	53.1
14	51.3	52.6	52.9	54.0

Table A6: Conversion of dB $L_{A10,18hr}$ to L_{den} (Future Assessment, 'Design' year, 4m Height, Free Field)

Location	Design (Future Assessment) Do-Minimum (dB $L_{10,18hr}$)	Design (Future Assessment) - Do Minimum (dB L_{den})	Design (Future Assessment) Do-Some (dB $L_{10,18hr}$)	Design (Future Assessment) Do-Some (dB L_{den})
1	55.4	56.1	60.5	60.5
2	63.9	63.4	65.2	64.6
3	58.4	58.7	59.4	59.6
4	60.8	60.8	62.3	62.1
5	71.5	70.0	70.6	69.2
6	66.5	65.7	66.1	65.3
7	66.0	65.2	65.1	64.5
8	58.4	58.7	59.6	59.7
9	62.5	62.2	63.4	63.0
10	66.5	65.7	67.4	66.4
12	51.3	52.6	52.8	53.9
13	51.4	52.7	52.6	53.7
14	52.3	53.5	53.6	54.6

7.5 Air Quality and Climate

7.5.1 Introduction

AWN Consulting Limited has been commissioned to conduct an assessment into the likely air quality and climate impact associated with the proposed Narrow Water Bridge, linking Omeath, Co. Louth with Warrenpoint, County Down.

Ambient Air Quality Standards

In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or "Air Quality Standards" are health- or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set (refer Tables 7.5.1 - 7.5.4 at the end of this chapter).

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the Air Quality Standards Regulations 2002, which incorporate EU Directives 1999/30/EC and 2000/69/EC. These directives shall soon be superceded in Irish law by Council Directive 2008/50/EC (published 11/06/08), which combines the previous air quality framework and subsequent daughter directives (see Table 7.5.8). Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions.

In regards to existing ambient air quality standards, it is not proposed to modify the standards but to strengthen existing provisions to ensure that non-compliances are removed. In addition, new ambient standards for $PM_{2.5}$ are included in Directive 2008/50/EC. The approach for $PM_{2.5}$ is to establish a target value of 25 $\mu g/m^3$, as an annual average (to be attained everywhere by 2010) and a limit value of 25 $\mu g/m^3$, as an annual average (to be attained everywhere by 2015), coupled with a target to reduce human exposure generally to $PM_{2.5}$ between 2010 and 2020. This exposure reduction target will range from 0% (for $PM_{2.5}$ concentrations of less than 8.5 $\mu g/m^3$ to 20% of the average exposure indicator (AEI) for concentrations of between 18 - 22 $\mu g/m^3$. Where the AEI is currently greater than 22 $\mu g/m^3$ all appropriate measures should be employed to reduce this level to 18 $\mu g/m^3$ by 2020. The AEI is based on measurements taken in urban background locations averaged over a three year period from 2008 - 2010 and again from 2018-2020. Additionally, an exposure concentration obligation of 20 $\mu g/m^3$ has been set to be complied with by 2015 again based on the AEI.

The Department of the Environment in Northern Ireland (DOENI) has published the Air Quality Standards Regulations (Northern Ireland) 2007, which came into operation on 28 May 2007. The regulations incorporate EU Directives 1999/30/EC and 2000/69/EC as outlined in the UK Air Quality Strategy 2007. The UK Air Quality Strategy 2007 also incorporates the new approach for $PM_{2.5}$ as outlined in Council Directive 2008/50/EC (see above). The provisional limit value for PM_{10} after 2010 has been removed in line with the approach outlined in Council Directive 2008/50/EC (see Table 7.5.8).

Climate Agreements

Ireland ratified the United Nations Framework Convention on Climate Change (UNFCCC) in April 1994 and the Kyoto Protocol in principle in 1997 and formally in

May 2002[2,3]. For the purposes of the EU burden sharing agreement under Article 4 of the Kyoto Protocol, in June 1998, Ireland agreed to limit the net growth of the six GHGs under the Kyoto Protocol to 13% above the 1990 level over the period 2008 to 2012[4,5]. The UNFCCC is continuing detailed negotiations in relation to GHGs reductions and in relation to technical issues such as Emissions Trading and burden sharing. The most recent Conference of the Parties (COP13) to the agreement was convened in Bali, Indonesia in December 2007.

The UK ratified the United Nations Framework Convention on Climate Change (UNFCCC) in March 1994 and the Kyoto Protocol in principle in 1998 and formally in May 2002[3]. For the purposes of the EU burden sharing agreement under Article 4 of the Kyoto Protocol, in June 1998, the UK agreed to reduce six GHGs under the Kyoto Protocol by 12.5% compared to the 1990 level over the period 2008 to 2012[6].

7.5.2 Methodology

The impact of the scheme should also be assessed in terms of the relative additional contribution of the scheme, expressed as a percentage of the limit value. Although no relative impact, as a percentage of the limit value, is enshrined in EU Legislation, the Irish National Roads Authority document "*Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*"[1] details a methodology for determining air quality impact significance criteria for road schemes. The degree of impact is determined based on both the absolute and relative impact of the scheme. The NRA significance criteria have been adopted for the current scheme and are detailed in Tables 7.22 and 7.23). The significance criteria are based on PM_{10} and NO_2 as these pollutants are most likely to exceed the limit values. However the criteria have also been applied to the predicted 8-hour CO, annual benzene and annual $PM_{2.5}$ concentrations for the purposes of this assessment.

The air quality assessment has been carried out following procedures described in the publications by the EPA[7,8] and using the methodology outlined in the guidance documents published by the UK DEFRA[9-14]. The assessment of air quality was carried out using a phased approach as recommended by the UK DEFRA[9]. The phased approach recommends that the complexity of an air quality assessment be consistent with the risk of failing to achieve the air quality standards. In the current assessment, an initial scoping of possible key pollutants was carried out and the likely location of air pollution "hot-spots" identified. An examination of recent EPA and Local Authority data in Ireland[15-18] and Northern Ireland[19] (see below under "Available Background Data"), has indicated that SO_2, smoke and CO are unlikely to be exceeded at locations such as the current one and thus these pollutants do not require detailed monitoring or assessment to be carried out. However, the analysis did indicate potential problems in regards to nitrogen dioxide (NO_2), PM_{10} and $PM_{2.5}$ at busy junctions in urban centres[15-19]. Benzene, although previously reported at quite high levels in urban centres[17], has recently been measured at several city centre locations to be well below the EU limit value[15-19].

The current assessment thus focused firstly on identifying the existing baseline levels of NO_2 and benzene in the region of the proposed scheme, both currently (by carrying out a baseline survey and by analysis of suitable EPA, DOENI and Local Authority monitoring data), and when the scheme is opened (through modelling). Thereafter, the impact of the scheme on air quality at the neighbouring sensitive receptors was determined relative to the existing baseline when the scheme is opened (2011) and in the design year (Year 2031). The assessment methodology involved air dispersion modelling using the UK DMRB Screening Model[11] (Version 1.03c (Released July 2007)) and following guidance issued by the UK DEFRA[12-14] and the EPA[7,8]. The inputs to the air dispersion model consist of information on road layouts, receptor locations, annual average daily traffic movements (AADT), annual average traffic speeds and background concentrations. Using this input data the model predicts ambient ground level concentrations at the worst-case sensitive receptor using generic meteorological data. This worst-case concentration is then added to the existing background concentration to give the worst-case predicted ambient concentration. The worst-case ambient concentration is then compared with the relevant ambient air quality standard to assess the compliance of the proposed scheme with these ambient air quality standards.

7.5.3 The Baseline Environment

The following section details the variable factors that affect local air quality. They include meteorological data, trends in air quality and existing baseline air quality.

Meteorological Data

A key factor in assessing temporal and spatial variations in air quality is the prevailing meteorological conditions. Depending on wind speed and direction, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels)[20]. Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM_{10}, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than $PM_{2.5}$) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles ($PM_{2.5}$ - PM_{10}) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} will be a non-linear function of wind speed.

The nearest representative weather station collating detailed weather records (including cloud cover) is Dublin Airport meteorological station, which is located approximately 70km south of the site. Data from Dublin Airport meteorological station has been examined to identify the prevailing wind direction and average wind speeds over the period 2001 – 2005. For data collated during these years the predominant wind is southwesterly with an average wind speed of approximately 4-6 m/s.

Trends in Air Quality

Air quality is variable and subject to both significant spatial and temporal variation. In relation to spatial variations in air quality, concentrations generally fall significantly with distance from major road sources[11]. Thus, residential exposure in urban and suburban areas will be determined by the location of sensitive receptors relative to major roads sources in the area. Temporally, air quality can vary significantly by orders of magnitude due to changes in traffic volumes, meteorological conditions and wind direction.

In assessing baseline air quality, two tools are generally used: ambient air monitoring and air dispersion modelling. In order to adequately characterise the current baseline environment through monitoring, comprehensive measurements would be required at a number of key receptors for PM_{10}, NO_2 and benzene. In addition, two of the key pollutants identified in the scoping study (PM_{10} and NO_2) have limit values which require assessment over time periods varying from one hour to one year. Thus, continuous monitoring over at least a one-year period at a number of locations would be necessary in order to fully determine compliance for these pollutants. Although this study would provide information on current air quality it would not be able to provide predictive information on baseline conditions[(10)], which are the conditions which prevail just prior to opening in the absence of the scheme (Year 2011). Hence the impacts of the scheme were fully assessed by air dispersion modelling[(10)] which is the most practical tool for this purpose. The baseline environment has also been assessed using modelling, since the use of the same predictive technique for both the "do nothing" and "do something" scenario will minimise errors and allow an accurate determination of the relative impact of the scheme.

Baseline Air Quality

A three-month monitoring study was carried out for NO_2 and benzene. The survey allows an indicative assessment of the influence of local road sources relative to the prevailing background level of these pollutants in the area and whether compliance is likely with the annual limit values for NO_2 and benzene.

NO_2

NO_2 was monitored, using nitrogen dioxide passive diffusion tubes, over three four-week periods at four locations near the proposed scheme (see **Figure 7.6** in Volume 3, M1-M4). The locations were chosen in order to assess roadside and typical exposure of the residential population to NO_2. The results also allow an assessment of the spatial variation of NO_2 away from the main road sources in the area. The spatial variation away from roadside is particularly important for NO_2, as a complex relationship exists between NO, NO_2 and O_3 leading to a non-linear variation of NO_2 concentrations with distance from the road. Passive sampling of NO_2 involves the molecular diffusion of NO_2 molecules through a polycarbonate tube and their subsequent adsorption onto a stainless steel disc coated with triethanolamine. Following sampling, the tubes were analysed using UV spectrophotometry, at a UKAS accredited laboratory (Bureau Veritas, Glasgow).

Studies in the UK have shown that diffusion tube monitoring results generally have a positive or negative bias when compared to continuous analysers. This bias is laboratory specific and is dependent on the specific analysis procedures at each laboratory. A diffusion tube bias for the Bureau Veritas laboratory of 0.91 was obtained from the UK Air Quality Review and Assessment website (www.uwe.ac.uk/aqm/review) and applied to the diffusion tube monitoring results.

Benzene

Benzene was monitored, using passive diffusion tubes over three four-week periods at two locations near the proposed scheme (see **Figure 7.6** in Volume 3, M1 and M3). Passive sampling of benzene involves the molecular diffusion of benzene molecules through a stainless steel tube and their subsequent adsorption onto a stainless steel gauze coated with Chromasorb 106. Following sampling, the tubes were analysed using Gas Chromatography, at a UKAS accredited laboratory. The locations were positioned to allow an assessment of roadside levels and typical exposure of the residential population to benzene.

Assessment of Compliance

Nitrogen dioxide (NO_2) results are presented in Table 7.5.7. Average concentrations of nitrogen dioxide from the retrieved samples were below the ambient limit value of 40 μg/m^3. The average measured levels ranged from 11 - 25 μg/m^3, thus reaching at most 63% of the limit value. The two locations along the A2 averaged higher NO_2

levels which is likely the result of higher traffic volumes and the proximity to Warrenpoint whilst lower levels were reported along the Omeath Road which is subjected to lower traffic levels and is more rural in nature.

Benzene results are presented in Table 7.5.8. Average concentrations from the retrieved samples reached at most only 6% of the EU annual limit value of 5 μg/m^3. No discernable spatial trends in the data set were apparent.

In summary, ambient air quality in the vicinity of the proposed scheme, based on an analysis of the baseline monitoring survey and existing EPA and Local Authority data (detailed below), is presently below the ambient air quality standards for NO_2 and benzene.

Available Background Data

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities in the Republic of Ireland and by the Department of the Environment Northern Ireland (DOENI). The most recent annual report on air quality "Air Quality Monitoring Annual Report 2007" (EPA, 2008)(17), details the range and scope of monitoring undertaken throughout Ireland.

As part of the implementation of the Framework Directive on Air Quality (1996/62/EC), four air quality zones have been defined in Ireland for air quality management and assessment purposes(17). Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 15 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000 is defined as Zone D. In terms of air monitoring, the current location is categorised as Zone D(17).

EPA monitoring is carried out at the rural Zone D locations, Askeaton, Glashaboy and Kilkitt using continuous monitors(17). In addition, the EPA carried out long-term monitoring at Ferbane, Navan and Cork Harbour in 2007, which are also Zone D locations(16-17).

Long-term NO_2 monitoring is carried out at the two rural Zone D locations, Glashaboy and Kilkitt(17). The NO_2 annual average in 2007 for both sites was 9 and 2 μg/m^3, respectively. The results of NO_2 monitoring carried out at the urban Zone D location in Cork Harbour in 2007 indicated an average NO_2 concentration of 11 μg/m^3(18), with no exceedences of the 1-hour limit value. Furthermore, average NO_2 concentrations measured at Ferbane and Navan, in 2007 (Zone D urban locations) measured 6 and 16 μg/m^3 respectively(17). Hence long-term average concentrations measured at these locations were significantly lower than the annual average limit value of 40 μg/m^3.

Data from the Northern Ireland monitoring sites has been combined with the pollutant emissions data from the UK National Atmospheric Emissions Inventory (NAEI) to produce detailed maps of average or peak background pollutant concentrations across Northern Ireland(19). The background map for NO_2 indicates that the background annual mean in the region of Warrenpoint is 8 μg/m^3 or less. Continuous monitoring at an urban background site in Derry recorded an annual mean of 12 μg/m^3 in 2006.

Based on the above information, a conservative estimate of the background NO_2 concentration for Narrow Water in 2008 is 15 μg/m^3.

The results of CO monitoring carried out in Ferbane, Navan and Cork Harbour in 2007 (urban Zone D locations) showed no exceedences of the 8-hour limit value(18), with an average level of between 0.2 - 0.5 mg/m^3. Based on the above information, a conservative estimate of the background CO concentration for Narrow Water in 2008 is 0.5 mg/m^3.

With regard to benzene, continuous monitoring was carried out at Waterford (Urban Zone C) in 2007(17), with a long-term average of 0.8 µg/m^3 respectively. Data from Belfast Central for 2006 recorded a level of 0.87 µg/m^3 as annual mean(19). Based on the above information, a conservative estimate of the background benzene concentration for Narrow Water in 2008 is 0.5 µg/m^3.

Long-term PM_{10} measurements carried out at Ferbane, Navan and Drogheda in 2007, gave an average level of 21, 23 and 18 µg/m^3(17,18) respectively. In addition, the results of Zone D measurements in Kilkitt and Cork Harbour in 2007 gave averages of 10 and 17 µg/m^3 respectively(17). Data from the Phoenix Park provides a good indication of urban background levels, with an annual average in 2007 of 12 µg/m^3(17).

Data from the Northern Ireland detailed maps of average or peak background pollutant concentrations across Northern Ireland(19) is also available for PM_{10}. The background map for PM_{10} indicates that the background annual mean in the region of Warrenpoint is between 13 - 17 µg/m^3. Continuous monitoring at a rural background site at Lough Navar recorded an annual mean of 12.8 µg/m^3 in 2007.

Based on the above information, a conservative estimate of the background PM_{10} concentration for Narrow Water in 2008 of 15 µg/m^3 has been used.

The results of $PM_{2.5}$ monitoring in Cork in 2007(18) indicated an average $PM_{2.5}/PM_{10}$ ratios of 0.53. Based on this information, a conservative ratio of 0.6 was used to generate a background $PM_{2.5}$ concentration in 2008 of 9.0 µg/m^3.

Estimates of the background concentrations in 2011 and 2031 were made using the Netcen background calculator, which uses year on year reduction factors provided by DEFRA(9).

In summary, existing baseline levels of NO_2, PM_{10}, $PM_{2.5}$, CO and benzene, based on extensive long-term data from the Irish EPA and the Department of the Environment in Northern Ireland (DOENI), are expected to be below ambient air quality limit values in the vicinity of the proposed scheme. A summary of the background concentrations is detailed in Table 7.5.9.

7.5.4 Characteristics of the Proposed Scheme

As stated above, road traffic would be expected to be the dominant source of emissions in the region of the scheme (with the possible exception of PM_{10}) and thus is the focus of the current assessment. Road traffic would also be expected to be the dominant source of greenhouse gas emissions as a result of the scheme. Vehicles will give rise to CO_2 and N_2O emissions near the proposed scheme.

7.5.5 Predicted Impact of the Proposed Scheme

The following section describes the air quality modelling procedures used and assesses the impacts of the proposed scheme for a number of scenarios.

Air Quality – Dispersion Modelling

Detailed traffic flow information was obtained from the traffic consultant for the project and has been used to model pollutant levels under various traffic scenarios and under sufficient spatial resolution to assess whether any significant air quality impact on sensitive receptors may occur.

Cumulative effects have been assessed, as recommended in the EU Directive on EIA (Council Directive 97/11/EC) and using the methodology of the UK DEFRA[(9,10)]. Firstly, background concentrations[(11)] have been included in the modelling study, for both "do nothing" and "do something" scenarios. These background concentrations are year-specific and account for non-localised sources of the pollutants of concern[(11)]. Appropriate background levels were selected based on the available monitoring data provided by the EPA, DOENI and Local Authorities[(15-18)] (see above and Table 7.5.9).

Once appropriate background concentrations were established, the existing situation, including background levels, was assessed in the absence of the scheme for the opening year (Year 2011) and the design year (Year 2031). The assessment methodology involved air dispersion modelling using the UK DMRB Screening Model (Version 1.03c) [(11)] and following guidance issued by the UK DEFRA[(11-14)]. Ambient concentrations of CO, benzene, NO_2, PM_{10} and $PM_{2.5}$ for the opening year (2011) and the design year (Year 2031) were predicted at the nearest sensitive receptors to the scheme. "Do nothing" and "do something" modelling was carried out at the building façade of the worst-case receptors for both 2011 and 2031. This assessment allows the significance of the scheme, with respect to both relative and absolute impact, to be determined both temporally and spatially. An assessment was also carried out at two different average traffic speeds, typical of worst-case peak-hour (10 km/hr on all roads) and average driving conditions.

Locations Used For Modelling Assessment

Two receptors were modelled near the scheme; 1) a worst case residential receptor located along the A2 Warrenpoint Harbour Road, to the north of the proposed scheme and secondly 2) a worst case residential receptor to the south of the Proposed scheme, along the Omeath Road. Results are reported assuming both average daily speeds and a worst-case rush hour speed of 10 km/hr. The discussion below is based on an average speed of 80 km/hr for the A2 Dual Carriageway and Omeath Road with a lower speed of 30 km/hr for the approach to the A2 Roundabout. The effect of reducing speeds from typical to 10 km/hr is discussed separately.

"Do Nothing" Modelling Assessment

PM_{10}, CO and Benzene

The results of the "do nothing" modelling assessment for PM_{10}, CO and benzene in the opening year are shown in Tables 7.5.10 – 7.5.11. Concentrations are well within the limit values under all scenarios at all worst-case receptors. Levels of all three pollutants range from 9 - 41% of the respective limit values in 2011.

The temporal trend in these pollutants can be established by an examination of levels in 2011 and 2031 (see Tables 7.5.10 and 7.5.11). Future trends for the "do nothing" scenario indicate similarly low levels of PM_{10}, CO and benzene. "Do nothing" levels of all three pollutants range from 10% of the limit value for benzene to 39% of the annual limit value for PM_{10} in 2031.

NO_2

The results of the “do nothing” assessment for NO_2 in the opening year are shown in Tables 7.27 – 7.28. Concentrations are below the annual limit value under all scenarios at all locations. Future trends for the “do nothing” scenario indicate even lower annual levels of NO_2. “Do nothing” annual average levels of NO_2 range from 36 - 50% of the annual limit value in 2011 and 2031.

The EU limit value for the maximum one-hour standard for NO_2 is based on a one-hour mean not to be exceeded more than 18 times a year (99.8th%ile). “Do nothing” levels in 2011 are below this limit value, with levels at the worst-case receptor 50% of the EU limit value.

Temporally, “do nothing” levels of maximum one-hour NO_2 concentrations over the period 2011 to 2031 will decrease, with levels peaking at 41% of the limit value at the worst-case receptor in the design year (2031) (see Tables 7.5.10 and 7.5.11).

$PM_{2.5}$

The results of the “do nothing” modelling assessment for $PM_{2.5}$ in the opening and design years are shown in Tables 7.5.10 and 7.5.11. The annual average $PM_{2.5}$ concentration peaks at 10.9 µg/m^3 in 2011 and 10.1 µg/m^3 in 2031. Hence levels are predicted to reach at most 44 % of the $PM_{2.5}$ limit value of 25 µg/m^3 which will come into force after 2015.

Modelled Impact of the Scheme Once Operational (“Do Something”)

PM_{10}, CO and Benzene

The results of the modelled impact of the scheme for PM_{10}, CO and benzene in the opening year are shown in Tables 7.5.10 and 7.5.11. The cumulative impact of both “do nothing” traffic levels and additional traffic due to the scheme are presented. Concentrations are below the ambient standards under all scenarios. Levels of all three pollutants range from 10 - 41% of the respective limit values in 2011.

Future trends with the scheme in place indicate similarly low levels of CO, benzene and $PM_{10.}$ Levels of all three pollutants are below the relevant limit values under all scenarios. Levels of all three pollutants range from 10 - 39% of the respective limit values in 2031.

The impact of the scheme can be assessed for existing receptors relative to “do nothing” levels in both the opening and design years (see Tables 7.5.10 and 7.5.11). For PM_{10}, CO and benzene, relative to “do nothing” levels, the impact of the scheme will lead to a slight increase in pollutant levels as a result of the scheme. As a worst-case, levels will increase by only 1.7% of the respective limit values.

Thus, using the assessment criteria outlined in Tables 7.5.15 and 7.5.16, the impact of the scheme in terms of PM_{10}, CO and benzene is negligible.

NO_2

The result of the assessment of the impact of the scheme for NO_2 in the opening and design years is shown in Tables 7.5.10 and 7.5.11. The annual average concentration is within the annual limit value for all scenarios. Future trends, with the scheme in place, indicate reduced annual average levels of NO_2. Levels of NO_2 range from 38 - 51% of the annual limit value in 2011 and 2031. The impact of the scheme will account for at most 1.7% of the annual limit value in either 2011 or 2031.

Maximum one-hour NO_2 levels in 2011 (as a 99.8^{th}%ile), with the scheme in place, will be significantly below the limit value, with levels at the worst-case receptor 51% of the limit value. Temporally, levels of maximum one-hour NO_2 concentrations, with the scheme in place, will decrease by up to 6% of the limit value between 2011 and 2031.

The impact of the scheme on maximum one-hour NO_2 levels can be assessed relative to "do nothing" levels in both the opening and design years (see Tables 7.5.10 and 7.5.11). Levels are only slightly increased with the scheme in place, with an increase of at most 1.7% of the limit value. However, predicted levels will still be well below the NO_2 maximum one-hour limit value, with worst-case levels peaking at 45% of the limit value in 2031.

Thus, using the assessment criteria outlined in Tables 7.5.8 and 7.5.9, the impact of the scheme in terms of NO_2 is negligible.

$PM_{2.5}$

The result of the assessment of the impact of the scheme for $PM_{2.5}$ in the opening and design years is shown in Tables 7.5.10 and 7.5.11. The annual average $PM_{2.5}$ concentration peaks at 11.0 μg/m^3 in 2011 and 10.2 μg/m^3 in 2031. Hence, levels are predicted to reach at most 44% of the $PM_{2.5}$ target value of 25 μg/m^3 which is likely be set after 2010.

The impact of the scheme on annual average $PM_{2.5}$ levels can be assessed relative to "do nothing" levels in the opening and design years (see Tables 7.5.10 and 7.5.11). Levels are slightly increased with the scheme in place, with an increase of at most 1.9% of the $PM_{2.5}$ limit value which will come into force in 2015.

Thus, using the assessment criteria outlined in Tables 7.5.5 and 7.5.6, the impact of the scheme in terms of $PM_{2.5}$ is negligible.

Worst-case Traffic Speed Scenario

An assessment of the effect of changing the traffic speed (for the entire assessment year) from an average speeds to a worst case peak hour speed of 10 km/hr has also been carried out for all pollutants (see Tables 7.5.10 and 7.5.11). The results indicate that pollutant levels are increased at the worst-case traffic speed. Nevertheless, pollutant levels are still well below the relevant limit values for PM_{10}, NO_2, CO and benzene and the limit value for $PM_{2.5}$ which is applicable from 2015.

Air Quality Impacts on Sensitive Ecosystems

The EC Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the "Habitats Directive") requires an Appropriate Assessment to be carried out where there is likely to be a significant impact upon a European protected site. Such sites include Natural Heritage Areas (NHA), Special Areas of Conservation (SAC), Special Protection Areas (SPA), National Parks, Nature Reserves, Refuges for Fauna, Refuges for Flora, Wildfowl Sanctuaries, Ramsar Sites, Biogenetic Reserves and UNESCO Biosphere Reserves. The proposed Narrow Water Bridge and associated works is partially located within the Carlingford Shore SAC.

The impact of NO_x (i.e. NO and NO_2) emissions resulting from the proposed bridge development at the Carlingford Shore SAC has been assessed. Dispersion modelling and prediction was carried out at typical traffic speeds. Ambient NO_x concentrations predicted along a transect of up to 200m within the Carlingford Shore SAC are given in Table 7.5.2, in line with Appendix 5 of the NRA guidelines(1). The road contribution to dry deposition along the transect is also given and was calculated using the methodology of the NRA as outlined in Appendix 5[(1)].

The predicted annual average NO_X level at the Carlingford Shore SAC is below the limit value of 30 µg/m^3 for the “do nothing” and “do something” scenarios in the opening year of 2011. Levels with the proposed development in place reach at most 65% of the limit in 2011. The impact of the proposed Narrow Water Bridge leads to an increase in NO_X concentrations of up to 1.1 µg/m^3 within the Carlingford Shore SAC at distances of 10m from the Narrow Water Bridge in 2011 as shown in Table 7.5.9.

However, the predicted annual average NO_x level at the Carlingford Shore SAC is below the limit value of 30 µg/m^3 for all scenarios in the opening year and design years. Levels with the proposed development in place reach 61% of the limit value in 2031 at 10m from the bridge centreline and continues to decrease with increasing distance from the bridge centreline. The impact of the proposed Narrow Water Bridge leads to an increase in NO_X concentrations of up to 1.1 µg/m^3 within the Carlingford Shore SAC in 2031. The NRA guidelines states in Appendix 5 that where the scheme is expected to cause an increase of more than 2 µg/m^3 and the predicted concentrations (including background) are close to, or exceed the standard, then the sensitivity of the habitat to NO_X should be assessed by the project ecologist. As the impact of the scheme is less than 2 µg/m^3 and the predicted concentration (including background) is not close to the limit value (defined as 75% of the limit value in the NRA Guidelines), no further assessment is necessary.

The bridge contribution to the NO_2 dry deposition rate along the 200m transect within the Carlingford Shore SAC is also detailed in Table 7.5.12. The maximum NO_2 dry deposition rate is 0.04 Kg(N)/ha/yr in either 2011 or 2031. This reaches at most 0.4% of the critical load for coastal habitats of 10-20 Kg(N)/ha/yr[(1)].

Summary of Modelling Assessment

“Do nothing” modelling assessments for PM_{10}, CO and benzene indicate that concentrations will be significantly within the ambient air quality standards under all scenarios. In addition, the impact of the scheme will account for only 1.7% of the respective limit values. Cumulatively, levels will still be well within the ambient air quality limit values under all scenarios. Levels of all three pollutants with the proposed scheme in place range from 10 - 41% of the respective limit values in 2011 and 2031. Thus, the impact of the scheme for these three pollutants is negligible.

The modelling assessment for NO_2 indicates that annual concentrations will be well within the air quality standard under all scenarios. Levels of NO_2 with the scheme in place will range from 38 - 51% of the annual limit value in 2011 and 2031. The maximum one-hour modelling assessment for NO_2 also indicates that levels will be within the applicable limit value in 2011 and 2031 for all scenarios. The impact of the scheme on NO_2 levels will be to increase levels by 1.7% of the respective maximum one-hour limit values in either 2011 or 2031. However, predicted levels will still be below the NO_2 maximum one-hour limit value, with worst-case levels peaking at 51% of the limit value in 2011 and at 45% of the limit value in 2031. Thus, the impact of the scheme, in terms of NO_2, is deemed negligible.

“Do nothing” modelling assessments for $PM_{2.5}$ indicates that concentrations will be significantly within the ambient air quality standards under all scenarios. In addition, the proposed scheme will have no significant impact on the annual target value. Cumulatively, levels will still be within the $PM_{2.5}$ limit value under all scenarios, with levels peaking at 44% of the limit in 2011. Thus, the impact of the scheme for $PM_{2.5}$ is negligible.

In summary, levels of traffic-derived air pollutants will not exceed the ambient air quality standards with the scheme in place. Furthermore, using the assessment criteria outlined in Tables 7.5.5 and 7.5.6, the impact of the scheme in terms of NO_2, PM_{10}, $PM_{2.5}$, CO and benzene is negligible.

Climate

Greenhouse gas emissions, as a result of this scheme, will be imperceptible in terms of Ireland's obligations under the Kyoto Protocol(2,3).

Modification Of Atmospheric Conditions

The size and nature of the scheme and the nature and volume of emissions will be imperceptible.

Modification Of The Existing Heat Balance In The Area

Mesoscale meteorological modelling results indicate that heat islands in US cities may lead to 1.5-3ºC increases relative to the suburbs in the afternoon in summer(21). Relative to this kind of increase, the size and nature of the proposed scheme and the nature and volume of emissions will be imperceptible.

7.5.6 Mitigation Measures

Construction Phase

Air Quality

There is the potential for a number of emissions to the atmosphere during the construction of the scheme. In particular, the construction activities may generate quantities of dust. Construction vehicles, generators etc., will also give rise to some exhaust emissions. However, due to the size and nature of the construction activities, exhaust emissions during construction will have a negligible impact on local air quality. A dust minimisation plan will be formulated for the construction phase of the project, as construction activities are likely to generate some dust emissions.

Climate

There is the potential for a number of greenhouse gas emissions to atmosphere during the construction of the scheme. Construction vehicles, generators etc., may give rise to CO_2 and N_2O emissions. However, due to the size and nature of the construction activities, CO_2 and N_2O emissions during construction will have a negligible impact on climate.

Operational Phase

Air Quality

Mitigation measures in relation to traffic-derived pollutants have focused generally on improvements in both engine technology and fuel quality. EU legislation, based on the EU sponsored Auto-Oil programmes, has imposed stringent emission standards for key pollutants (Regulation (EC) No 715/2007) for passenger cars to be complied with in 2009 (Euro V) and 2014 (Euro VI). With regard to heavy duty vehicles, EU Directive 2005/78/EC defines the emission standard currently in force, Euro IV, as well as the next stage (Euro V) which will enter into force in October 2008. In addition, it defines a non-binding standard called Enhanced Environmentally-friendly

Vehicle (EEV). In relation to fuel quality, SI No. 407 of 1999 and SI No. 72 of 2000 have introduced significant reductions in both sulphur and benzene content of fuels.

In relation to design and operational aspects of road schemes, emissions of pollutants from road traffic can be controlled most effectively by either diverting traffic away from heavily congested areas or ensuring free flowing traffic through good traffic management plans and the use of automatic traffic control systems[(12)]. Improvements in air quality are likely over the next few years as a result of the on-going comprehensive vehicle inspection and maintenance program, fiscal measures to encourage the use of alternatively fuelled vehicles and the introduction of cleaner fuels.

Climate

CO_2 emissions will be reduced to 120 g/km by 2012 through EU legislation. This measure will reduce CO_2 emissions from new cars by an average of 25% in the period from 1995 to 2008/2009 whilst 15% of the necessary effort towards the overall climate change target of the EU will be met by this measure alone[(22)]. Additional fuel efficiency measures include VRT and Motor Tax rebalancing to favour the purchases of more fuel-efficient vehicles, the National Car Test and Fuel Economy Labelling[(23,23)].

7.5.7 Monitoring

N/A

7.5.8 Reinstatement

N/A

7.5.9 References

(1) National Roads Authority (2006) Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes

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7.5.10 Ambient Air Quality Standards

National standards for ambient air pollutants in Ireland have generally ensued from Council Directives enacted in the EU (& previously the EC & EEC) (see Table 7.5.1 & 7.5.2). The initial interest in ambient air pollution legislation in the EU dates from the early 1980s and was in response to the most serious pollutant problems at that time. In response to the problem of acid rain, sulphur dioxide and later nitrogen dioxide were both the focus of EU legislation. Linked to the acid rain problem was urban smog associated with fuel burning for space heating purposes. Also apparent at this time were the problems caused by leaded petrol and EU legislation was introduced to deal with this problem in the early 1980s.

In recent years the EU has focused on defining a basis strategy across the EU in relation to ambient air quality. In 1996, a Framework Directive, Council Directive 96/62/EC, on ambient air quality assessment and management was enacted. The aims of the Directive are fourfold. Firstly, the Directive's aim is to establish objectives for ambient air quality designed to avoid harmful effects to health. Secondly, the

Directive aims to assess ambient air quality on the basis of common methods and criteria throughout the EU. Additionally, it is aimed to make information on air quality available to the public via alert thresholds and fourthly, it aims to maintain air quality where it is good and improve it in other cases.

As part of these measures to improve air quality, the European Commission has adopted proposals for daughter legislation under Directive 96/62/EC. The first of these directives to be enacted, Council Directive 1999/30/EC, was passed into Irish Law as S.I. No 271 of 2002 (Air Quality Standards Regulations 2002), and has set limit values which came into operation on 17th June 2002. The Air Quality Standards Regulations 2002 detail margins of tolerance, which are trigger levels for certain types of action in the period leading to the attainment date. The margin of tolerance varies from 60% for lead, to 30% for 24-hour limit value for PM_{10}, 40% for the hourly and annual limit value for NO_2 and 26% for hourly SO_2 limit values. The margin of tolerance commenced from June 2002, and will start to reduce from 1 January 2003 and every 12 months thereafter by equal annual percentages to reach 0% by the attainment date. A second daughter directive, EU Council Directive 2000/69/EC, details limit values for both carbon monoxide and benzene in ambient air. This has also been passed into Irish Law under the Air Quality Standards Regulations 2002. The most recent EU Council Directive on ambient air quality was published on the 11/06/08. Council Directive 2008/50/EC combines the previous Air Quality Framework Directive and its subsequent daughter directives. Provisions were also made for the inclusion of new ambient limit values relating to $PM_{2.5}$. The margin of tolerance specific to each pollutant were also slightly adjusted from previous directives as outlined in Table 7.5.1.

Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions. The Alert Threshold is defined in Council Directive 2008/50/EC as “a level beyond which there is a risk to human health from brief exposure and at which immediate steps shall be taken as laid down in Directive 2008/50/EC”. These steps include undertaking to ensure that the necessary steps are taken to inform the public (e.g. by means of radio, television and the press).

The Margin of Tolerance is defined in Council Directive 2008/50/EC as a concentration which is higher than the limit value when legislation comes into force. It decreases to meet the limit value by the attainment date. The Upper Assessment Threshold is defined in Council Directive 2008/50/EC as a concentration above which high quality measurement is mandatory. Data from measurement may be supplemented by information from other sources, including air quality modelling.

An annual average limit for both NO_x (NO and NO_2) is applicable for the protection of vegetation in highly rural areas away from major sources of NO_x such as large conurbations, factories and high road vehicle activity such as a dual carriageway or motorway. Annex III of EU Directive 2008/50/EC identifies that monitoring to demonstrate compliance with the NO_X limit for the protection of vegetation should be carried out distances greater than:

- 5 km from the nearest motorway or dual carriageway
- 5 km from the nearest major industrial installation
- 20 km from a major urban conurbation

As a guideline, a monitoring station should be indicative of approximately 1000 km^2 of surrounding area.

Under the terms of EU Framework Directive on Ambient Air Quality (96/62/EC), geographical areas within member states have been classified in terms of zones. The zones have been defined in order to meet the criteria for air quality monitoring, assessment and management as described in the Framework Directive and Daughter Directives. Zone A is defined as Dublin and its environs, Zone B is defined as Cork City, Zone C is defined as 16 urban areas with a population greater than 15,000 and Zone D is defined as the remainder of the country. The Zones were defined based on among other things, population and existing ambient air quality.

EU Council Directive 96/62/EC on ambient air quality and assessment has been adopted into Irish Legislation (S.I. No. 33 of 1999). The act has designated the Environmental Protection Agency (EPA) as the competent authority responsible for the implementation of the Directive and for assessing ambient air quality in the State. Other commonly referenced ambient air quality standards include the World Health Organisation. The WHO guidelines differ from air quality standards in that they are primarily set to protect public health from the effects of air pollution. Air quality standards, however, are air quality guidelines recommended by governments, for which additional factors, such as socio-economic factors, may be considered.

Air Dispersion Modelling

The inputs to the DMRB model consist of information on road layouts, receptor locations, annual average daily traffic movements, annual average traffic speeds and background concentrations(11). Using this input data the model predicts ambient ground level concentrations at the worst-case sensitive receptor using generic meteorological data.

The DMRB has recently undergone an extensive validation exercise(14) as part of the UK's Review and Assessment Process to designate areas as Air Quality Management Areas (AQMAs). The validation exercise was carried out at 12 monitoring sites within the UK DEFRAs national air quality monitoring network. The validation exercise was carried out for NO_X, NO_2 and PM_{10}, and included urban background and kerbside/roadside locations, "open" and "confined" settings and a variety of geographical locations(14).

In relation to NO_2, the model generally over-predicts concentrations, with a greater degree of over-prediction at "open" site locations. The performance of the model with respect to NO_2 mirrors that of NO_X showing that the over-prediction is due to NO_X calculations rather than the NO_X:NO_2 conversion. Within most urban situations, the model overestimates annual mean NO_2 concentrations by between 0 to 40% at confined locations and by 20 to 60% at open locations. The performance is considered comparable with that of sophisticated dispersion models when applied to situations where specific local validation corrections have not been carried out.

The model also tends to over-predict PM_{10}. Within most urban situations, the model will over-estimate annual mean PM_{10} concentrations by between 20 to 40%. The performance is comparable to more sophisticated models, which, if not validated locally, can be expected to predict concentrations within the range of ±50%.

Thus, the validation exercise has confirmed that the model is a useful screening tool for the Second Stage Review and Assessment, for which a conservative approach is applicable(14).

7.5.11 Dust Minimisation Plan

A dust minimisation plan will be formulated for the construction phase of the project, as construction activities are likely to generate some dust emissions. The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The majority of any dust produced will be deposited close to the potential source and any impacts from dust deposition will typically be within several hundred metres of the construction area.

In order to ensure that no dust nuisance occurs, a series of measures will be implemented. Site roads shall be regularly cleaned and maintained as appropriate. Hard surface roads shall be swept to remove mud and aggregate materials from their surface while any un-surfaced roads shall be restricted to essential site traffic only. Furthermore, any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions.

Vehicles using site roads shall have their speed restricted, and this speed restriction must be enforced rigidly. Indeed, on any un-surfaced site road, this shall be 20 km per hour, and on hard surfaced roads as site management dictates. Vehicles delivering material with dust potential shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust.

All vehicles exiting the site shall make use of a wheel wash facility, preferably automatic, prior to entering onto public roads, to ensure mud and other wastes are not tracked onto public roads. Public roads outside the site shall be regularly inspected for cleanliness, and cleaned as necessary.

Material handling systems and site stockpiling of materials shall be designed and laid out to minimise exposure to wind. Water misting or sprays shall be used as required if particularly dusty activities are necessary during dry or windy periods.

Furthermore, during movement of the soil both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions.

At all times, the procedures put in place will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, significant dust producing activities will be immediately terminated and satisfactory procedures implemented to rectify the problem before the resumption of the operations.

The dust minimisation plan shall be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practise and procedures.

Table 7.5.1 European Union Ambient Air Quality Standard (Based on Directive 2008/50/EC)

Pollutant	Regulation Note 1	Limit Type	Margin of Tolerance	Value
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	40% until 2003 reducing linearly to 0% by 2010	200 μg/m^3 NO_2
		Annual limit for protection of human health	40% until 2003 reducing linearly to 0% by 2010	40 μg/m^3 NO_2
		Annual limit for protection of vegetation	None	30 μg/m^3 NO + NO_2
Lead	2008/50/EC	Annual limit for protection of human health	100% Note 2	0.5 μg/m^3
Sulphur dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	150 μg/m^3	350 μg/m^3
		Daily limit for protection of human health - not to be exceeded more than 3 times/year	None	125 μg/m^3
		Annual & Winter limit for the protection of ecosystems	None	20 μg/m^3
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50%	50 μg/m^3 PM_{10}
		Annual limit for protection of human health	20%	40 μg/m^3 PM_{10}
$PM_{2.5}$ (Stage 1)	2008/50/EC	Annual limit for protection of human health	20% from June 2008. Decreasing linearly to 0% by 2015	25 μg/m^3 $PM_{2.5}$
$PM_{2.5}$ (Stage 2)	-	Annual limit for protection of human health	None	20 μg/m^3 $PM_{2.5}$
Benzene	2008/50/EC	Annual limit for protection of human health	100% until 2006 reducing linearly to 0% by 2010	5 μg/m^3
Carbon Monoxide	2008/50/EC	8-hour limit (on a rolling basis) for protection of human health	60%	10 mg/m^3 (8.6 ppm)

Note 1 EU 2008/50/EC – Clean Air For Europe (CAFÉ) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

Note 2 EU 2008/50/EC states - '*Limit value to be met only by 1 January 2010 in the immediate vicinity of the specific industrial sources situated on sites contaminated by decades of industrial activities. In such cases the limit value will be 1.0 μg/m^3. The area in which higher limit values apply must not extend further than 1000 m from such specific sources*'

Table 7.5.2 Previous European Union Air Standards (Superseded by 2008/50/EC)

Pollutant	Regulation	Type	Period	Value
Nitrogen Dioxide	85/203/EEC	Limit Value	98th percentile of yearly mean hourly	200 μg/m^3
		Guide Value	concentrations	135 μg/m^3
		Guide Value	50th percentile of yearly mean hourly concentrations	50 μg/m^3
Lead	82/884/EEC	Limit Value	Annual mean	2 μg/m^3
Sulphur dioxide	80/779/EEC	Limit Value	98th percentile of yearly mean hourly concentrations	250-350[Note 1] μg/m^3
		Limit Value	Winter (medium of daily values)	130 or 180[Note 1] μg/m^3
		Limit Value	One year (medium of daily values)	80 or 120[Note 1] μg/m^3
		Guide Value	98th percentile of yearly mean hourly concentrations	135 μg/m^3
		Guide Value	50th percentile of 1-hour means	50 μg/m^3
Smoke	80/779/EEC	Limit Value	One year (medium of daily values)	80 μg/m^3
		Limit Value	Winter (medium of daily values)	130 μg/m^3
		Limit Value	98th percentile of daily values	250 μg/m^3

Note 1 The lower daily values refer to the situation with corresponding high levels of black smoke.

Table 7.5.3 US National Ambient Air Quality Standards (NAAQS) & PSD Increments

Pollutant	Averaging Period	Primary & Secondary Standard Note 1 (μg/m^3)	*PSD Increment Class II Note 2* (μg/m^3)
PM_{10}	Annual - Average over 3 years	50	17
	24-Hour - as a 99th%ile over 3 years	150	30
NO_2	Annual Mean	100	25
CO	8-Hour - 3-year average of annual 4th highest daily maximum 8-hour conc.	10,000	-
	1-Hour - not to be exceeded more than 3 times in 3 consecutive years	40,000	-
Hydrocarbon (Benzene)	3 Hours (6-9 AM) (corrected for methane)	160	-

Note 1 Primary standards to protect public health whilst secondary standards are set to protect public welfare

Note 2 Class I areas are national parks and similar areas. Class II are all areas not originally classified as Class I.

Table 7.5.4 WHO Guidelines For Air Quality Europe 1999

Substances	Time-weighted Average	Averaging Time
Lead	0.5-1.0 μg/m^3	1 year
Nitrogen dioxide	200 μg/m^3 40-50 μg/m^3	1 hour annual
Carbon monoxide	100 μg/m^3 60 μg/m^3 30 μg/m^3 10 μg/m^3	15 minutes 30 minutes 1 hour 8 hour
Benzene	Note 1	
Particulate matter (PM_{10})	Note 2	

Note 1 No safe level recommended owing to carcinogenicity.

Note 2 No specific guideline recommended because no obvious exposure concentration and duration that could be judged a threshold and decreased by uncertainty factors to avoid risk.

Table 7.5.5 Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude of Change	Annual Mean NO_2 / PM_{10}	Days PM_{10} > 50 µg/m^3
Very Large	Increase / decrease >25%	Increase / decrease >25 days
Large	Increase / decrease 15-25%	Increase / decrease 15-25 days
Moderate	Increase / decrease 10-15%	Increase / decrease 10-15 days
Small	Increase / decrease 5-10%	Increase / decrease 5-10 days
Very Small	Increase / decrease 1-5%	Increase / decrease 1-5 days
Extremely Small	Increase / decrease <1%	Increase / decrease <1 days

Source: *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* - National Roads Authority (2006)

Table 7.5.6 Air Quality Impact Significance Criteria

Absolute Concentration in Relation to Standard[Note 1]	Change in Concentration					
	Extremely Small	Very Small	Small	Moderate	Large	Very Large
Decrease with Scheme						
Above Standard with Scheme	slight beneficial	slight beneficial	substantial beneficial	substantial beneficial	very substantial beneficial	very substantial beneficial
Above Standard in Do-min, Below with Scheme	slight beneficial	moderate beneficial	substantial beneficial	substantial beneficial	very substantial beneficial	very substantial beneficial
Below Standard in Do-min, but not Well Below	negligible	slight beneficial	slight beneficial	moderate beneficial	moderate beneficial	substantial beneficial
Well Below Standard in Do-min	negligible	negligible	slight beneficial	slight beneficial	slight beneficial	moderate beneficial
Increase with Scheme						
Above Standard in Do-min	slight adverse	slight adverse	substantial adverse	substantial adverse	very substantial adverse	very substantial adverse
Below Standard in Do-min, Above with Scheme	slight adverse	moderate adverse	substantial adverse	substantial adverse	very substantial adverse	very substantial adverse
Below Standard with Scheme, but not Well Below	negligible	slight adverse	slight adverse	moderate adverse	moderate adverse	substantial adverse
Well Below Standard with Scheme	negligible	negligible	slight adverse	slight adverse	slight adverse	moderate adverse

Note 1 Well Below Standard = <75% of limit value.

Source: *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* - National Roads Authority (2006)

Table 7.5.7 Results Of NO_2 Diffusion Tube Monitoring Carried Out In The Vicinity Of The Proposed Narrow Water Bridge

Location	NO_2 (µg/m^3) (23/05/08 - 23/06/08)	NO_2 (µg/m^3) (23/06/08 - 22/07/08)	NO_2 (µg/m^3) (22/07/08 - 22/08/08)	NO_2 (µg/m^3) (Uncorrected 3-month Average)	NO_2 (µg/m^3) (Corrected 3-month Average)(3)
R1 – A2 Roadside	17	16	24	19	17
R2 – A2 Warrenpoint Harbour	28	22	31	27	25
R3 – Omeath Road (east)	11	13	-(1)	12	11
R4 – Omeath Road (west)	21	22	24	22	20
Limit Value	40(2)				

(1) Sample Not Retrieved
(2) EU Council Directive 2008/50/EC (as an annual average)
(3) Diffusion tube bias factor of 0.91 applied to laboratory results.

Table 7.5.8 Results Of Benzene Diffusion Tube Monitoring Carried Out In The Vicinity Of The Proposed Narrow Water Bridge

Location	Benzene (µg/m^3) (23/05/08 - 23/06/08)	Benzene (µg/m^3) (23/06/08 - 22/07/08)	Benzene (µg/m^3) (22/07/08 - 22/08/08)	Benzene (µg/m^3) (3-month Average)
R1 – A2 Roadside	0.1	0.4	0.4	0.3
R3 – Omeath Road (east)	0.1	0.2	-(1)	0.2
Limit Value	5(2)			

(1) Sample Not Retrieved
(2) EU Council Directive 2008/50/EC (as an annual average)

Table 7.5.9 Summary Of Background Concentrations Used In The Air Dispersion Model

Background Values Note 1	Nitrogen Oxides (µg/m^3)	Nitrogen Dioxide (µg/m^3)	Benzene (µg/m^3)	Particulates (PM_{10}) (µg/m^3)	Particulates ($PM_{2.5}$) (µg/m^3) Note 2	Carbon Monoxide (mg/m^3)
Year 2008	17.1	15.0	0.50	15.0	9.0	0.50
Year 2011	17.1	13.5	0.45	14.0	8.4	0.40
Year 2031	16.2	12.8	0.47	13.9	8.3	0.39

Note 1 Reduction in future years using the Netcen background calculator (January 2006).
Note 2 A ratio of 0.6 has been used for the ratio of $PM_{2.5}$ / PM_{10}

Table 7.5.10 Air Quality Assessment, Proposed Narrow Water Bridge, County Louth & County Down. Summary of Predicted Air Quality at a Worst Case Receptor Located Near The A2 Warrenpoint Harbour Road

Scenarios	Traffic Speed (km/hr)	Carbon Monoxide (mg/m^3)	Benzene ($\mu g/m^3$)	Nitrogen Dioxide ($\mu g/m^3$)		Particulates ($\mu g/m^3$)		
		Maximum 8-hour	Annual Average	99.8th%ile of Max. 1-Hr	Annual Average	PM_{10} Annual Average	PM_{10}: No. Days >50 $\mu g/m^3$	$PM_{2.5}$ Annual Average
2011 Do Nothing	10	3.1	0.64	116	23.2	18.3	2	12.7
	50	2.5	0.55	101	20.1	16.5	0	10.8
2011 Do Something	10	3.2	0.65	117	23.4	18.4	2	12.8
	50	2.5	0.55	101	20.3	16.6	1	10.9
2031 Do Nothing	10	3.1	0.68	101	20.1	16.8	1	11.2
	50	2.4	0.58	89	17.9	15.7	0	10.1
2031 Do Something	10	3.1	0.69	101	20.2	16.8	1	11.3
	50	2.4	0.58	90	17.9	15.7	0	10.2
Standards [Note 1]		10	5	200 [Notes 2]	40	40 [Note 2]	35 [Notes 3]	25

[Note 1] EU Council Directive 2008/50/EC

[Note 2] 1-hr limit of 200 $\mu g/m^3$ not to be exceeded > 18 times/year (9X.8th %ile)

[Note 3] 24-Hr limit of 50 $\mu g/m^3$ not to be exceeded >35 times/year (90.1th %ile)

Table 7.5.11 Air Quality Assessment, Proposed Narrow Water Bridge, County Louth and County Down. Summary Of Predicted Air Quality at a Worst Case Receptor Located Near The Omeath Road.

Scenarios	Traffic Speed (km/hr)	Carbon Monoxide (mg/m^3)	Benzene ($\mu g/m^3$)	Nitrogen Dioxide ($\mu g/m^3$)		Particulates ($\mu g/m^3$)		
		Maximum 8-hour	Annual Average	99.8^{th}%ile of Max. 1-Hr	Annual Average	PM_{10} Annual Average	PM_{10}: No. Days >50 $\mu g/m^3$	$PM_{2.5}$ Annual Average
2011 Do Nothing	10	2.4	0.51	83	16.6	15.2	0	9.6
	50	2.1	0.47	77	15.4	14.5	0	8.9
2011 Do Something	10	2.6	0.55	86	17.1	15.6	0	10.0
	50	2.2	0.50	80	16.1	15.0	0	9.4
2031 Do Nothing	10	2.4	0.54	77	15.3	14.8	0	9.3
	50	2.0	0.49	72	14.4	14.3	0	8.8
2031 Do Something	10	2.6	0.58	79	15.8	15.2	0	9.6
	50	2.2	0.53	75	15.0	14.7	0	9.2
Standards Note 1		10	5	200 Notes 2	40	40 Note 2	35 Notes 3	25

Note 1 EU Council Directive 2008/50/EC

Note 2 1-hr limit of 200 $\mu g/m^3$ not to be exceeded > 18 times/year (9X.8th %ile)

Note 3 24-Hr limit of 50 $\mu g/m^3$ not to be exceeded >35 times/year (90.1th %ile)

Table 7.5.12 Air Quality Assessment of Ecosystems, Proposed Narrow Water Bridge, County Louth and County Down. Assessment of Impact Along A Transect From Proposed Bridge Through The Carlingford Shore SAC

Dist. To Road (m)		2011 NO_x Conc. (µg/m³)			2031 NO_x Conc. (µg/m³)			NO_2 Dry Deposition Rate Impact (Kg(N) /ha/yr)	
Do Nothing	Do Something	Do Nothing	Do Something	Bridge Impact	Do Nothing	Do Something	Bridge Impact	2011	2031
10	10		19.4	1.1		18.2	1.1	0.04	0.04
20	20		19.2	0.9		17.9	0.8	0.03	0.03
30	30		19.0	0.7		17.7	0.7	0.02	0.02
40	40		18.8	0.5		17.6	0.5	0.02	0.02
50	50		18.7	0.4		17.5	0.4	0.01	0.01
60	60		18.6	0.3		17.4	0.3	0.01	0.01
70	70		18.6	0.3		17.3	0.3	0.01	0.01
80	80		18.5	0.2		17.3	0.2	0.01	0.01
90	90		18.5	0.2		17.3	0.2	0.01	0.01
100	100		18.5	0.1		17.2	0.1	0.00	0.00
110	110		18.4	0.1		17.2	0.1	0.00	0.00
120	120		18.4	0.1		17.2	0.1	0.00	0.00
130	130	18.3	18.4	0.1	17.1	17.2	0.1	0.00	0.00
140	140	18.1	18.4	0.3	16.9	17.2	0.2	0.01	0.01
150	150	17.9	18.4	0.5	16.8	17.1	0.3	0.01	0.01
160	160	17.8	18.4	0.5	16.7	17.1	0.4	0.02	0.01
170	170	17.8	18.4	0.6	16.7	17.1	0.4	0.02	0.01
180	180	17.7	18.4	0.7	16.6	17.1	0.5	0.02	0.02
190	190	17.6	18.4	0.8	16.5	17.1	0.6	0.03	0.02
200	200	17.5	18.4	0.9	16.5	17.1	0.7	0.03	0.02
Standards		30 µg/m³	30 µg/m³	-	30 µg/m³	30 µg/m³	-	10 - 20 Kg(N)/ha/yr	

7.6 Soils, Geology and Hydrogeology

7.6.1 Existing Ground Conditions

Information was initially obtained for a wider study area as part of the Constraints Study Report and the Route Selection Report. Details of the general environment in the vicinity of the site are provided where applicable. The EIS has been prepared using information from the following sources:

7.6.2 Summary of Available Information

Mapping

Geologic mapping from Geological Survey of Ireland and Geological Survey of Northern Ireland covering the solid geology of Co. Louth and Co. Down is available both in paper and electronic format. The bedrock geology including previously known faulting is shown in **Figure 7.9** in Volume 3. Digital mapping available at www.gsi.ie/mapping and from www.bgs.ac.uk/geoindex also shows the quaternary geology along with aquifer vulnerability, known groundwater wells and existing ground investigation information.

Aerial Photography

Ordnance Survey aerial photography was obtained in the vicinity of the crossing to identify large scale ground characteristics. Aerial photography along the route indicates an area of made ground which was being filled at or shortly before the time of the photo in 2005.

Ground Investigations & Surveys

Ground investigations by IGSL Limited and geophysical surveying by Apex Geoservices Limited were carried out during the first stage of investigation for the Narrow Water Bridge Project:

- Detailed Design Ground Investigation (Land works), 2008
    - Ground investigation by IGSL (Factual Report No. 13953).
    - Geophysical surveying by Apex Geophysics Limited (Project No. 8261).
- Detailed Design Ground Investigation (Marine works), 2010
    - Ground investigation by Priority Geotechnical (Project No. P11019).

Field walks by Roughan & O'Donovan staff during these investigations have also helped to identify the ground conditions along the proposed route. Photographs are shown below where relevant to the text.

The following are the findings of these surveys and investigations:

Geophysical Survey

The geophysical surveying has been used to identify changes in the soils and bedrock at the bridge crossing location across the river and in cut and fill areas for the approach roads. The geophysics report including interpretation of the ground profiles and mapping made the following conclusions and recommendations relevant to the geotechnical constraints of the proposed bridge and approaches. Note that the chainages indicated in the geophysical report drawings have been superseded due to minor shifts in the alignment. The chainages in the following text are correct:

- Depth to bedrock generally varies between 5 and 14m below ground level from Chainage 0 to the southern edge of the mudflats (approx. Chainage 330) and Chainage 440.
- Locally more shallow bedrock has been interpreted between Chainage 65-102 where it can be expected at depths of 4-5m below ground level.
- Along the southern portion of the route from Chainage 20 to Chainage 338 (north-western section) and to Chainage 321 (south-eastern section) medium-thick overburden has been interpreted as sand/gravel/made ground underlain by clayey or water saturated sand/gravel (possible raised beach)/made ground underlain by greywacke/sandstone with minor mudstone/shale.
- Thick deposits of silt/clay/alluvium (>27m) were interpreted infilling a bedrock channel under the Newry River. This channel appears to be steep sided especially on its southern margin. It is possible that this channel developed along a fault such as the Newry Fault. Interpretation in this section may have been compromised by the presence of brackish salt water affecting readings.
- The mudflats are interpreted as underlain by thin to moderately thick silt/clay/alluvium overlying discontinuous gravelly silt/clay overlying mudstone/shale and greywacke/sandstone.

Ground Investigations

In total, the following exploratory hole information is available to assess overburden and bedrock characteristics at locations along the proposed alignment:

- 6 cable percussion boreholes with rotary follow-on
- 2 cable percussion boreholes
- 7 rotary core holes (performed over water in the Newry River)
- 8 trial pits
- 14 dynamic probes (performed over water in the Newry River)
- 4 static probes (performed over water in the Newry River)

The geologic profile is shown in **Figures 7.7** in Volume 3. Geotechnical Laboratory testing of selected samples collected during these works was carried out.

Further detailed ground investigations will be required in some areas. Adequate information is available for this preliminary design of the roads, as outlined in the following sections.

Table 7.6.1 presents a summary of the ground investigation results.

Table 7.6.1 Summary of Ground Investigation Results

Approximate Chainages		**Material**	**Profile**
From	**To**		**Cut/Fill**
MAINLINE			
Ch. 000		Southern Roundabout Tie-in to Local Road R173	At grade
000	**160**	Dense sands/gravels & stiff clay to 5-10m over rock	Fill
160	**285**	Dense sands/gravels & stiff clay to 10m over rock	Cut
285	**330**	Dense sands/gravels & stiff clay to 8-10m over rock	Fill

Table 7.6.1 Summary of Ground Investigation Results Contd.

Approximate Chainages		Material	Profile
From	To		Cut/Fill
MAINLINE			
330	**540**	Peaty topsoil, alluvial mud & shingle tidal flats + Newry River over silts, gravels, cobbles, boulders and fractured rock at 4-6m.	Bridge
540	**625**	Made ground and alluvial mud & shingle tidal flats, gravels and fractured rock at 4-6m.	Bridge + Fill
625	**660**	Made ground, gravels, cobbles and fractured rock at 4-6m.	Fill
Ch. 660		Northern Roundabout Tie-in to Primary Road A2	At grade

7.6.3 Description of the Existing Environment

Existing Soils

Glacial Tills and Glacial Sands and Gravels

The site is underlain by glacial till derived from granite, as identified from EPA digital mapping, as shown in **Figure 7.8**. The depth of the till occurring within the site has been confirmed by cable percussion borings during ground investigation. Dense to very dense glacial till comprising granite and greywacke boulders and clayey gravels are present to depths of between 5.2m and 8.5m below ground level. All in-situ Standard Penetration Test results were equivalent to N=50 or Refusal due to the boulders present.

Glacial outwash sands and gravel materials are generally present on the Carlingford peninsula. The till deposits contain occasional thin bands of moderately to well sorted coarse grained glacial soils which permit relatively low groundwater flow, as discussed in '*Existing Hydrogeology'* below. Trial pit excavations revealed lenses of 0.1m to 0.2m that allowed slow continued seepage for the duration of the excavations. The clayey soils below the lenses were not water-bearing. Very stiff laminated slightly sandy slightly gravelly silts and clays were also discovered locally in trial pit excavations, as were boulders of up to 1.0m size.

Alluvium, Gravels and Boulders

Alluvial materials deposited by river action have been identified in areas along the Newry River. These are generally thin deposits of silts and gravels, up to a maximum thickness of between 1.5m and 3.0m where a matrix of cobbles and boulders are present. The depth of soft silty alluvium proven was determined to a maximum of 1.3m by static probing at the northern mudflats, but is generally 0.5m or less across the majority of the riverbed.

This information from rotary coring and probing contradicts the interpretation of geophysical survey data indicating that alluvial deposits may extend to a maximum depth of over 27m as described in Section 7.6.1 above. Coring through to bedrock has proven that between 1.5m and 6.0m thickness of soil containing significant proportions of boulders lies under the riverbed and over the highly fractured bedrock. These soils are generally very dense.

Peat/Organic Deposits

Peat and brown earth podsolic (organic) clay soils have been identified in the study area using EPA ENVision digital mapping (refer **Figure 7.8** in Volume 3). Cable percussion boreholes indicate that these deposits comprise organic topsoil to a maximum depth of approximately 0.4m close to the southern foreshore. The subsoil directly underneath the peat is confirmed by cable percussion borings as being very dense glacial till with cobbles and boulders.

Made Ground

Much man-made ground is present in the study area, most notably by existing roads, near to existing buildings or on farmland. A pronounced ridge is related to excavation and filling of material at the location of a Dismantled Railway which is indicated to have crossed the site at approximate Chainage 220 to 250 based on Historic 25” OS mapping. From aerial photography, it is apparent that spoil material dug from a nearby small residential construction site filled in the excavation in 2005. This material appears to consist of glacial till bearing weathered rock bearing highly oxidized minerals. The previous level of the railway is evident in the cutting adjacent to an old railway bridge east of the site at this location which is much below the existing ground level. Although the soils at or close to this location have been inspected during ground investigation, no evidence of poorly compacted soils have been found. On this basis, it is anticipated that the infill is predominantly recompacted glacial till.

Minor quantities of rubbish comprising plastic bottles and bags, glass bottles and aluminium cans were present at the surface close to the foreshore along boundary ditches and walls, apparently washed up on the high tide.

Archaeological survey results indicate a training wall along the edge of the forest at Narrow Water and continued along the river bank, supporting a union railway line. This has since deteriorated and over time has become obscured within the main riverbank.

Results from a land-use search by the Environment & Heritage Service of Northern Ireland also indicate that part of the northern riverbank comprised part of a railway rock fill embankment. It would appear that it was partially removed to accommodate a drainage outfall from the Treatment Plant near the A2 roundabout some time after the railway became disused but part of it remains in place close to the proposed northern abutment. However, it is also possible that the river undermined or washed out the embankment.

Trial pitting along the Control Building Access Road identified local pockets of potentially contaminated fill. It is estimated that up to 40% of the materials consisted of clay pipes, plastic, glass, concrete blocks and metal, which are generally relatively inert and can be sorted for disposal or recycling. These seem to be at the locations of dilapidated buildings which have been pulled down and strewn out. Large mounds of masonry rubble were also identified. A flagstone was observed in one of the pits and is considered to be remnant of a disused sewage connection. Within the wider confines of the same parcel of land, rubbish and pieces of broken furniture are scattered on the surface.

It is known that dredging of the Newry River has taken place historically, however the location of deposition of the dredged alluvium is not known. Site investigation of deposits close to the riverbanks did not reveal any significant alluvial deposits or spoil materials derived from alluvial deposits other than stated as Alluvium in above section.

Table 7.6.2 presents a summary of the properties of the soils discussed above.

Table 7.6.2: Typical Soil Properties

Soil Type	Particle Size / Type	Strength	Compressibility	Use as Earthworks
Gravel	Coarse	Good	Low	Good
Glacial Till	Fine and Coarse	Variable	Low-medium	Variable, generally good
Peat	Fine/Organic	Very poor	Very high	Not suitable
Alluvium	Fine	Poor	High	Poor
	Coarse	Variable	Medium	Variable
Boulders	Coarse	Good	Good	Varies, difficult to handle
Made Ground	Variable	Variable	Variable	Variable

Existing Bedrock

Existing geological formations underlying the site have been identified from the Geological Survey of Ireland's (GSI's) 1996 geological mapping for the area (Geology of Monaghan and Carlingford – Sheets 8 and 9) and accompanying memoirs and from the Geological Survey of Northern Ireland's (GSNI's) 1978 Special Mourne Mountains geological mapping (**Figure 7.9** in Volume 3).

The rocks present in the general area are the results of a very active geological history. They comprise of some of the igneous rocks forming the Slieve Gullion Central Complex (Tertiary Peroid) and also sedimentary deposits from the Lower Palaeozoic Central Belt (Silurian Period, Inniskeen Formation).

These periods of geologic activity are summarised in Table 7.6.3 starting with the oldest.

Table 7.6.3: Geological Formations Occurring in the Study Area

Period	Formation	Rock Types	Excavatability	Cutting Stability	Map Symbol (where used)
Lower Palaeozoic (Silurian)	Inniskeen	Greywacke-sandstone and shale/mudstone	Generally rippable	Generally stable, favourable dip	IN (GSI) b (GSNI)
Tertiary	Slieve Gullion Complex	Igneous (Granophyre)	May require Blasting	Generally stable	Pg (GSI) F^p (GSNI)
	Minor Intrusions	Igneous / Metamorphic (Quartz-feldspar)	May require Blasting	Generally stable	Gr, Ng (GSI) I (GSNI)

The site itself is understood to be underlain solely by sedimentary rock of the Inniskeen Formation which is composed of turbiditic greywacke sandstones and minor amounts of shale or mudstones (Silurian deposits). This formation is thought to be medium to thickly bedded. There is characteristically high micaceous and biotite content in this formation. These minerals readily decompose if exposed to the environment so the sandstone should therefore be susceptible to weathering.

Due to the tectonic movements that occurred during and since volcanic activity, faulting is present in the vicinity of the site. One large fault line in particular is shown to follow along the course of the Newry River. Much of the site is within the zone that may have been influenced by these movements. Faulting affects the quality of rock which is often intensively fractured following ground.

Coring at both land and marine borehole locations has proven siltstone, sandstone or interbedded limestone rocks with fractures that are often extreme closely spaced and with two sets of joints, typically at dip angles of 45° and 80°. Between 10m and 20m of predominantly solid rock core have been recovered from the boreholes.

Minerals and Economic Geology

Greywacke stones are generally suitable for use as aggregates in road surfacing materials due to the different rates of weathering between the constituent grains and matrix minerals and also because of the high Polished Stone Value their hard and compacted constituents can achieve (Geraghty, 1996). Quarries extracting stone for aggregates are present close to the river upstream of the site on both sides of the river. No quarrying activities have been identified at the site itself using either BGS GeoIndex or GSI webmapping.

Available geologic mapping indicates an occurrence of Baryte minerals to the north of the northern end of the site. Barium sulphate compounds can be associated with enhanced durability as they are insoluble where present as cementitious content. It is more often encountered as secondary mineral veining or as ores present in lodes (Geikie, 1953). The presence of other sulphates cannot be discounted as these are problematic for the durability of buried structures and foundations.

Existing Hydrogeology

Permeability

The permeability of glacial tills derived from granite is expected to be relatively high. Soils encountered during ground investigations do not appear to have high moisture contents and are not significantly water-bearing. Groundwater strikes have been encountered in relatively thin granular lenses within the glacial tills. Due to the topography along most of the site there does not seem to be significant recharge through the overburden soils.

Also, the permeability of Tills derived from the local granites has been assessed as part of groundwater vulnerability studies for the whole of Northern Ireland to have high permeability, whereas tills derived from the local sedimentary rocks have low permeability (Ball et al, 2005).

Drainage

The site is drained by minor tributaries flowing into the Newry River. The main stream or river close to the southern side of the site other than the Newry River serves as the county boundary between Louth and Armagh. This is draining an area of very high relief on the northern side of Anglesey Mountain.

A small stream crosses the site at Chainage 80, falling to the west before turning north and flowing towards this river around the perimeter of the forest. On the northern side of the Newry River, there are two streams or rivers indicated, converging with the main river channel opposite the Beacon at Narrow Water.

Groundwater Strikes

Based on groundwater strikes encountered in cable percussion borings the groundwater flow is predominantly through bedrock and overburden glacial sands/gravels. No significant strikes were made in the boreholes which were terminated at refusal in glacial till containing boulders. BH101 and BH102, both located in areas where fill construction is proposed, encountered seepage and slow water ingress at between 2.50 and 5.00m BGL. Levels rose to 1.20m BGL in BH102.

Land-based borings were determined to have reached rock where chiselling punched through the boulders with groundwater subsequently rising up the borehole. This assessment is consistent with the geophysical survey report ground profile and has since been verified in several locations by follow-on rotary drilling.

BH103, located further downhill, did not encounter any ground water, nor was any groundwater struck at depths through which the road construction will be in cut. Inspection of the particle size distribution of soils and the geologic profile suggest that the water held in the gravels at the higher southern section of the route is impeded or only poorly connected to the granular soils on the lower side of the hill at the bridge approach because of the presence of predominantly fine grained low permeability soils. The surface drainage system would therefore also seem to be representative of the hydrogeologic regime, with the majority of flow from the northern section continuing westwards and off the route alignment.

Water strikes encountered in TP103 and BH105 approximately demonstrate the steep hydraulic gradient existing along the route as it descends down towards the river through moderate permeability. Standpipes have been installed for monitoring of groundwater levels at BH103 and BH105.

The boreholes in the Newry River all are located in tidal areas, with water levels rising and falling during drilling works, which were conducted off a jack-up barge.

Aquifer Classification and Vulnerability Assessment

Consultation with Geological Survey of Ireland (GSI) groundwater and aquifer information indicates the bedrock aquifer classifications. The Inniskeen Formation has been classified as a poor aquifer that is generally unproductive except for local zones (Pl). Well yields in this aquifer can vary and may generally be <40m^3/day. Aquifers with this potential are generally characterised as having few and poorly connected fractures, fissures and joints. It is likely that they are benefiting from shallow or local zones of slightly higher permeability exist within the top few metres of more fractured/weathered rock.

The fault zones, depending upon the nature of the material in the fault zone, may act either as barriers to groundwater flow or as groundwater conduits. The folding and faulting of the rocks may also confound the locations of the recharge and discharge zones of the flow systems in the area.

Seven wells are indicated within 1km of the site according to GSI's Groundwater Webmapping, which also indicates that bedrock interim aquifer vulnerability varies from high to low, up to extreme for much of the surrounding area where rock is near the surface.

Information on abstraction and usage has been consulted, indicating that the wells are for domestic use only. Three of these wells are stated to yield between 40 and 55 m^3/day, but the least productive two yield less than 10 m^3/day.

Based on conditions observed in cores recovered from borehole drilling and the groundwater levels, it appears that the wider aquifer performance is affected by the infilled fissure network, resulting in poor aquifer storage, short flow paths (tens of metres) and low 'recharge acceptance'.

Consultation with the Geological Survey of Ireland (GSI) does not suggest that there are any significant Quaternary sand and gravel aquifers within the study area on the south side of the river.

Groundwater mapping available on the British Geological Survey website for Northern Ireland (BGS GeoIndex) indicates that the northern bank of the River Newry contains a significant portion of the study area has a high potential superficial gravel aquifer (refer **Figure 7.8** in Volume 3). TP104 and TP105 did not encounter any groundwater to confirm this. The vulnerability of this aquifer is medium to high (Class 4e) as there are superficial layers present.

7.6.4 Impacts of Development

Sufficient design information on the ground conditions is available on the soil and bedrock to discuss the predicted impacts of the proposed development.

Impacts on Soils

Earthwork operations will require the removal of material in cuttings and placing of material in areas of fill. Associated with these demands there will be a small adverse impact as a result of the loss of a small proportion of both high fertility and low fertility soils to accommodate the road alignment embankments, cuttings and accesses. Combined with the importance of these attributes, the overall magnitude of the direct and indirect impacts is imperceptible to permanent slight adverse.

Along the southern section of the development there is close to equal balance of earthworks quantities between cut and fill materials. However considering the amount of topsoil and unsuitable material that will be removed there will be some shortfall, with a net deficit of approximately 8,250 cubic metres (assumed to be equivalent to 20,000 tons). Additional material will be required to be imported to make up this deficit. This volume may alter slightly when allowance is made for pavement materials and proposed landscaping. Some of the topsoil and unsuitable material may be used for landscaping purposes while the remainder will require disposal off site.

The requirement to source these volumes from a nearby quarry has an indirect permanent small adverse impact on quarry resources and necessitates hauling these material volumes, both for delivery to and collection from site by trucks and other large vehicles. The impact of these movements is described in Section 11.3.

The construction of embankments and bridge foundations will have a moderate impact on recent deposits such as soft cohesive alluvium soils than on glacial deposits. The loading applied cannot be sustained by normally consolidated strata without leading to considerable settlements, potentially excessive in either the short or long term. As these are limited to shallow depths, they are to be removed for formation of earthworks foundations.

The embankment on the northern riverbank is likely to require excavation & replacement of soft soils as well as rock armour slope protection within the tidal range. Apart from this, the impact due to the loss of low fertility soils below the surface is negligible.

During the construction phase there is potential for erosion of overburden to occur on the side slopes. In addition compaction of soils will occur under temporary access roads. With appropriate construction detailing and site management, the impacts of these will be negligible.

Cofferdams are required for construction of the foundation supports to the bridge abutments and for the navigation beacon structure. Within the cofferdams the soils are to be removed and temporarily stored for reinstatement at the end of construction. This will have an impact on the topsoil, with negligible to temporary or short term direct small adverse impacts.

There is a potential direct and indirect permanent small adverse impact pertaining to the excavation, removal and disposal or treatment of contaminated soils for construction of the Control Building Access Road. The quantities involved are minimal.

Impacts on Solid Geology

No potentially significant impact from the development on the solid geology (bedrock) of the site has been identified. No rock cuttings are envisaged based on the available information on the depth of overburden along the site. Surface excavations into hard boulders and sandstone rock for the bridge north abutment foundations are required however, as it is to be deepened to a lower level of -8.4mOD to accommodate the rolling bascule counterweight mechanism. These will be progressed from a secant piled cofferdam socketed into the rock, potentially with grouted rock bolt anchors to counteract any buoyancy of the structure.

Piling operations will install structural foundations through to competent bedrock by boring out holes to the specified diameter and installing steel and concrete piles. Loading and stresses applied to the bedrock will be well within the capacity of the rock mass and shall be insignificant relative to prevalent earth pressures once distributed.

Other than the structural void at the north abutment, no man-made voids will be left in the rock in the permanent condition. The risk of there being significant naturally existing voids such as cavities present is low however fissures and fractures are most likely. Piling construction and rock excavations will therefore have a negligible impact on these features.

Impacts on Hydrogeology

There will be possible draw down of ground water locally to facilitate construction activities in areas of cut. As the existing soils are poorly connected and have limited storage and recharge, this is a potential direct permanent slight to moderate adverse impact.

In areas of road crossings through zones of high aquifer vulnerability, specific design measures for road drainage may be required to prevent surface activity from polluting the underlying groundwater. Groundwater quality could be negatively impacted in the long term, due to increased groundwater vulnerability in the areas of cutting, particularly between Chainage 250 and 300, where road surface runoff in superficial drains will have reduced overburden cover over the aquifer. Accidental spillage could potentially contaminate the aquifer by direct percolation or via the superficial water network. This is a potential long term slight adverse impact.

High groundwater levels are often present in soft soils such as alluvium or peat, requiring dewatering prior to excavations for foundations. Insufficient dewatering can be the cause of unnecessary settlements during and after construction as pore pressures dissipate.

Fractured rock may have increased aquifer potential due to flow through fissures. Since the bedrock aquifer at the site is indicated to be moderately productive and of local importance, it is possible that piling operations close to tidal waters may have short term localised impacts on groundwater due to boring operations. The location of these short term operations will be at the downstream end of this aquifer and should only be affected for a very short time hence the impact to hydrogeology will be negligible.

7.6.5 Proposed Mitigation Measures

In general, the temporary and permanent impacts on soils, geology and hydrogeology are considered minimal and will be managed by a number of best practice control measures including:

- All suitable material excavated within the cut sections shall be used to the greatest possible degree as fill material on the development.
- All unsuitable material excavated shall be disposed of in accordance with legislative requirement with due regard for the impact on the disposal site. Where possible this material will be utilised in landscaping of the development.
- Embankment and cut slopes which are considered at risk from erosion are to be topsoiled and seeded as soon as possible to prevent the deterioration due to weathering effects.
- Potential pathways for surface pollution by road surface water runoff will be mitigated by means of a suitable drainage system, from approximately Chainage 250 to 300 in particular.
- It is likely that a clay liner or geosynthetic membrane could be utilised between Chainage 250 and 300 to reduce the potential for contamination of soils and groundwater by petrol or other contaminants.
- All topsoil and any pockets of organic material will be removed from the proposed route prior to construction. Where construction of earthworks on soft ground is required at the northern riverbank, excavation of soft soil materials will be required prior to placing any embankment fill materials.
- Topsoil will be removed from all temporary access roads in advance of construction and stored. For the permanent condition reinstatement the underlying soil will be scarified and the topsoil will be replaced and seeded following the removal of temporary works.
- Appropriate drainage will be provided to collect seepage water and slope angles provided suitable for materials in side slopes.
- Monitoring of groundwater installations to be undertaken at construction stage.
- A geotextile screen and boom with oil barrier will be required around marine works to prevent runoff, silt, oil or other deposits generated by construction activities such as boring in overburden or rock from polluting the river.
- A monitoring programme for sampling and testing of suspended solids and turbidity in the Newry River during any such construction activities.

- Replacement of soils in tidal ranges with general granular Class 1 or select granular Class 6A fill is proposed, with appropriate geotextile separation and rock armour shoulders to the embankment.
- Avoidance of excavation and removal of potentially contaminated soils where alternative engineering solutions can be used in the proposed development to ensure the existing ground is capable of providing adequate formation to access roads over potentially contaminated ground.
- Where soft cohesive alluvium, gravels and boulders are present, proof-rolling may be used to confirm whether the soils need to be removed or if they may remain in place subject to detailed design.

7.6.6 Residual Impacts

No significant residual impacts of soil, geology or hydrogeology is anticipated as a result of the development.

7.6.7 Sources of Information

The following sources of information were used:

- Geraghty, M., 1996, Geology of Monaghan-Carlingford, Bedrock Geology Memoirs and 1:100,000 Map sheets 8 and 9, Geological Survey of Ireland.
- Geological Survey of Ireland, Digital Mapping, 2008 (http://www.gsi.ie/Mapping.htm)
- Geological Survey of Northern Ireland, 1978, Mourne Mountains Special Sheet Solid Edition 1:50,000
- Geological Survey of Northern Ireland, BGS GeoIndex Digital Mapping, 2008 (http://www.bgs.ac.uk/GeoIndex/index.htm)
- Environmental Protection Agency, ENVision Digital Mapping, 2008 (http://maps.epa.ie/InternetMapViewer/mapviewer.aspx)
- Geological Survey of Ireland, Directory of active quarries, pits and mines in Ireland, 2001.

7.6.8 References

Hanrahan, E.T., 1977, Irish Glacial Till: Origin and Characteristics, Oighear-Thalamh Éireann

Charlesworth, J.K., 1973, Historical Geology of Ireland, Oliver and Boyd

Hatch, F.H. & Rastall, R.H., 1965, Petrology of the Sedimentary Rocks, Thomas Murby & Co.

Geikie, J., 1953, Structural and Field Geology, Oliver & Boyd, Edinburgh.

Ball, D., McConvey, P. & Campbell, E., 2005, A groundwater vulnerability screening methodology for Northern Ireland, British Geological Survey Commissioned Report CR/05/103N.

NRA, 2008, Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.

Chapter 8

Landscape & Visual Impact

Chapter 8 Landscape & Visual Impact

8.1 Introduction and Terms of Reference

Brady Shipman Martin, Landscape, Planning and Environmental Consultants, was commissioned by Roughan & O'Donovan (ROD) to prepare a landscape (and visual) impact assessment report for the proposed Narrow Water Bridge Project. This section assesses the likely significant effects of the proposed development on landscape and visual environment and forms part of the Environmental Impact Statement/Environmental Statement (EIS/ES) required for this scheme.

Landscape has two separate but closely related aspects. The first is visual impact; that is the extent to which a proposed development can be seen in the landscape. The second is impact on landscape character; that is the impact that a proposed development may have on the fabric of the landscape.

Landscape character is defined as the distinct and recognisable pattern of elements that occur consistently in a particular area. This draws on the appearance of the land; including shape, form and colour, and their particular interactions to create specific images and patterns distinctive to particular localities – in other words to create a 'sense of place'.

8.2 Methodology

8.2.1 General

Both desktop and field studies were undertaken in the landscape and visual assessment.

The desk study allowed for the identification of the relevant landscape and visual designations and guidance policy relating to the local and wider landscape context.

The baseline assessment included a review of national and local development plans and relevant documents in order to consider the likely impact of the proposed development within the context of existing landscape policy for the area. A list of baseline reference documents is provided in Section 8.2.4 Guidelines, Information and Policy References.

The desk study also included for review of ordnance survey mapping, aerial photography and site plans, together with plans, sections and elevations of the proposed development. In addition, various local information sources, including internet-based resources, were consulted in the course of the assessment. Other chapters of this EIS/ES were also reviewed providing both contextual information and consideration of potential for interaction of effects.

Site visits involved roadside surveys of the wider setting on both sides of Narrow Water, together with walking surveys of immediate areas and trails in the vicinity of the site.

8.2.2 Assessment Methodology

The assessment methodology has regard to advice notes and guidelines for landscape and visual assessment as set out in the following documents:

- Advice notes on current practice in the preparation of Environmental Impact Statements, 2003; Environmental Protection Agency.

- Design Manual for Roads and Bridges: Volume 11: Section 3: Part 5: Landscape Effects; Highways Agency, Department of Transport.
- Environmental Impact Assessment of National Road Schemes – A Practical Guide; National Roads Authority.
- Guidelines for Landscape and Visual Impact Assessment 2nd Edition, 2002; Landscape Institute and Institute of Environmental Management and Assessment.
- Guidelines on information to be contained in Environmental Impact Statements, 2002; Environmental Protection Agency.

In carrying out the landscape and visual assessment the baseline study of the receiving landscape describes:

- The landscape planning context, including any special values that may apply, *e.g*. regional or local landscape designations;
- The landscape character, including patterns and scale of landform, land cover, land use and built development;
- The visual landscape, including location of visual receptors, and
- In summary the significance and sensitivity of the landscape and visual environment.

The effects of the proposed development on the receiving landscape and visual environment are assessed and impacts described in terms of their significance as described under Significance Assessment Criteria below. In the assessment, landscape impacts are defined as:

- direct effects upon specific landscape elements;
- changes in the fabric, character and quality of the landscape
- effects on the overall pattern of landscape, regional and local distinctiveness, and
- effects on designated landscapes, amenity and conservation areas.

Visual impacts are considered in viewer groups and defined as:

- direct effects on views;
- effects on viewers, properties, and
- effects on visual amenity

Measures which aim to avoid, reduce and remediate significant impacts are described where appropriate under Mitigation Measures and any remaining significant impact noted under Residual Impacts.

8.2.3 Significance Assessment Criteria

The construction of the proposed bridge and associated works will give rise to effects on the landscape and visual environment, which are assessed in terms of the significance levels provided in Table 8.1.

Table 8.1 Significance of Impacts

Level of Impact	Definition
Imperceptible impact	An impact capable of measurement but without noticeable consequences or no discernable change in the existing view
Slight impact	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities. Arises where the proposed scheme forms only a small element in the overall panorama or where there is substantial intervening screening in the form of topography and/or vegetation.
Moderate impact	An impact that alters the character of the environment in a manner that is consistent with existing and emerging trends. Arises where an appreciable segment of the existing view is impacted or where there is intrusion in the foreground.
Significant impact	An impact which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment Arises where the proposed scheme would result in significant alteration of the existing view or where the view is obstructed or so dominated by the proposed scheme that it becomes the focus of attention. Generally, there will be open views of the development in the foreground.
Profound impact	An impact, which obliterates sensitive characteristics

Impacts may be *positive*, *neutral* or *negative* and impact duration may be considered as being *temporary* (up to 1 year); *short-term* (from 1 to 7 years); *medium-term* (from 7 to 15 years); *long-term* (from 15 to 60 years) or p*ermanent* (in excess of 60 years)[1].

8.2.4 Landscape Guidelines, Information and Policy Reference

The assessment has regard to the information as set out in the following documents:

Republic of Ireland

- A Geological Field Guide to Cooley, Gullion, Mourne & Slieve Croob, 2008: Baxter, S.
- Atlas of the Irish Rural Landscape, 1997: Aalen, F.H.A., Whelan, K., and Stout, M.
- Carlingford Local Area Plan 2002: Louth County Council.
- Inventory of Outstanding Landscapes in Ireland, 1977: An Foras Forbartha.
- Louth County Development Plan 2009 – 2015: Louth County Council.
- Omeath Local Area Plan 2002: Louth County Council.
- Landscape Character Assessment of County Louth, 2002: Louth County Council.
- Landscape and Landscape Assessment – Consultation Draft Guidelines for Planning Authorities, 2000: Department of Environment and Local Government.

Northern Ireland

- Banbridge / Newry and Mourne Area Plan 2015: (Draft Plan August, 2006); Planning Service, Department of the Environment Northern Ireland.

[1] EPA Guidelines on the information to be contained in Environmental Impact Statements, 2002

- National Parks and other Protected Landscape Areas, 2004: Department of the Environment Northern Ireland.
- A Planning Strategy for Rural Northern Ireland, 1993: Department of the Environment Northern Ireland.
- Northern Ireland Landscape Character Assessment 2000: Department of the Environment Northern Ireland.
- Planning Policy Statement 6: Planning, Archaeology and the Built Heritage, 1999: Planning Service, Department of the Environment Northern Ireland.
- Planning Policy Statement 21: Sustainable Development in the Countryside, 2010: Planning Service, Department of the Environment Northern Ireland.
- Statement of Policy on Protected Landscapes 'Shared Horizons' 2003: Environmental and Heritage Service, Department of the Environment Northern Ireland.
- Warrenpoint Strategic Development Framework 2004: Newry and Mourne District Council.

8.3 Landscape Planning Context

The location for the proposed bridge crossing is set within one of the more highly designated landscapes on both sides of the border. The following provides a detailed overview of the landscape objectives, policies, and strategies relevant to the project within each jurisdiction.

8.3.1 Landscape Planning: Republic of Ireland

In 1977, An Foras Forbartha published an Inventory of Outstanding Landscapes in Ireland. The Carlingford Mountains: Flurrybridge - Grange Cross was listed (at No. 14) within the inventory. The landscape type was described as "*wooded uplands*" where distinctive features of "*granite and volcanic rocks make up this chain of conical peaks. Steep north-facing slopes give fine views of the fjord of Carlingford Lough and the Mourne Mountains beyond*". "*Housing development*" was listed as a potential hazard. The area identified in the Inventory substantially coincides with the landscape unit described as the 'Carlingford Lough Mountains and West Feede Uplands' in the Landscape Character Assessment of County Louth 2002, see Plate 8.3 below.

The National Inventory of Architectural Heritage (NIAH) includes listings for historic gardens and designed landscapes in the Republic of Ireland. There is no listing close to the proposed bridge crossing with the nearest being Park Hotel (Omeath Park) and Drummullagh both located between 1 and 2km southeast of the site at Omeath. (www.buildingsofireland.ie/Surveys/Gardens/). Heritage Gardens and Designed Landscapes are also discussed under Section 2.7.4 (page 41) of the Louth County Development Plan, 2009-2015.

8.3.2 Landscape Planning: Louth County Development Plan 2009-2015

Being located on the coast of Carlingford Lough the site for the proposed bridge crossing and its connection to the R173 within County Louth lies within an Area of High Scenic Quality and of specific development control. The area also falls within the visual context of a number of protected views and prospects and protected structures. An Area of Outstanding Natural Beauty (AONB) lies south of the site of the proposed bridge crossing and associated connection to the R173. The project does not impact on trees and woodlands scheduled for preservation. These and other landscape and visual issues are discussed in more detail in the following.

Conservation and Heritage

Chapter 2 of the Plan notes (Section 2.3 **Natural Heritage and Biodiversity**, page 21) that the county contains numerous natural assets including an extensive coastline, marine environments, wetlands, woodlands, rivers and upland habitats that together support a rich variety of plant and animal species. Amongst these, the upland areas of the Cooley Peninsula are recognised as being some of the most beautiful and unspoilt in the country. It is noted (page 22) that the Plan "*has a fundamental role in facilitating development whilst protecting and enhancing the natural and built environment.*"

Policies CON 1 to CON 7 set out the Council's responsibilities for designating, protecting, promoting and enhancing its natural and built assets.

The **Landscape Character Assessment** of County Louth (at section 2.4, page 23), highlights (at Table 2.1, page 23) the international significance of the Carlingford Lough and Mountains, including West Feede Uplands. Two specific Policies have regard to landscape character as follows:

Policy CON 1: To afford protection to the landscapes and natural environments of the county, by permitting only those forms of development that are considered sustainable in rural areas and do not unduly damage or take from the character of the landscape or natural environment.

Policy CON 2: To co-operate with adjoining local authorities, both north and south of the border, to ensure that the environment is maintained in a sustainable manner and to support the co-ordinated designation of sensitive landscapes and policy approaches with adjoining areas and on all aspects of environmental protection particularly where transboundary environmental vulnerabilities are identified.

Section 2.6.5 of the Plan (page 34) discusses **Trees and Woodlands**. There are no Champion Trees (Table 2.6, page 33) or Trees Protected by Tree Preservation Orders (TPOs) in the vicinity of the proposed bridge crossing. Table 2.8 of the Plan lists Trees and Woodlands of Special Amenity Value and indicates one listing - TP17: Woodlands at Omeath Park as being the nearest to the vicinity of the proposed bridge crossing. Policies CON 16 to CON 20 relate to the protection of trees and woodlands of special amenity value; the assessment of the implications of proposed development on significant trees; and the promotion of deciduous native tree planting generally.

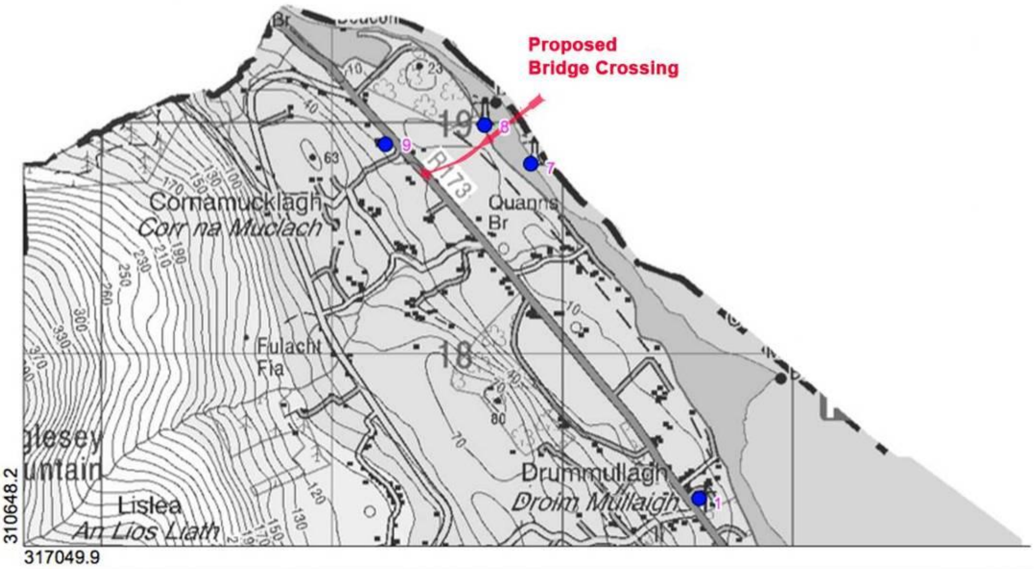
Section 2.7.2 of the Plan (page 38) discusses **Protected Structures** and sets out policies (page 40) for their protection. Four protected structures lie within 2km of the proposed bridge crossing. St. Andrew's Church Omeath (see reference LHS0002-001, **Plate 8.1**), is located circa 1.8km southeast of the site of the bridge crossing. A second structure, a house at Cornamucklagh (see Ref. LHS0002-009, **Plate 8.1**), lies circa 250m northwest of the proposed tie-in roundabout on the R173. The proposed bridge also passes closely between two free-standing lighthouses (see Ref. LHS0002-007 and LHS0002-008, see **Plate 8.1**), both located on the southern shore of Carlingford Lough.

Three policies (CON 23, CON 24 and CON 25, page 40) relate to Protected Structures:

CON 23: To permit the deletion of structures from the Register of Protected Structures and the demolition or significant modification of a protected structure, only in exceptional circumstances.

CON 24: To ensure that new development either adjacent to or at a distance from a protected structure shall complement and be sympathetic to the structure or its setting in terms of its design, scale, height, massing, alignment and use of material.

CON 25: To encourage the retention, sympathetic reuse and rehabilitation of protected structures and their settings.



I. D. No.	Map Sheet	Address	Name	Description	Notes	NIAH No. see buildingsofireland.ie
Lhs002-001	2	Drummullagh	St Andrew's Church	Church	Freestanding former Church of Ireland church, dated 1838, Three-bay nave, three-stage pinnacled square tower centrally located at west end, single-bay chancel to east end with lean-to vestry projecting from south side.	13833004
LHS002-007	2	Beacon, Cornamucklagh	Beacon	Lighthouse	Freestanding light beacon, built c. 1880, one of a pair. Circular-plan, tapering shaft, conical roof. Ashlar granite roof, projecting eaves corbel string. Uncoursed rubble granite walling.	13900201
LHS002-008	2	Lighthouse, Cornamucklagh	Lighthouse	Lighthouse	Freestanding light beacon, built c. 1880, one of a pair. Circular-plan, tapering shaft, conical roof. Ashlar granite roof, projecting eaves corbel string. Uncoursed rubble granite walling.	13900202
LHS002-009	2	Cornamucklagh		House	Detached three-bay two-storey house, built c. 1920. Slightly projecting flat-roofed single-storey entrance porch flanked by full-height canted bay windows, single-storey pitched roof wing to east.	13900203

Plate 8.1 **Protected Structures Zones** Extract: Map 2 Volume 3 Louth County Development Plan - annotated to show location of proposed bridge.

Rural Development and Natural Resources

Chapter 3 of the Plan notes (section 3.1 Introduction, page 45) that rural areas of the county are changing rapidly as a result of the changing nature of farming and the demands of modern agricultural practices, the impact of the growing demand for urban generated one-off houses in the countryside and the recreational needs of urban based populations.

The Council's Rural Development Strategy (section 3.3, page 48) is based on promoting sustainable rural development aimed at maintaining vibrant and viable rural communities while also seeking to protect the amenity, recreational and heritage value of the rural landscapes and countryside of the county.

Development Zones

Section 3.10 of the Plan (page 57) details development zones for the county. The purpose of the zones is to ensure that development protects the amenities of rural areas and takes place in a sustainable and appropriate manner. The county is divided into five Development Zones 1 to 5, see **Plate 8.2**, where Development Zones 1, 2 and 3 are relevant to the location of the proposed crossing. The particular summary strategic objective for each zone is outlined in Table 3.3 of the Plan and reproduced – in-part – in **Table 8.2** below.

Located at higher elevations, Zone 1 relates principally to the extremely sensitive high mountainous areas of Cooley, Feede, and Ravensdale.

Located between the mountains and the coast, Zone 2 relates to high scenic areas that are found in the lower regions of the Cooley Mountains, in Upper Faughart, Ardee Bog, Hamilstown, Fieldstown, Monasterboice, Mount Oriel, Dunany Point and the Boyne Valley. There is, however, a substantial existing rural population within these areas and the Plan supports the continued vibrancy and vitality of these communities.

Zone 3 covers the coastline of County Louth stretches from the County Down border, along Carlingford Lough and Dundalk Bay to the Boyne Estuary outside Drogheda. It is considered to be of considerable intrinsic, special amenity and recreational value and is also home to a variety of natural habitats with several species of flora and fauna.

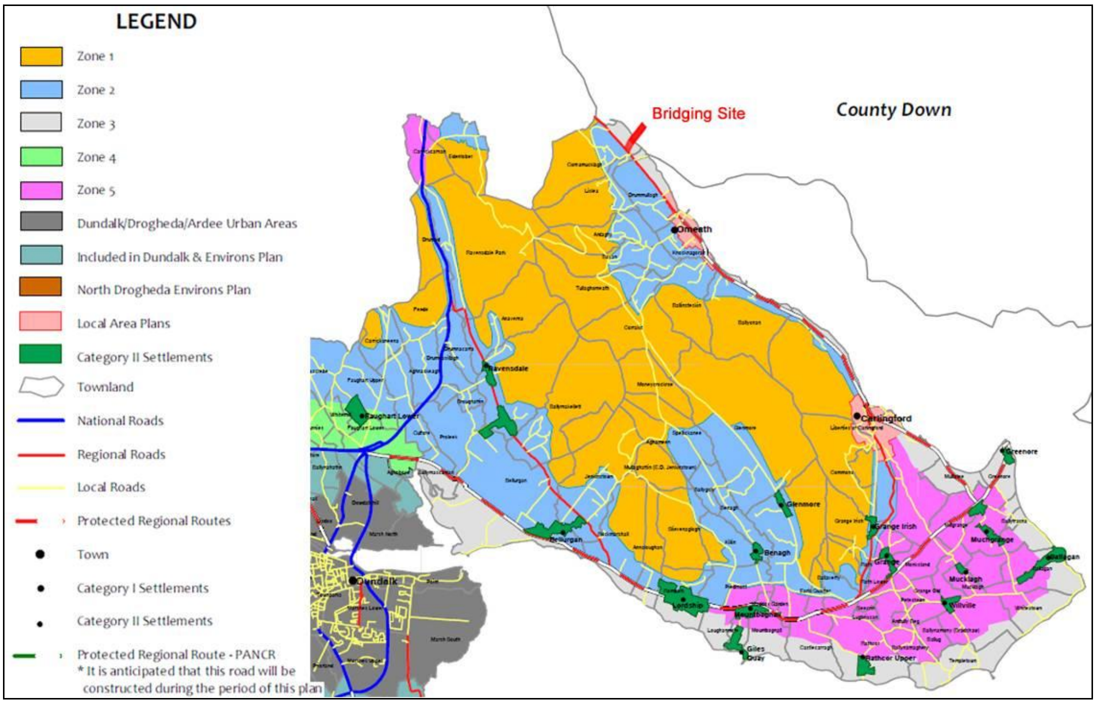


Plate 8.2 **Development Zones** Extract: Map 3.2 County Development Plan - annotated to show location of proposed bridge.

Table 8.2 **Summary Strategic Objectives for Development Zones** *Extract Table 3.3 of County Development Plan*

Zone	Strategic Objective
1	To preserve and protect the natural unspoilt physical landscapes.
2	To protect the scenic quality of the landscape and facilitate development required to sustain the existing rural community.
3	To protect the recreational and amenity value of the coast.

In effect, the entirety of the County Louth element of the proposed project is located within Development Zone 3 and the Plan contains two specific Policies of relevance:

RD 36: To only permit development that would not be detrimental to the visual and recreational amenities of the coast. Such development would include limited one-off housing, extensions to existing authorised uses and farmyards, tourism, (excluding holiday homes) leisure and recreation related projects, and renewable energy schemes.

RD 37: Multi-unit residential developments, large-scale intensive agricultural, industrial and commercial developments or other developments of similar scale or nature would not be considered appropriate within this zone.

Recreation and Amenity

County Louth possesses two **Areas of Outstanding Natural Beauty** (AONB) designated by reason of their unspoiled natural landscapes and spectacular scenic quality (section 6.3.1, page 120). AONB1 covers the Carlingford and Feede Mountains area, see **Plate 8.3**. The significance of the Carlingford landscape is also acknowledged and recognised in the Landscape Character Assessment of County Louth (2002), as discussed under Landscape Character later in this chapter.

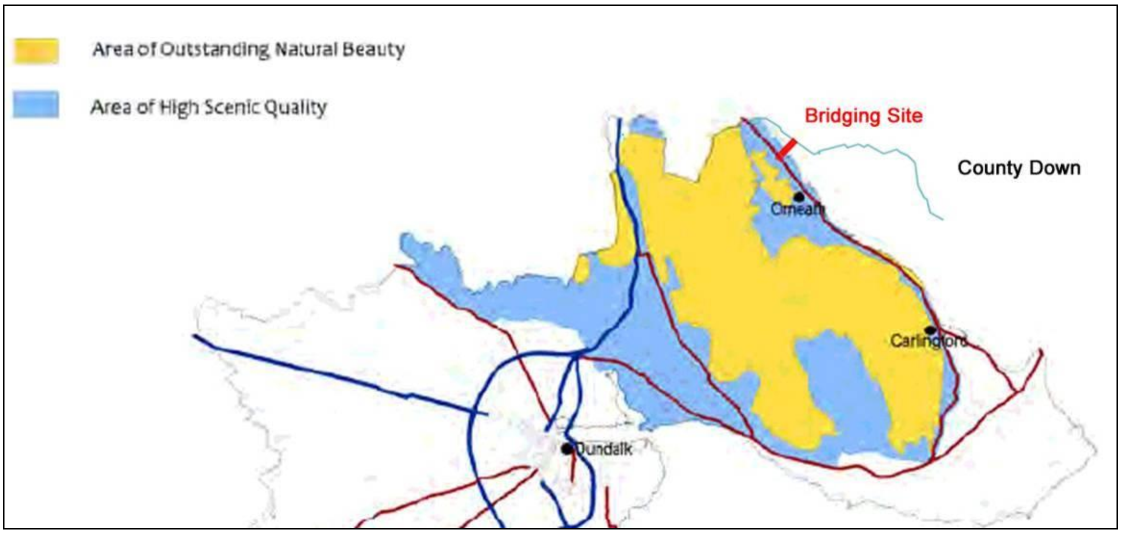


Plate 8.3 **Areas of Outstanding Natural Beauty** Extract: Map 6.1 County Development Plan - annotated to show location of proposed bridge.

The Coastline

Section 6.4 (page 120 of the Plan) states that the coastline of County Louth stretches for more that 120 kilometers from north of Omeath in Carlingford Lough to Drogheda on the Boyne Estuary. The character of the Carlingford coastline draws on views over narrow coastal waters framed by steep uplands on the southern side and rolling hills backed by more significant mountains to the north. Carlingford has become a popular holiday destination based on its historic heritage and marina facility. The Council recommends the preparation of an Integrated Coastal Zone Management Plan (ICZM) for Carlingford Lough and sets out specific policies in this regard, together with flood protection and in protection of the amenity value of the coast (Policies RA 7 to RA 9, page 120).

Scenic Routes

Section 6.5, (page 121) of the Plan states that it is the policy (Policy RA 10) of the Council to prohibit development that would interfere with or adversely affect the scenic routes as identified in table 6.4. The scenic routes in the vicinity of the proposed bridge crossing are listed in **Table 8.3** and identified on **Plate 8.4**.

Table 8.3 **Scenic Routes** *Extract: Table 6.4 of County Development Plan*

Reference	Route
SR22	Windy Gap – Omeath Village
SR25	Carlingford - Omeath

Views and Prospects

Section 6.6, page 122 of the Plan states that it is the policy of the Council to preserve the views and prospects of special amenity value as identified in table 6.5 (Policy RA 11) and to improve, where necessary, public access to viewing points subject to the availability of resources (Policy RA 12).

Views and Prospects of special amenity value are listed in Table 6.5 of Plan (section 6.6, page 121). Views and Prospects in the vicinity of the proposed bridge crossing are listed in **Table 8.4** and indentified on **Plate 8.4**.

Table 8.4 **Views and Prospects** *Extract: Table 6.5 of County Development Plan*

Reference	Views and Prospects
V1	Drummullagh – View towards Narrow Water
V2	Clermontpase Road
V3	Clermont Cairn RTE Road
V4	Windy Gap
V5	Carlingford Lough

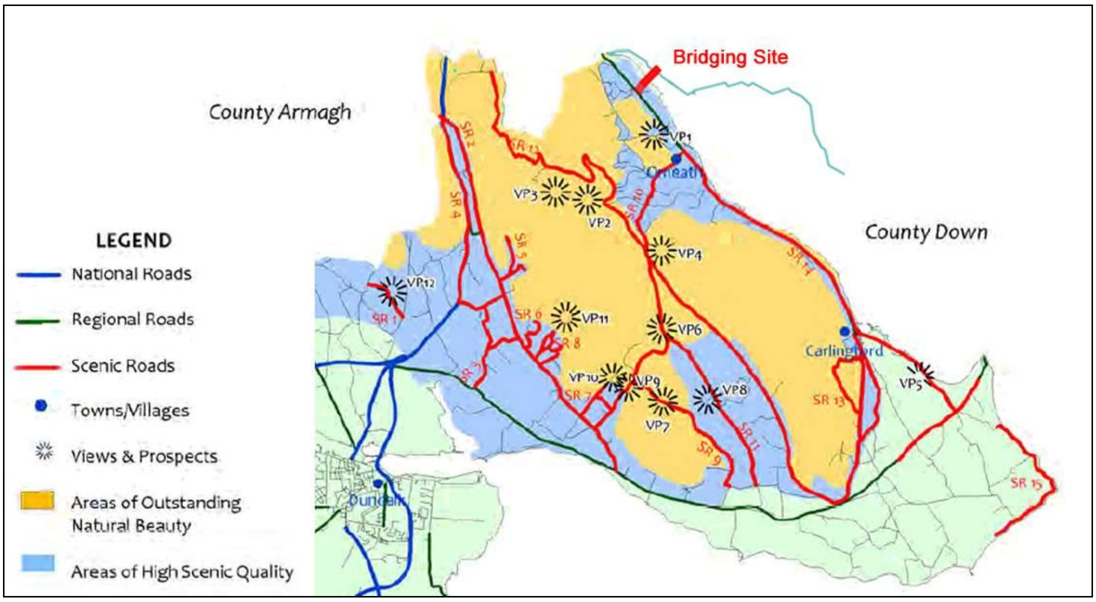


Plate 8.4 **Scenic Routes and Views & Prospects** Extract: Map 6.2 County Development Plan - annotated to show location of proposed bridge.

Walks and Cycle Paths

Section 6.7, (page 123) of the Plan sets out objectives and policies (Policies RA 13 to RA 18, page 124) for the promotion of walking and cycling. Many of the walks and cycle-ways focus on the Cooley Peninsula, where the most significant route is the Táin Way, see **Plate 8.5**. The Council has also prepared *A Walking Strategy for the Cooley Peninsula*, which envisages the development of further looped walks at Slieve Foy, Meave's Gap, Greenore, Templetown and in Cooley. Section 8.16 of the Plan states that where feasible, provision will be made for cycling and walking within new road proposals and improvement schemes (Policy TC 29, page 166).

Plate 8.5 **The Táin Way**: Extract Map 6.3 County Development Plan, 2009-2015

8.3.3 Landscape Character Assessment of County Louth, 2002

The Landscape Character Assessment sub-divides County Louth into 9 separate landscape character units, two of which – the Cooley Lowlands and Coastal Area' and the 'Carlingford Lough, Mountains including West Feede Uplands' – cover the wider Carlingford Peninsula, see **Plate 8.6**.

The 'Cooley Lowlands and Coastal Area' covers the eastern and southern peninsula where the landscape is relatively flat and slopes gradually towards the sea to the north, east and south. To the west, the Carlingford Mountains provide a steeply rising backdrop.

The Carlingford Lough and Mountains Area, including the West Feede uplands covers the main central and northern area of the Carlingford Peninsula, including the setting for the proposed bridge crossing at Narrow Water – see Plate 8.3.

The landscape unit forms the greater central and northern part of the Carlingford peninsula and Feede Mountain. Slieve Foye (588m OD) and Black Mountain (508 m AOD) are separated by steeply sloping valleys. The two well-defined ridges at

Aghnameen and Windy Gap present a dramatic change in landscape approaching from both the south and the north.

Pasture land is primarily located below the 170 m contour. Above this level the landscape is typically open upland with bracken, gorse and heather, bringing variety to the landscape with changing colours at different seasons.

Rock scree is also evident at the lower slopes of Slieve Foye in Glenmore. The road between Carlingford and Omeath (R173) offers panoramic views across the lough to the Mourne Mountains. Expansive views are also available when traveling north between Windy Gap and Omeath and South from Aghameen to Jenkinstown.

The Ravensdale Park valley between Feede and Blacks Mountains with its narrow steep sloping wooded landscape is very enclosed and was once considered as a potential site for the construction of a large water reservoir to supply Dundalk.

In contrast to the rest of the coastline, Slieve Foye slopes steeply to the coast where there is a sharp precipitous edge.

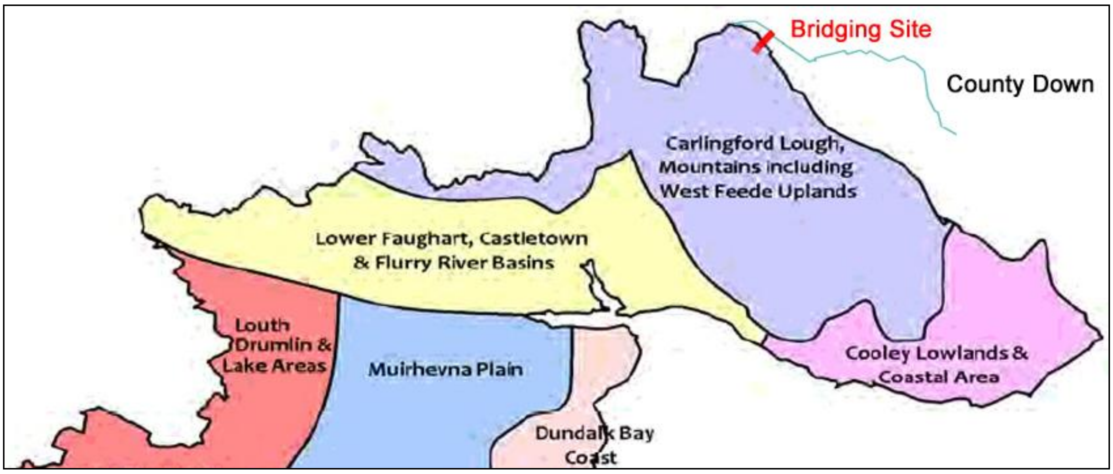


Plate 8.6 **County Louth: Landscape Character Units** Extract: Map 2.1 County Development Plan, 2009-2015 – annotated to show location of proposed bridge.

The Key Characteristics of the Carlingford Lough and Mountains Area is provided in **Table 8.5** below (the full document is available online at *http://www.louthheritage.ie/content/files/LouthLandscapeCharacterAssessment.pdf*

Table 8.5 **Landscape Characteristics** *(from Landscape Character Assessment of Louth, 2002)*

Carlingford Lough & Mountains including West Feede uplands.
Key Characteristics
• A dramatic mountainous area where the visual impact is increased, by its location on a peninsula.
• The valley of Glenmore, tapering off to its enclosure at the higher level which allows for a full appreciation of the landform in the area.
• The open moorland of the higher areas with its variety of bracken, gorse and heathers.
• The imposing geological feature of the Lough itself between the Cooley and Mourne mountains.

Carlingford Lough & Mountains including West Feede uplands.
Key Characteristics
• The intimate road network in the area which offers a great variety of landscapes in such a small area. • The sense of isolation of tranquillity in the Moneycrockroe area. • Large pockets of coniferous forests throughout the area, a few of which area poorly defined. • Area is rich in archaeological items and renowned in legend folklore. • Pressures for isolated housing in the scenic areas, which tend to be quite large in their mass.

In developing tourism, the Council recognises the importance of co-operation between various local authorities and relevant agencies both north and south of the border (section **7.5.2 Co-operation with other Bodies**, page 145). The Plan goes on to state that such "*initiatives could involve the co-funding of tourism infrastructure, product development and marketing.*"

The Plan states (section **7.5.3 Cross Border Geologically Themed Project**, page 145) that the Council "*will explore with the relevant authorities north of the border the development of an integrated, themed, cross border project based around the common themes of a high quality landscape and natural heritage*". In considering such projects, the Plan recognises that the common bond of the high-quality landscape of Cooley, the Mournes and Slieve Gullion also has economic benefit, which can be harnessed through "*the respective local authorities adopting a collaborative approach to the development of the region's natural wealth*".

The provision of a road link between the Cooley Peninsula and County Down at Narrow Water is a stated objective of the Development Plan (section **7.5.4 Narrow Water Bridge**, p. 146). It is considered that the bridge "*would make a valuable contribution to the development of tourism in Louth and the Mournes*" and it is the Policy (TOU 6, page 146) of the Council "*To co-operate with the authorities in Northern Ireland in the provision of a road bridge between Cooley and south County Down.*"

The objective of developing Narrow Water Bridge is re-iterated under Section 8.7 Roads Improvement Programme 2008-2015 (page 160) and listed in Table 8.9 Strategic New Roads of the County Development Plan.

8.3.4 Landscape Planning: Northern Ireland

Planning and Development in Northern Ireland is controlled by the Planning Service, an agency within the Department of the Environment. Designations, policies, proposals and zonings flow from the Plan Strategy and reflect the Strategic Planning Guidelines contained in the Regional Development Strategy (RDS) and the regional planning policies contained in Planning Policy Statements (PPSs)

The setting for the northern tie-in to the existing roundabout on the A2 at Warrenpoint is a highly designated landscape – see **Plate 8.7 Landscape Designations** (and refer Figure 8.1 'Landscape Setting', EIS/ES Volume 3) In terms of landscape designation the proposal:

- falls within the Mourne Area of Outstanding Natural Beauty (AONB);
- crosses a Newry City to Rostrevor Coastal Policy Area (CPA);

- adjoins the Newry (Warrenpoint) Green Belt, a large area which includes the A2 and tie-in roundabout;
- falls within the Narrow Water Local Landscape Policy Area (LLPA) Area of Outstanding Natural Beauty (ANOB);
- lies close to the Narrow Water House Historic Park, Garden & Demesne;
- lies within the visual context of an Archaeological Site & Monument in State care (Narrow Water Castle), and
- lies with the visual context of a scheduled Archaeological Site & Monument.

These landscape and visual aspects are discussed in more detail in the following sections.

A Planning Strategy for Rural Northern Ireland (PSRNI)

A Planning Strategy for Rural Northern Ireland incorporates regional policies and associated practice for the planning and control of development in rural areas. The PSRNI has in effect been almost entirely replaced by specific Planning Policy Statements (PPSs)

Strategic Policy SP 10: Tourism aims to facilitate appropriate tourist and recreational developments, stating that "*planning policy will be exercised positively in favour of tourism, subject to environmental impact*". Policy TOU 1, notes that while tourist proposals will be balanced against the objectives of protecting these areas, "*the Department recognises that in some scenic areas, where development must be strictly curtailed, there may be a need, exceptionally, for a "one-off" unique facility to meet a particular tourist need. Such unique proposals will be considered on their merits taking into account need, location, siting and an assessment of environmental impacts."*

Policy TOU 2 aims to protect key environmental assets for the tourist industry, including areas that owe their attraction to the exceptional quality of the landscape or particular features of the built environment, *e.g*. Areas of Outstanding Natural Beauty, Conservation Areas and historical and archaeological sites. The Policy also notes that in some cases, tourist development may be acceptable in an area of stricter planning control and refers to Policy CO 5. While focusing on Tourist and Recreation Schemes, this Policy notes that "*exceptionally, proposals on the undeveloped coastline may be acceptable where the development is judged to be of considerable regional importance to the tourist industry*".

Design Policy DES 4 **Areas of Outstanding Natural Beauty** requires that development proposals in AONBs be sensitive to the distinctive character of the area and the quality of their landscape, heritage and wildlife. Designation as an AONB does not necessarily rule out certain forms of development. However, it will be necessary to put forward proposals that reflect an appreciation of, and sympathy for, the special character of each AONB

Planning Policy Statements (PPS)

Planning Policy Statements set out the regional planning policies on particular aspects of land use planning and apply to the whole of Northern Ireland.

PPS 02: **Planning and Nature Conservation** sets out policy at item 64 (page 20) in relation to protection of **Trees and Woodlands** that are of particular importance because of their nature conservation value or their contribution to the amenity of a particular locality. There are no trees and woodlands of significance impacted along the area of the proposed bridge crossing at Narrow Water.

PPS 06: **Planning, Archaeology and the Built Heritage**, sets the context for *interalia* Archaeological Sites and Monuments; Historic Parks, Gardens and Demesnes; Listed Buildings; Conservation Areas; Areas of Townscape or Village Character and Local Landscape Policy Areas.

Section 3.0 **Archaeological Sites and Monuments** (page 13) includes Policy BH 1 on the Preservation of Archaeological Remains of Regional Importance and their Settings:

"The Department will operate a presumption in favour of the physical preservation in situ of archaeological remains of regional importance and their settings. These comprise monuments in State Care, scheduled monuments and other important sites and monuments which would merit scheduling. Development which would adversely affect such sites of regional importance or the integrity of their settings will not be permitted unless there are exceptional circumstances".

Narrow Water Castle (*i.e.* old castle) is listed as an Archaeological Site & Monument in State care. A second scheduled archaeological site & monument, a motte (refer Chapter 10) is located northwest of the existing A2 roundabout at Warrenpoint to which the proposed bridge will tie-in on the northern side of Narrow Water.

Section 5.0 **Historic Parks, Gardens and Demesnes** (page 20) includes Policy BH 6 on the Protection of Parks, Gardens and Demesnes of Special Historic Interest:

"The Department will not normally permit development which would lead to the loss of, or cause harm to, the character, principal components or setting of parks, gardens and demesnes of special historic interest. Where planning permission is granted this will normally be conditional on the recording of any features of interest which will be lost before development commences."

Section 5 goes on to state that in assessing development in or adjacent to parks, gardens and demesnes of special historic interest, particular attention will be paid to the impact of the proposal on:

- the archaeological, historical or botanical interest of the site;
- the site's original design concept, overall quality and setting;
- trees and woodland and the site's contribution to local landscape character;
- any buildings or features of character within the site including boundary walls, pathways, garden terraces or water features; and
- planned historic views of or from the site or buildings within it.

The demesne of Narrow Water House (Castle), which lies north of the existing A2, is identified as a Historic Park, Garden and Demesne. The demesne bounds the existing roundabout on the A2 at Warrenpoint to which the proposed bridge will tie-in on the northern side of Narrow Water, see **Plate 8.7**. For more information, see **Appendix 8.1** for Extract from Register of Parks, Gardens and Demesnes of Special Historic Interest Northern Ireland.

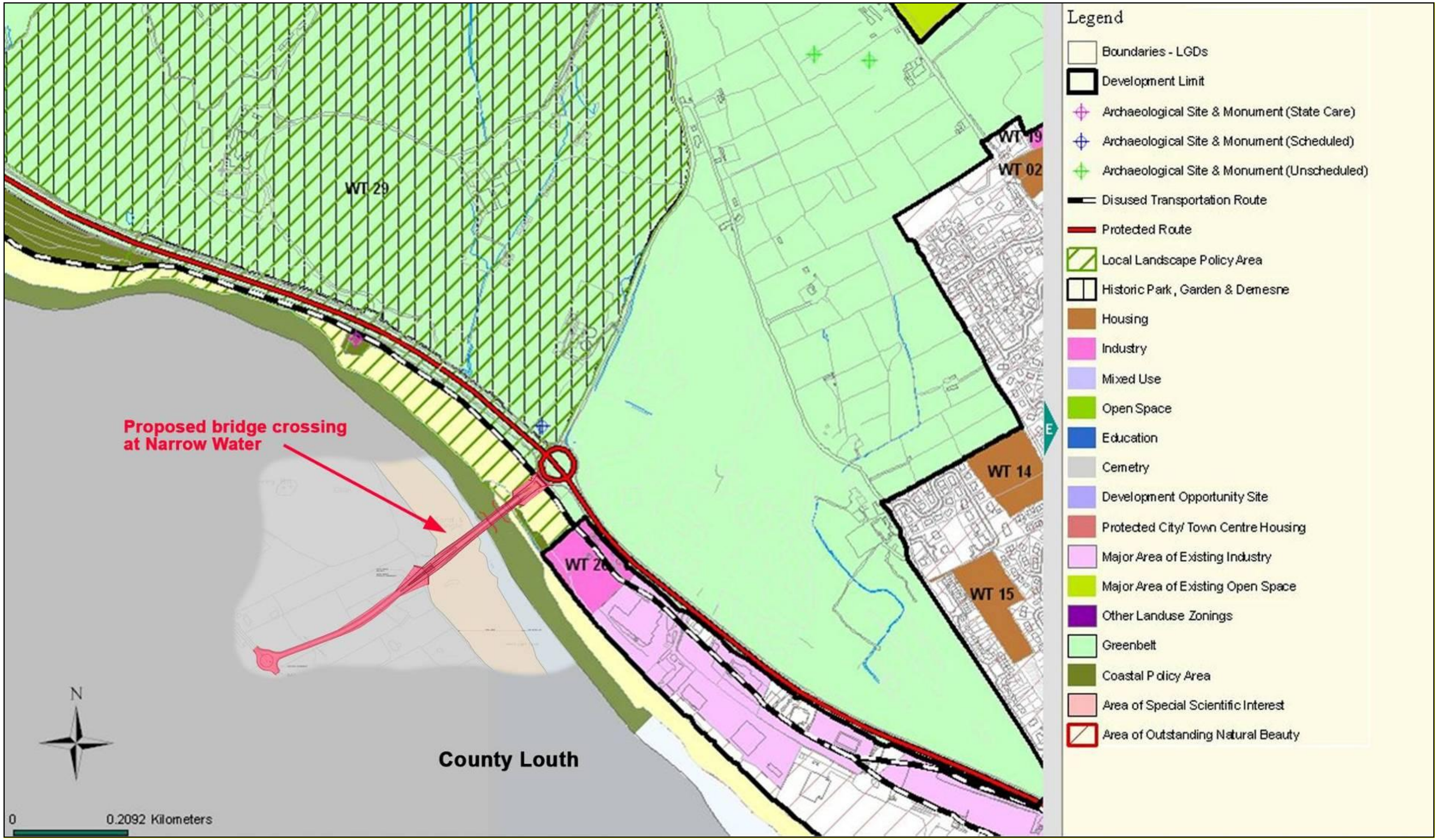


Plate 8.7 **County Down: Landscape Planning Context** *Extract: Map No.3 /06a Warrenpoint (Banbridge / Newry and Mourne Area Plan 2015) - annotated to show location of proposed bridge*

8.3.5 Banbridge Newry and Mourne Area Plan, 2015 (Draft)

In sustaining, developing and promoting its area, the document sets out a series of **Plan Objectives** (Vol. 1, page 15), which include:

- to conserve, sustain and enhance the area's environmental qualities, local distinctiveness and sites of environmental importance in terms of landscape character and diversity, wildlife and habitats, townscape and archaeology;

The **Plan Strategy** (Vol. 1, page 16) aims *interalia* to:

- Sustain a living and working countryside whilst supporting the growth and regeneration of towns and villages and protecting from inappropriate development those areas that are vulnerable to development pressure or that are visually or environmentally sensitive, through rural Policy Area designations;
- Identify, define and designate, as appropriate, areas of conservation, archaeological, scientific, landscape or amenity importance or interest, within both the natural and built heritage of the Plan Area;
- Establish key site requirements, as appropriate, against which particular site development proposals will be assessed, in order to help achieve good quality development, to respect environmental assets and to facilitate the development of balanced communities in accordance with the strategic requirements of the RDS;

Under **Strategic Plan Framework: Countryside and Coast** (Vol. 1, page 23), the Plan sets out details of its policy context in relation to Regional Policy Context, including Strategic Planning Guidelines; Green Belts; Countryside Policy Areas (CPAs); Special Countryside Policy Areas (SCPAs), and the Coast and Coastal Policy Areas. The objective of the rural planning strategy is to enhance, protect and sustain a working countryside within an attractive and unique rural environment, whilst conserving the natural environment.

Under **Development in the Open Countryside**, (Vol. 1, page 24) the Plan highlights concerns about erosion of rural character and tranquillity and lists, amongst some of the cumulative impacts, "*the increased visual impact of more structures in the landscape*".

Under **Green Belts** (Vol. 1, page 25) the Plan notes there function in maintaining "*a distinctive rural setting around towns and villages in the wider city region*". The corridor of the A2, including the area around the roundabout to which the project development is to tie-in to fall within the Newry (Warrenpoint) Green Belt, *i.e*. Designation NC 01 (Vol. 3, page 243), see **Plate 8.7**.

Under **The Coast** (Vol. 1, page 26) the Plan notes that almost all of the coastal area is within either the Mourne AONB or the Ring of Gullion AONB, and in addition sections of the coast are protected by a number of international and national nature conservation designations (**See Chapter 7, Section 7.2 Ecology**).

The proposed connection to the existing roundabout on the A2 crosses a **Coastal Policy Area** (Newry to Rostrevor), *i.e.* Designation NC 11 (Vol. 3, page 245). Policy COU 2 (Vol. 1, page 27) states that within "the Coastal Policy Area, planning permission will only be granted to development proposals which are:

- of such national or regional importance as to outweigh any potential detrimental impact on the coastal environment; or

- it can be demonstrated that any proposal will improve the quality of the coastal landscape, or improve accessibility for recreation, while still protecting nature conservation; or
- for the consolidation of existing development providing it is in character and scale, does not threaten any nature conservation or built heritage interest and can be integrated with the landscape.

Under **Environment and Conservation** (Vol. 1, page 73), the Plan notes *interalia* specific Strategic Planning Guidelines to conserve the natural environment (SPG-ENV 1); to protect and manage the Northern Ireland coastline (SPG-ENV 2), and to conserve the built environment (SPG-ENV 3). Under **Archaeology and the Built Heritage** (Vol. 1, page 76), the Plan notes that specific protection has been afforded to archaeological sites and monuments; vernacular and historic buildings; features and structures from past industries; planned parkland landscapes and historic townscapes. A number of historic features are of relevance to the proposed bridge crossing:

- Narrow Water Castle (*i.e*. tower and keep) is an Archaeological Site and Monument in State care;
- A second Scheduled Archaeological Site and Monument (a Motte) is located northwest of the A2 roundabout;
- Narrow Water Castle (i.e. House) is a designated Historic Park, Garden and Demesne – Designation NC 14 (Vol. 3, page 251) see under Warrenpoint below also;
- An Area of Townscape Character has been designated within Warrenpoint.

Warrenpoint

Warrenpoint is described (Vol. 3, page 105) as the second largest town in the District after Newry and Northern Ireland's third busiest port. The coastal town sits at the juxtaposition of the Newry River and Carlingford Lough, with the Mourne Mountains providing a visual backdrop. Narrow Water Castle and Demesne bound define the western boundary of the town. To the north, the landscape is undulating with mature hedgerows and trees and is dotted with archaeological sites and monuments. Modern development has spread out in all directions from the original Victorian settlement. Some recent developments are very prominent when viewed from across Carlingford Lough.

While the town is well-located on the coast and within the Mournes Area of Outstanding Natural Beauty, it is recognised that there is a need to strengthen Warrenpoint's role as a port and tourism destination, while ensuring protection of its coastline and the conservation of its built environment.

Under Environment and Conservation (Vol. 3, page 119), both the Town Centre and Seafront (WT27) and Well Road (WT28) are designated as Areas of Townscape Character (ATC).

Narrow Water Castle and Demesne is designated under Local Landscape Policy Area WT29, and described as set out in **Table 8.6**. Spring Meadows, Burren Road is similarly designated at WT30, see **Table 8.7**.

Table 8.6 **Narrow Water Castle and Demesne** *Extract Vol. 3: Banbridge, Newry and Mourne Area Plan 2015:*

Designation WT 29: Local Landscape Policy Area **Narrow Water Castle and Demesne.**
A LLPA is designated as identified on Map No. 3/06a – Warrenpoint. **Those features and areas that contribute to the environmental quality, integrity or character of these areas are listed below:** • Narrow Water Castle (listed building and grounds), within large parkland setting with mature planting, planned landscape, and significant vegetation; • Important buildings with mature vegetation provide a quality local focus and enhance the view of the town when approaching from Newry on the A2; • Old Narrow Water Castle with adjacent lands and amenity area to the sea side of the A2; • Stream corridor and nature conservation interest.

Table 8.7 **Spring Meadows, Burren Road** *Extract Vol. 3: Banbridge, Newry and Mourne Area Plan 2015*

Designation WT 30: Local Landscape Policy Area **Spring Meadows, Burren Road.**
A LLPA is designated as identified on Map No. 3/06a – Warrenpoint. **Those features and areas that contribute to the environmental quality, integrity or character of these areas are listed below:** • Standing stone (monument in state care) and the surrounding area providing the setting.

Countryside Assessment and Landscape Character

Technical Supplements 8 and 9 considers Countryside Assessment. Section 3.2 (page 31) deals with **Landscape Character Areas** and at sub-section 3.2.2, describes the Warrenpoint Landscape as having a "*dramatic landscape setting on the shores of Carlingford Lough at the entrance to the Newry River. The town is backed by the foothills of the Mournes and has views to the steep, wooded slopes of Anglesey Mountain on the opposite shores. The industrial port is on the flat strip of land to the west of the town and its cranes are prominent on the approach road from the north. Narrow Water Castle and the Narrow Water estate form the gateway to Warrenpoint from the north. There are long views along the waterfront from the coastal road to the east. The town is backed by the steep slopes of Slievecarnane. The lower slopes have an intricate pattern of streams, with numerous archaeological sites on local ridge-tops*".

Section 3.4 (page 35) deals with the **Coast** and at sub-section 3.4.1, describes the Newry City to Rostrevor coastal policy area as beginning "*south of the Greenbank Industrial Estate in Newry City and follows the channel of the Carlingford Lough inlet, past Victoria Lock towards Warrenpoint. It includes mud and shingle either side of Newry River between Greenbank and Narrow Water Castle. The Policy Area excludes Warrenpoint Port area, before resuming at the Warrenpoint Marina and travelling along the coast between Warrenpoint and Rostrevor. It consists of all land between the road and the Lough, except for occupied dwellings along the coastline past Dobbins Point and Rosetta towards Rostrevor. In Rostrevor, the Policy Area passes the weir, excluding the Ghann River and continues to the Quay on Shore Road, east of the village*".

Technical Supplement 8 also deals with **Special Countryside Policy Areas** (section 3.6, page 36) and **Local Landscape Policy Areas** (section 3.6, page 37).

In discussing Warrenpoint at Section 5.6.4 the Technical Supplement 8 lists Assets and Constraints within the town including, *interalia*:

- Natural setting and constraints; Warrenpoint is bounded to the west by Narrow Water Castle and Demesne and to the east by the Moygannon river. To the north the landscape is undulating with mature hedgerows and trees and is dotted with archaeological sites and monuments;
- Warrenpoint's setting on the shores of Carlingford Lough;
- Coastal tourist location at the foothills to the Mourne Mountains;
- The Narrow Water Castle (State Care Monument) and landscaped Demesne (Historic Park Garden and Demesne), Listed buildings and gateway coastal setting along the Newry Road on the NW approach to Warrenpoint (Plan LLPA);
- Mourne AONB and Carlingford Lough Area of Special Scientific Interest (ASSI);
- Built heritage features include the scheduled and state care archaeological monuments at 'Narrow Water Motte and Castle', Rathturret, Burren Road standing stone, Ballymaconaghy Enclosure and the Moygannon Raths and Antiquity.

Technical Supplement 9 (page 238) locates the proposed bridge crossing within Landscape Character Unit 69: Newry Basin. The landscape is described as set out in **Table 8.8** below.

Table 8.8 **Newry Basin** *(from Banbridge, Newry and Mourne Area Plan 2015: Technical Supplement 9)*

Landscape Character Area 69: Newry Basin
The Newry Basin is a large scale rolling drumlin landscape situated between the Ring of Gullion and the Mourne Mountains. The area is drained by tributaries of the Newry River which flow in attractive river valleys. The drumlins are orientated north-north-west to south-south-east. To the south east, the drumlins are displaced by broader ridges separated by narrow, flat-bottomed valleys with ribbon loughs and bogs such as Derryleckagh Lake and Greenan Lough. To the south of Newry, the Newry River flows in a dramatic, steep sided narrow valley. The Newry Basin is a very diverse area, with a rich heritage of historic landscapes and archaeological sites. The rolling fields have a neat and artificially green appearance, although pastures become increasingly marginal with rocky knolls, bracken and gorse hedgerows towards the foothills of the Mourne Mountains. Elsewhere, well trimmed low hedges and tree belts separate fields, creating an intact and unified landscape pattern. Small woodlands, such as Derryleckagh Wood, are often found on valley sides. There are occasional panoramic views of the Mourne Mountains from the tops of the drumlins. The landscape seems open and exposed on ridge-tops and enclosed and sheltered within the valleys. There are scattered individual bungalows and large farms throughout the area and the many new immaculate dwellings have a neat suburban feel. New bungalows and derelict stone cottages are often sited on drumlin tops, particularly towards Slieve Roosley. There is a network of small hedged and hedge banked winding roads connecting scattered dwellings. These and the major roads 'roller coaster' over the drumlins, creating a confusing and often disorientating landscape for the traveller. The town of Newry is at the head of the Newry River which leads to Carlingford Lough, the port of Warrenpoint and the small town of Rostrevor are located in sheltered bays along the coast. Narrow Water Castle is an important historic landmark at the entrance to the Newry River.

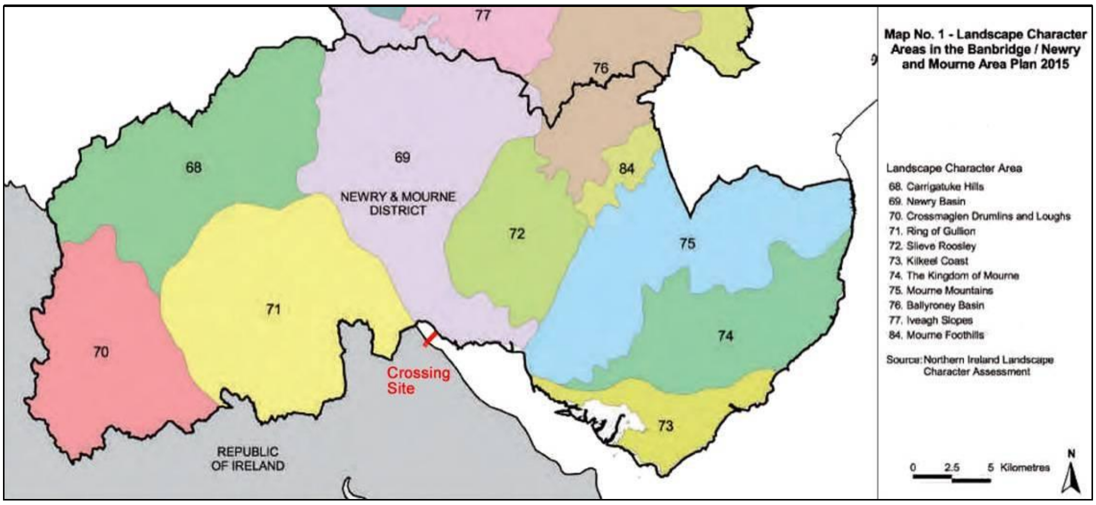


Plate 8.8 **County Down: Landscape Character Areas** *Extract: Map 1 Banbridge, Newry and Mourne Plan, 2015: Technical Supplement 9 – annotated to show location of proposed bridge.*

8.3.6 Description of the Receiving Environment

While differing in terminology of designation on either side of the border, it is clear from the landscape planning context that the proposed bridge crossing is set within an area of significant and valued landscapes. This landscape significance draws on the inherent physical and visual attributes of the landscape setting and on its associated nature conservation and cultural heritage. Aspects of nature conservation and cultural heritage are considered in detail in separate chapters of the EIS/ES.

8.3.7 Wider Landscape Context

Aalen *et al.* in the Atlas of the Irish Rural Landscape places the wider location of the proposed bridge crossing within the Igneous uplands of Down and Armagh (page 11). Complex igneous intrusions around the deep fiordic inlet of Carlingford Lough have formed four distinct mountain masses – the uplands of Slieve Gullion, the Carlingford peninsula, the Mournes and Slieve Croob. Each upland mass was strongly affected by ice erosion and their unimproved flanks, ice-scoured and largely drift-free, overlook tightly settled lowlands, thickly blanketed with moronic material. In the Carlingford Mountains, igneous rock form rugged peaks and broken ring-dyke appears in the glabbro hills of Slieve Foye. Slieve Croob is formed of granite and its elevated moorland merges to the south with the Mourne foothills. The Mournes themselves are more recent granite domes.

8.3.8 Local Landscape Context

Narrow Water is located within a valley at the western end of Carlingford Lough approximately 10km south-east of Newry Town. The area lies immediately west of Warrenpoint – the principal town on the northern side, and Omeath/Carlingford on the southern side – on the north side and approximately 2km north-west of the village of Omeath on the south side, see **Figure 8.1**'Landscape Setting' in EIS/ES Volume 3.

Outside of built-up centres the immediate land-use on both its northern and southern shores, is predominantly agricultural, interspersed with rural housing, most prominently south of the lough. Land is generally of poor to medium quality, rough grazing, and planting to forestry is common.

The Newry River forms a wide tidal body of water at the base of the strongly wooded valley between north Louth, south Armagh and south Down. The river runs eastwards in broads sweeps towards Carlingford Lough, a broad and deep fiord that is the setting for dramatic views of landscape north towards the Mourne Mountains and south to the Carlingford / West Feede Mountains. While in detail there are differing approaches to the consideration of landscape and landscape character on either side of the border, it is clear that the area, north and south, is one landscape character area – a broad estuarine river valley narrowly defined by rolling wooded hills, backed by open uplands, see **Figure 8.1** 'Landscape Setting' in EIS/ES Volume 3.

West of Narrow Water – and despite open views eastwards – the area retains a strong inland river valley character, see **Photograph 8.1**. By contrast, east of Narrow Water, the valley broadens and opens and the character is estuarine and increasingly coastal, see **Photograph 8.2**.

Photograph 8.1: View west along Newry River Valley

Photograph 8.2: View east along over Carlingford Lough

While the change from inland river corridor to broad coastal estuary is gradual, the perceived change is punctuated at Narrow Water by a narrowing of the water-body between Narrow Water Castle on the north and the wooded Ferry Hill promontory on the south, see **Photograph 8.3**.

Photograph 8.3: View west between Narrow Water Castle and Ferry Hill

In defining the entrance to Warrenpoint, Narrow Water Castle is a prominent feature of the cultural heritage of the valley. Nevertheless, the setting of the castle is comprised in views east approaching Warrenpoint by the backdrop of the port, its cranes and activities, and adjoining mixed-use retail developments along Newry Road, see **Photograph 8.4**. Permission has been granted for a mixed use commercial, residential and hotel development on the previously infilled estuary lands approaching Warrenpoint east of the existing roundabout on the A2. Narrow Water Castle (House), a heritage and demesne property, lies on the opposite northern side of the A2 Newry Road. Narrow Water House, is a building of recognised architectural merit and its grounds are designated as a historic park and demesne. The property has mature belts of trees that provide significant buffering and screening from the Newry Road. However, these trees are deciduous in nature and views are considerably more open during winter months, see **Photograph 8.5**.

Photograph 8.4: View east to Narrow Water Castle with Warrenpoint port in background

Photograph 8.5: View west towards Narrow Water Castle and Narrow Water House

The ribbon expansion of mixed-use commercial and retail units along the Nerwy Road increasingly separates the approach to Warrenpoint from Carlingford Lough. Expansion of housing development in recent years onto background hills has also had a negative impact on the setting of Warrenpoint[2], especially as viewed from south of the lough, see **Photographs 8.6 and 8.7**. Nevertheless, these elevated housing areas have dramatic views south over the lough to the background uplands on Carlingford peninsula, see **Photograph 8.8**.

Photograph 8.6: View north towards Warrenpoint

Photograph 8.7: View west along Newry Road, Warrenpoint

[2] Warrenpoint Strategic Development Framework, 2004

Photograph 8.8: View south from elevated residential areas, Warrenpoint

Warrenpoint Golf Course lies northeast of the A2 roundabout. The golf course has a parkland setting, with mature trees and groups of trees defining the fairways and providing for screening of ribbon development along Newry Road, see **Photograph 8.9**.

Photograph 8.9: View south from Clubhouse of Warrenpoint Golf Club

On the south side of Carlingford Lough, the expansion of rural one-off housing has had the greatest impact on the quality of the rural landscape. This development is most evident on the lowlands, linking the coast to the uplands in the background, see **Photograph 8.10**. Carlingford uplands have retained their open, rugged character and the broad domes are covered in a bracken and heather. Housing development is particularly noticeable along the R173 where a number of residences are located close to the vicinity of the proposed tie-in. One property sits atop a local ridge overlooking the lough close to the proposed bridging point, see **Photograph 8.11**.

Photograph 8.10: View south towards housing in landscape from Warrenpoint

Photograph 8.11: View north from R172 towards property located immediately east of proposed link road between the bridge and R173.

8.3.9 Viewer Groups

Views may be considered from a range of similar viewer areas/groups from within the local and wider setting of the proposed bridge crossing.

Southern Uplands

Includes elevated views from southern uplands and ridge through Flag Staff Hill, Anglesey Mountain, Clermont, Carrickrawor and Carlingford Mountain peaks. Existing views are expansive and panoramic, encompassing undulating open countryside; high mountains (Mournes), Carlingford Lough, open sea, as well as small coastal town and countryside developments. The site for the proposed bridge crossing is openly visible from the majority of these areas.

Northern Uplands

Includes elevated views from northern uplands including Slieve Roe, Lechan More, Slievemeel, Slievemartin and Slievemeen peaks. Existing views are expansive and panoramic, encompassing undulating open upland countryside; high mountains, Carlingford Lough and Uplands, open sea, as well as small coastal town and countryside developments. The site for the proposed bridge crossing is distantly visible from some of these areas.

Newry River

Includes the narrow inland river valley, west of Narrow Water Castle. Existing views are restricted to changing vistas along the wooded river valley with occasional views to background uplands. Heritage structures, such as Narrow Water Castle are prominent focal points. The site for the proposed bridge crossing is openly visible from the south-eastern end of the river valley.

Carlingford Lough

Includes the increasingly wide waterbody of the lough with views opening to the sea and north and south to prominent uplands and mountains. Coastal towns, particularly Warrenpoint, with its port, are prominently located on the interface of water and land and views west are drawn inland along the narrowing valley. As such the site for the proposed bridge crossing is openly visible from the north-western end of the lough.

Old Narrow Water Castle and Narrow Water Castle (House)

Includes the setting for 2 heritage properties, one the old Narrow Water Castle prominently located on the bank of the Newry River and the second, Narrow Water House set within a parkland landscape on the opposite side of the A2 dual carriageway.

Existing views from the old castle are strongly influenced by the tidal waters of the river and lough, though there are also views to the southern uplands. The Castle is also a prominent focal feature within views from surrounding areas. The site for the proposed bridge crossing is adjacent to and forms a dominant part of the immediate context of the view.

Existing views from Narrow Water House are partly screened by mature tree belts along the A2 Road. However, views do exist to distant uplands and southeast over the lough. In winter views are significantly more open due to the deciduous nature of the plantings. The site for the proposed bridge crossing is only partly glimpsed through boundary plantings.

Warrenpoint Architectural Town Character Area

Includes the historic centre of Warrenpoint and the seafront. Existing views are strongly aligned south and east towards the open waters of the lough. There are no views southwest towards the location of the proposed bridge crossing.

Elevated residential areas within north and west Warrenpoint

Includes extensive areas of housing development on elevated lands north of the golf course and west of the town centre. Existing views southeast over the town to the lough and south over the golf course and mixed-use developments along the Newry Road to the upland landscapes south of the lough. Though the proposed bridge crossing is partly visible the Newry River is not a prominent feature.

A2 Warrenpoint - Newry Road

The A2 dual carriageway runs directly along the northern side of the Newry River, passing the old Narrow Water Castle and connecting into the existing Burren Road/Newry Road roundabout at the western end of Warrenpoint. East of the roundabout Warrenpoint parkland golf course defines the northern side of the road, while infill land and mixed-use business and commercial units close off views towards the port and lough. Towards the west existing views are to the Newry River, its wooded valley sides and background uplands. The old Narrow Water Castle is a prominent focal point and feature, east of which views are increasingly confined to the road corridor. The location of the proposed bridge crossing is prominent within views approaching from the northwest and at the A2 roundabout.

R173/B79 Newry – Carlingford Road

The R173 / B79 road runs along the southern side of the Newry Canal and River before moving inland from the coast of the lough at Ferry Hill. Lands rises steeply to the south and as such existing views are mainly north and northeast over the canal and river to partly wooded hills and distant background mountains. East of Ferry Hill, the road moves inland and views are over immediate agricultural lowlands with residential properties, to the expanding built development of Warrenpoint Town with background uplands and mountains. The gently undulating nature of the lowland landscape cuts out views to the lough and the proposed tie-in point to the R173 is visible alongside residential properties.

Lowland landscape between County Bridge and Quann's Bridge at Ferry Hill

Includes gently undulating agricultural lowland running from the upland 100m contour to the coast, located to either side of the R173 from County Bridge at Ferry Hill to Quann's Bridge. The area includes a range of county roads and a large number of dispersed single-plot residential properties. Lands rise steeply to the south and higher areas and properties have open views over the lowland and lough to Warrenpoint and background hills and mountains. Lower areas and properties have either no view or a reduced view of the lough and focus either north towards Warrenpoint and the background hills and mountains or south to steeply rising uplands.

Southern coast, including Omeath

Open lowland runs north to define the southern coast of the lough from where there are panoramic views both along and across Carlingford Lough with development at Warrenpoint and its port prominent features within the backdrop of hills and mountain landscape. The southern coast includes a number of coastal properties and the village seafront and pier at Omeath. The location of the proposed bridge crossing is prominent within views west along the southern shore.

8.3.10 Landscape Significance and Sensitivity

In relation to the proposed development the landscape and visual aspects that are considered to be of significance include:

- the general landscape fabric of the scenic river valley;
- the landscape amenity, character, and visual designations pertaining to local and wider setting, including the coast on both sides of the border;
- the setting of the heritage properties of the old Narrow Water Castle and Narrow Water House and Demesne, and
- the direct visual impact on residential properties, particularly south of Narrow Water.

All of the above aspects are also considered to be of particular landscape and visual sensitivity in terms of potential alteration or change of their inherent character and setting.

8.3.11 Do-nothing Scenario

The development of a link between South Down and the Carlingford peninsula has been a long-standing objective of Louth County Council and the requirement to improve links between the two areas is widely recognised as being beneficial for cultural, social and tourism development reasons. It is likely that should the proposed development not proceed the area will continue to develop and be promoted in line with existing trends.

8.4 Proposed Development

It is proposed to construct a new bridge across Narrow Water between County Louth in the Republic of Ireland and Warrenpoint, County Down in Northern Ireland. The proposed bridge will tie in directly to an existing roundabout on the A2, west of Warrenpoint. On the southern side the development will include for approximately 500m of link road connection to the R173 Newry – Carlingford Regional Road, located west of Omeath village. It is also proposed to construct an additional leading light, immediately east of the proposed bridge on the southern shore of the estuary. This structure will be similar in form and scale to that of the existing leading light. A small control building will be constructed on the northern shore accessed separately off the A2 Newry Road at Warrenpoint. The proposed development is described in detail in Chapter 3 of this EIS/ES. As such only a brief description of the project and its features is noted in the following.

8.4.1 The Proposed Bridge

It is proposed that the structure will comprise a cable-stayed bridge with a rolling bascule opening span. The structure is supported by asymmetric back-ward inclined towers, with the higher (84m) tower located on the southern side of the crossing. The lower (32m) twin towers on the northern side operate the rolling bascule opening span. One simple, small leaf pier substructure is located within the River Newry

The bridge, which is illustrated on **the Photomontages Figures 8.2 to 8.5** in Volume 3 of the EIS/ES consists of a two span structure over the Newry River, the south span has 138.35m and the north span has 56.8m. The main cable-stayed span is supported by a double plane of cable-stays which are anchored to the inclined vertical tower.

The cable-stayed bridge will have a completely steel stiffened deck, reducing the required size of the cable-stays and allowing for a thin deck in the order of 1.25m deep. The southern tower is the dominant visual and structural element of the bridge and will carry the majority of the permanent dead loads. The tower will be constructed from structural steel, consisting of an outer and inner steel skin which will be in-filled with self-compacting concrete. The bridge will be finished in an off-white colouring, which will reduce glare in strong sunlight.

8.4.2 Illumination of the Proposed Bridge

At night, the bridge will be illuminated with an architectural lighting scheme. The lighting is considered important for a number of reasons:

- To enhance the architectural significance of the structure;
- As a signature structure enhancing the importance of the setting;
- To provide a recognisable distance feature; and
- To allow birds in flight at night to avoid the structure and cable-stays.

The main concept of the lighting design is to ensure that the towers and cable stays are the strongest visual features at night and that the scheme will reinforce the high quality aesthetic nature of the bridge. The narrow luminaries will wash the towers and cable stays in pale light, providing immediate recognition of the bridge's setting.

Narrow beam luminaries mounted on the deck and anchorage abutments will be directed up at the cables and towers, picking out the structure and cable stays in coloured lighting. As the beams converge they will have the effect of strongly highlighting and framing the bridge structure. Light emitting fibre optics may be used to enhance this vision and define the cable stays.

The directed nature of the luminaries and the low level of luminescence provided will be designed to ensure that neighbouring residents will not suffer from glare, that there will be no impact on the fish movements within the Newry River and will ensure that any birds moving at night can see and avoid the bridge structure.

8.5 Assessment of Impacts

8.5.1 Introduction and Context

In considering landscape and visual impacts it is considered important to provide a level of project-related context that is likely to have a strong influence on the likely perception of these impacts.

At the outset, it is acknowledged that the issue of bridge design and the visual impact of bridges has always been – and will always continue to be – highly influenced by subjective considerations and by personal experiences. Issues that influence such consideration include issues of direct and indirect impact; protection of existing heritage or environment; concern over nature and scale of change; or simply a fundamental preference or dislike for a particular design style.

In any case it is accepted that a high degree of subjectivity is involved in viewers' perceptions of such bridging structures. Some may consider a bridge to be a negative intrusion and out of character with its setting. Equally others may consider a bridge to be a positive expression, confidently enhancing the qualities of an area.

In this context, it is important to reflect on the open and objective considerations of Planning Policy Statement 6 (paragraph 1.14, page 8), which states under 'Conservation and Economic Prosperity' that "*Just as there is continuity between past and present, so also there is between present and future. We have a duty to care for what we ourselves have inherited not simply for our own benefit but also with a view to passing it on, as a living legacy, to those who come after us. We can add to our historic legacy by creating examples of high quality architecture and townscape and landscape design which can fittingly represent our own age in the decades and centuries to come*".

Though part of most road constructions, bridges and particularly landmark structures probably more than any other element, remain in the visual memory of the viewer. Bridges should espouse progressive design, engineering excellence and landscape, cultural and social connection. For these reasons, as with architecture or any design, an individual's response to a particular bridge will always be highly subjective.

This perception is never more critical than when the location for the bridge, the bridge design and the landscape setting are all seen as having individual significance.

Success with such individualistic considerations occurs only where the attributes of all combine to add a level of coherent significance within the overall.

In their best examples, bridges often come to define their setting. Today bridges like the Golden Gate Bridge in San Francisco, or the more recent Millau Bridge in remotest France, are as much about their location as they are about statement of bridge design. Such iconic landmark structures have clearly added to the perception of their setting. Equally it must be noted that poor quality bridge design can have a significant negative impact on a landscape and visual experience.

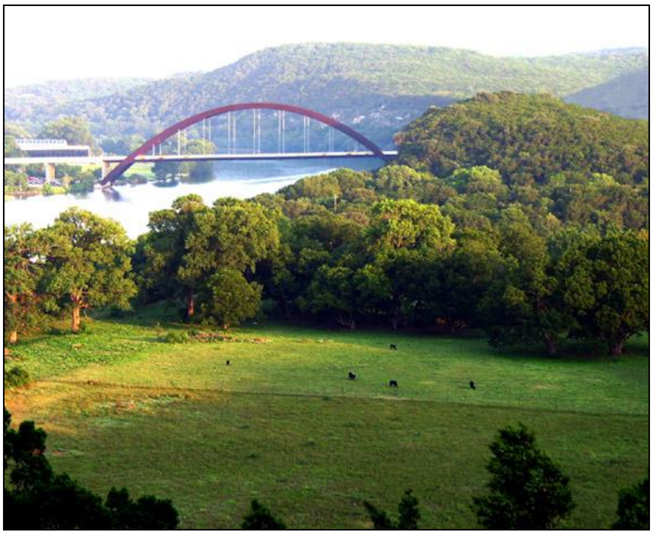
In discussing the landscape and visual impact of the proposed bridge it is considered worthwhile reflecting on examples of other bridges and their landscape settings. The following considers the influence that the highest-quality of bridge design can have on significant landscape settings.

Photographs 8.12 to 8.16 include examples of bridges within a variety of landscapes.

Salginatobel Bridge, in Switzerland is located within a dramatic landscape setting near Schiers in the Swiss Alps.

It is clear that despite the dramatic landscape, the bridge does not detract from its setting, but rather, the classic yet simple engineering accentuates and contrasts with the natural rugged setting.

Photograph 8.12



Pennybacker's 360 Bridge in Austin, Texas is set within the more subtle landscape of an inland river valley.

The bridge adds to the overall visual image of the landscape, providing a point of reference focus and added value to the setting.

Photograph 8.13

Bear Mountain Bridge in New York State.

An example of visually significant but traditional bridge design set within an inherently high-quality scenic landscape setting.

Photograph 8.14

Dubrovnik cable-stayed bridge is a contemporary styled structure set within the dramatic river / estuary landscape at the entrance to the Port of Gruz, Croatia.

Photograph 8.15

The M1 Boyne Valley Bridge, County Louth has come to be seen as an icon of a progressive Boyne Valley landscape, one of the most cultural and historic landscapes in Ireland.

Photograph 8.16

8.5.2 Impact on Landscape Character and Landscape Planning

Notwithstanding the significance of the proposed development, it is considered that the proposed development will not adversely or directly alter the inherent quality of the landscape, its significance or value. Indeed as a landmark structure, this unique bridge has the potential to add to the significance of its setting and to assist in place-making and momentum towards realising local landscape and wider tourist-related objectives.

The proposed bridge will be a prominent and visual element within the landscape. While visual impact is discussed separately at Section 8.6.3 below, this visual prominence has an influence on landscape character. Undoubtedly, the bridge will become a point of focus within its setting; a connection between two separate parts of a composite landscape, and a structure of dominant presence within its immediate context. The bridge will not have a direct impact the old Narrow Water Castle. However, it will significantly alter its landscape setting, where at present the castle has a sub-dominant position relative to the landscape. As a result of the development, the castle will have a sub-dominant role to the bridge, which will form the dominant feature of the setting – refer **Figures 8.2 to 8.6** in Volume 3 of the EIS/ES.

The assessment of impact is also considered against the acceptance of the Cooley peninsula / South Down landscape as a dynamic, living and high-quality environment, much of it created by the deliberate development and management of towns and villages and properties such as Narrow Water Castle and Narrow Water House. Therefore, the existing setting is not solely a natural landscape, but a landscape of parts, some natural, some man-made, some historic and some contemporary.

As espoused by Northern Ireland Planning Policy Statement (PPS) 6, just as there is continuity between past and present, so there should be allowance for connection between present and future. It is correct to protect the inherited for present and future generations, however, there is also an onus on the present to create a future legacy. In this setting it is considered that the proposed bridge has a balanced impact on the landscape that does not seriously detract from existing sensitive characteristics. Furthermore, as a signature structure, the bridge can provide for a dramatic and valued link between the present and future – a link that is capable of having a positive influence on the local and wider perception and promotion of the local and wider area into the future.

8.5.3 Visual Impact

The proposed cable-stay bridge, with its inclined towers, introduces a visually unique bridge design not only to this region, but to the island as a whole. It will present a visually dramatic form and structural appearance to viewers and users both on and off the bridge. The sense of uniqueness and drama is heightened in the nature of operation of the lifting bridge section.

Viewed from off the bridge, the towers, deck and cables present a visually active silhouette form when viewed against the sky and landscape – see **Figures 8.2 to 8.4** in Volume 3 of the EIS/ES. The form is particularly enlivened through the innovative design of the opening mechanism.

Viewers on the bridge will also see the detail of the towers and cables at close range. The towers and cables introduce a continuous structural presence for most of the crossing. Thus, the scale, proportion, materials and coloration of the towers and cables become important characteristics in viewers' perception of the bridge. The towers will be constructed of steel elements with a light off-white coloration, thereby presenting a visual contrast against the darker upland / wooded landscape setting of the river corridor landscape – see **Figures 8.2 to 8.5** in Volume 3 of the EIS/ES. Bridge railings and barriers are highly visible to bridge users and will influence the viewing experience from the bridge.

The viewer's perception of the abutments and tower bases will be based in-part on the visual balance between the span and the height of the towers. As the abutments and tower bases will be seen at close range, both from land and water, design details, form, and surface treatments are important visual elements.

The main structural elements of the bridge will be highly visible to viewers and users on the bridge itself and from:

- the A2, east and west of the tie-in;
- the old Narrow Water Castle;
- elevated residential areas within the residential areas of northwest Warrenpoint;
- limited areas within Warrenpoint Golf Course, including a number of golf holes and the clubhouse;
- the shoreline and waters of the Newry River and Carlingford Lough;
- from numerous residential properties located within the lowland landscape on the south side, including those particularly close to bridge approach road and proposed roundabout on the R173;
- the lowland and upland landscape on the southern side;
- the more distant upland landscape on the northern side.

The impact of the development on these communities is discussed in the following under the various Viewer Groups as set out at 8.4.3 above. It is also important to note that perception of visual impact is and will remain a highly subjective experience, where one person may see the bridge as a negative intrusive structure, others may value its innovative landmark quality.

Other aspects of the proposed development, including the additional signal tower and control building will have no significant landscape or visual impact.

Southern Uplands

The proposed bridge will be visible in views from many areas on and within the southern uplands. **Figure 8.5** in Volume 3 of the EIS/ES is taken from Flagstaff Hill, and while the bridge is clearly visible, the significant nature of the structure is visually pleasing and positive and the bridge appears to set an appropriate demarcation to the westward expansion of Warrenpoint. The bridge does distract from views of Narrow Water Castle but does not detract from its significance. To some degree the bridge provides for improved separation from inappropriate shoreline developments along Newry Road to the east.

Northern Uplands

The bridge will be visible to a limited degree in views from some more distant uplands north and northeast of Warrenpoint. Even where visible, the bridge will have no significant visual presence within an otherwise expansive and panoramic setting.

Newry River, Carlingford Lough and A2 / B79 Roads

The proposed bridge will be a visually prominent form and structure in views east along the river corridor and west from the lough. The bridge will also be prominent in views along the A2 on the north shore and to a lesser degree along the B79 on the south shore. Nevertheless, it is considered that the bridge will be a significant and positive structural element within the landscape. Rather than be seen as a negative visual intrusion, the unique structure can be viewed as an example of high-quality, progressive 21st century design.

Narrow Water Castle and Narrow Water House

The proposed bridge will be openly and most dramatically visible from the old Narrow Water Castle – see **Figures 8.4 and 8.5** in Volume 3. The bridge will significantly alter the existing visual context of the views from the castle; although at present views east incorporate poor quality mixed-use and port-related developments along Newry Road. In this context the bridge forms a dramatic separation from the expanding mixed-use and port-related developments and appears to visually distance and re-scale the background landscape.

Nevertheless, as a landmark structure, the bridge will also bestow a wider regional and potentially international significance on the area and will provide for impressive new interpretation and views of the castle and its river setting. As such, while the construction and provision of the bridge has the potential for significant adverse visual impact, the development by reason of its unfamiliarity and its high-quality design will equally have potential for positive impact.

Views from Narrow Water House are strongly contained and influenced by the boundary plantings of its demesne setting. Nevertheless, views to the bridge will be possible, particularly during winter months and from upper floors – see **Figure 8.6** in Volume 3. As a clearly contemporary structure the bridge – and particularly the towers – will constitute a contrasting intrusion and have a slight to moderate adverse impact from the property and its setting.

Warrenpoint Architectural Town Character Area

Warrenpoint ACA is a relatively confined and focused built environment, from within which the proposed bridge will have little or negligible visual impact.

Elevated residential areas within north and west Warrenpoint

The bridge and particularly the main tower will be visible in views from many properties located on elevated south facing lands within residential areas west of Warrenpoint Town Centre. However, the bridge will not impact adversely on the more significant open views to the southern uplands and east to the coastal waters. The southern tower will give rise to a moderate level of visual intrusion.

R173 Carlingford Road and lowland landscape between County Bridge and Quann's Bridge at Ferry Hill

The proposed development will have its most significant visual impact on the immediate landscape at the southern end of the bridge, where the main tower is inclined back towards the upland landscape and reaches a height of over 86m in height. The tower will appear as a prominent and visually dominant element from those properties located so close as not have a visual context of the entire bridge structure.

The structure will give rise to a number of significant visual impacts, including significant medium and longer-term negative visual impact for the most immediate property. Significant shorter-term negative visual impact will arise for other properties within this coastal lowland landscape, including for a small number of properties located close to the proposed roundabout on the R173.

With more visual context the structure can be better appreciated within the lowland landscape and the resultant impact is therefore reduced.

Southern coast, including Omeath

The proposed bridge will be an openly visible and dramatic feature within views along the coast east to Omeath and beyond – see **Figures 8.2 and 8.3** in Volume 3. Its location at Narrow Water will tend to define the inland limit of Carlingford Lough, with a clearly more river valley landscape to the west. While it will be visible the 12.95m high leading light will not be intrusive or adversely impacting in views within this context.

8.5.4 Visual Impact at Night

The night-time illumination of this significance development is an important feature, particularly in relation to the presentation of the bridge within its context. The proposal is to illuminate the architectural qualities of the structure, emphasising the underside of the bridge, the cables and the tower on the southern side.

The western approach to Warrenpoint with its Port and associated mixed-use developments is already a highly illuminated environment where the extent of exposed light source is dominant and detracting. To the south, lighting from dispersed properties is a notable feature of the shore-side and lowland landscape. The background uplands are dark spaces outlined against the night sky.

Proposed illumination will present the bridge as a particularly dramatic structure at night, adding to its overall landmark and place-making value and its overall positive visual interest. The illuminated bridge will have a significant positive impact in defining a demarcation between a darker inland river valley and an outer coastal landscape with already highly illuminated at Warrenpoint and more sporadically on the south shore.

Nevertheless, it is also important to note that illumination of the main south tower also has the potential to accentuate the already significant visual impact of the structure for more immediate residential properties on the lowland landscape. Detailed design of the lighting proposal must avoid this impact.

8.5.5 Worst-case Scenario

The significant mitigation measures have been included within the proposed design of the development (see Section 8.7 below). As such, the worst-case scenario, when other mitigation measures are considered to fail or not be put in place, is unlikely to give rise to significant adverse landscape or visual impacts.

8.6 Mitigation Measures

8.6.1 General and Bridge Design

Given the nature of the project, consideration of mitigation has been a significant aspect of the project design and as such the proposal incorporates a number of design elements to minimise the landscape and visual impact of the project. These elements include:

- An alignment that is near perpendicular to the river centerline, which is thereby shorter and a more visually natural bridging
- A tie-in to an existing roundabout on the A2 on the northern side of the river, thereby reducing impact on shore and surrounding area;
- Siting the bridge adjacent to and avoiding impact on the wooded promontory of Ferry Hill. In this way the wooded hill provides a visual foreground/background anchor for the main tower on the southern side of the bridge. This effect is clearly illustrated in the Photomontages;
- Minimising and down-sizing the number of piers and apparent mass of the structural components, thereby decreasing adverse visual impacts on views along the river/lough; and
- Incorporation of a signature bridge design with inclined towers and a unique opening mechanism.

As such cognisance was taken of the significance of the landscape setting and it was considered that the landmark bridge best:

- acknowledges and reflects the recognised scenic and visual qualities of its wider setting;
- provides an iconic structure that will assist in the development and realisation of co-ordinated and focused amenity, landscape and recreation objectives and policies for the significant landscape resource of the Cooley Peninsula and the South Down landscapes;
- marks a location of a clear transition between inland river valley and open coastal inlet;
- defines a boundary to westward extension of visually detracting port, port-related and mixed-use development along the shore towards Narrow Water Castle at Warrenpoint;

The visual profile of the bridge is fundamental to how the bridge will be perceived within the landscape. At a basic level the bridge comprises two towers with a thin cable-stay supported deck. Undoubtedly, the most significant physical elements of the proposal are the towers, which have been designed to reflect the nature of the adjoining landscape. The main tower located on the south shore is a tall structure inclined back towards the higher uplands of Anglesey Mountain. By contrast the northern tower is low and more in-keeping with the rolling hills of the northern shore. Between them the towers frame an open vista east 'to the sea' and west to the 'incised river valley'. This open vista is enhanced by the thin cable-stay supported deck, which requires only a single thin pier within the river channel.

The proposed location was selected for a variety of reasons, including its proximity to the wooded promontory of Ferry Hill, which provides a visual anchor for foreground and background views, (views east and west respectively) of the base of the main tower.

8.6.2 Treatment of bridge Embankments

The bridge embankments on the northern side of the crossing are open in views from the A2 and Narrow Water Castle. The areas shall be sensitively contoured into tie-ins with the retained shoreline and seeded to a coastal and locally appropriate grass seed. Locally appropriate planting shall also be use to soften the engineered aspects of the embankment and to provide for added diversity.

On the southern embankments it is proposed to plant groups of scrub/shrub within a locally appropriate grassland mix on the slope. This will help to anchor the end of the bridge and low scrub is already a characteristic of the shores of Carlingford Lough.

8.6.3 Treatment of Approach Road

While the bridge ties-in directly to the existing roundabout on the A2 on the northern shore, a section of approach road is required to be constructed across pasture lands on the southern side. The southern approach road is located to the east of the wooded Ferry Hill and passes close to existing residential property. The full extent of cut and fill slopes along the road will be planted as a ribbon copse of low-canopy woodlands interlinked with locally appropriate thorn hedgerows. A more mature planting is to be provided as a bat 'flyover' where the scheme severs a hedgerow on the southern side of the lough.

8.6.4 Planting Specification

The proposed planting will generally be established with 'bare root transplants', 'whips' and 'feathered trees' which adapt readily to disturbed ground conditions. The low-canopy woodland shall comprise 60% tree and 40% shrub species. The tree mix shall be 50% transplants, 50 and 75cm high; 30% whips, 100 to 120cm high; and 20% feathered trees of between 175 and 200cm high. All tree species shall be planted at 120cm centres. The shrub mix shall use locally appropriate thorn, willow etc. of between 40 and 60cm high. All shrub species shall be planted at 90cm centres.

Tree species utilised will be selected from a list, which will include alder, birches, ash, oak, scot's pine and willows and other plants found naturalised in the locality. Shrub planting species utilised will be selected from a list, which will include blackthorn, hawthorn, hazel, willows, gorse and other plants found naturalised in the locality.

Hedge planting will be primarily of blackthorn and hawthorn at 90 – 120cm high planted at 50cm centres within two staggered rows The hedge shall be planted with ash trees of 'standard size' to be randomly-spaced but averaging 1 tree / linear metre.

Shrub planting areas on the bridge embankments shall be of locally appropriate species, 50-75cm high, planted at 90cm centres, planted so as to cover a minimum of 50% of the slope.

General grass seeding areas to be topsoiled and seeded with a low maintenance mix. Otherwise locally appropriate seed mixes shall be used.

Refer to Figure 8.7 in Volume 3 of the EIS/ES showing the Landscape Masterplan.

APPENDIX 8.1
Register of Parks, Gardens and Demesnes of Special Historic Interest Northern Ireland

Extract:

NARROW WATER CASTLE, Co. Down **(REGISTERED SITE – AREA PLAN NEWRY & MOURNE 16)**

The present house was built during the years 1831 to 37 to the designs of Thomas Duff of Newry (listed HB 16/11/19). It replaced an earlier house, known as Mount Hall (the name of the occupants), of which a wing survives. A map of 1800 shows this house with garden, grove and shrubbery, orchard, pasture, woods, and parkland trees. It is thought that Sir Joseph Paxton made plans for the Italian Garden, notable for it impressive grass terraces, balustrading, cut stone steps and urns. Horizontal ground was once filled with flower beds, remembered in photographs but now grassed. Early 20th century photographs also show the wild garden in the Pleasure Grounds to the north west of the house, said to have been created by Thomas Smith of Newry. This is no longer maintained. Articles in garden journals at the end of the 19th century mention the garden and remarkable trees are noted in *Trees of Great Britain and Ireland* of 1909 and 1910. A folly summer house survives on high ground in woodland. There are extensive plantations of trees. The parkland trees are few and far between. The walled garden is not cultivated and glasshouses have gone. The Head Gardener's House (or Steward's House) is very impressively large (listed HB 16/11/20). 18th century outbuildings are listed (HB 16/11/21). Two gate lodges survive, Castle Gate and Tudor Lodge by Duff (listed HB 16/11/23) and contemporary with the house. However Duff's Newry Gate has gone and the earlier rear gate. SMR: DOWN 51:38 enclosure. The south east corner of the demesne is a golf course. Private.

Chapter 9

Material Assets

Chapter 9 Material Assets

9.1 Introduction

This section of the Environmental Impact Statement / Environmental Statement discusses the impact of the proposed road and bridge on the Material Assets directly impacted. The wider social and economic impacts are discussed in Chapter 6 and, as such, are not addressed here.

A road and bridge construction scheme may affect assets if it involves any of the following:

- Acquisition of land;
- Demolition of buildings;
- Revaluation of or change in the development potential of adjoining lands / properties.

The principal impact of the scheme is a loss of agricultural property on lands crossed by the proposed road from the R173 to the Foreshore. This agricultural impact is all within the townland of Cornamucklagh, County Louth.

In County Down, the location and construction of the control building will also have a minor impact on the lands to the south of the A2 roundabout for which Carneyhaugh Properties Ltd. have outline planning permission for a mixed use development consisting of a hotel, restaurant, residential and office and retail units. At the second public consultation and at a subsequent meeting the proponent of this proposal indicated their full support for the Narrow Water Bridge Project and willingness to cooperate with Roads Service in the acquisition of lands by agreement.

There will also be limited indirect impacts on a number of residential properties and privately owned foreshore.

9.2 Predicted Impacts on Agricultural Property

The area to be permanently removed from agricultural production is approximately 3.16 Ha. (see **Figure 9.1** in Volume 3).

The proposed bridge project will directly impact on four agricultural land holdings all of which are in County Louth, by reducing the area of each holding. All necessary lands will be acquired under the Compulsory Purchase Order in the Republic of Ireland and Vesting in Northern Ireland, and through agreement where feasible. All mitigation measures outlined in the following sections will also be adhered to and agreed with each impacted landowner.

Philip Farrelly & Company carried out the Agronomy study during October 2008. The farms impacted by the proposed development were visited and the agricultural impact was assessed on the affected farm.

9.2.1 Methodology

An assessment of the existing agricultural situation was carried out through the completion of a detailed farm survey. The survey assessed how the development would impact on the current farming activities carried out on the land and what measures would be necessary to mitigate any negative impact.

Degree of Impact

The degree to which a new road impacts upon an individual farm depends on:

- The degree of any severance;
- The type of farm enterprises carried out;
- Land take;
- Farm size;
- Removal of buildings and/or facilities.

The significance of the effects of the proposed road on farms is assessed using the criteria presented in the table below which is based on the Environmental Protection Agency (EPA) “Guidelines on the Information to be Contained in Environmental Impact Statements” (March 2002) and Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (2003).

Degree of Severance

The degree of severance of a farm may be classified as follows:

- **Major severance** - farms are characterised by the proposed development splitting the farm more or less in two. Access may not be available to the severed area or to a farmyard or other significant farm facility. The impact of this type of severance would have a major affect on the management of the farm enterprise in accommodating the new division between two or more land parcels.
- **Moderate severance** - farms where a significant portion of the farm is separated from the rest by the new development. Access would be available to both portions of land although alternative access points and gateways may need to be provided.
- **Minor severance** - farms are characterised by having a relatively small portion of the holding isolated by the new development, or where it runs along one side of the farm on the inside of its boundary.
- **None** - farms are characterised by having no portions of the holding isolated, however they experience some small land-take because of the proposed development.

Enterprise Type

Dairy farms and other livestock farms where stock have to be moved on a daily basis will be most severely affected by developments that sever the farm. A reduction in the areas available to the dairy herd for grazing due to the farm severance can often mean a reduction in the number of dairy cows on the farm.

The reduction in stock numbers or the extra difficulties involved in moving stock between two separate land parcels, may reduce the viability of the enterprise. On dairy farms where access between the farm buildings and the grazing area for the dairy herd cannot be maintained the farmer may be forced to change the enterprise type to a less profitable enterprise. This may be as a result of the disturbance caused to the farming system rather than the amount of land lost.

Farms containing equine stock are also of concern. Horses are of a more nervous disposition than other stock types. They are prone to stress caused by irregular noise and moving vehicles. Such stress may render individual land parcels unsuitable for grazing equine stock. In some cases fields left in an irregular shape (e.g. triangle shaped fields, fields with sharp/narrow corners) may also be unsuitable for grazing with equine livestock.

Dry-stock enterprises (e.g. beef, sheep) are less severely impacted than dairy farms. Stock on these farms is not moved on as frequently as stock on a dairy farm. As a result farmers with these enterprise types can adapt their farming practices to mitigate the damage caused by the proposed development. The location of grazing areas in respect to farm buildings are also less significant on a beef or sheep farm than on a dairy farm. In general such farms suffer less of an overall negative affect if impacted upon by a development of this type.

Tillage farms are less severely impacted than dairy or beef farms. Machinery can easily move from one land parcel to another. Fields may be less regularly shaped and more awkward to farm but can still be workable.

Severance will not occur on any of the affected land parcels.

9.2.2 Receiving Environment

In assessing the impact of the proposed construction of the service area on agriculture, it is useful to compare the general agricultural activity at a national and county level with that of the area immediately affected by the development. This will indicate the significance of the agricultural production taking place along the route of the proposed development. As all agricultural land holdings affected are in County Louth, only statistics for the Republic of Ireland are considered.

Agriculture in Louth

County Louth has a total Utilisable Agricultural Area (U.A.A.) of 61,308 hectares (CSO Census of Agriculture, June 2000). This represents approximately 1.4% of the national agricultural land area. There are 1,742 farms in Co. Louth with the average farm size in the county being 35.2 hectares. This is broadly similar than the national average farm size of 33.2 hectares. The average work units employed on the farms in Co. Louth is 1.1 units per farm (a work unit is equal to 1,800 hours or more labour input per person per annum).

Grassland based livestock farming is particularly important in Co. Louth. The predominant farm enterprise is specialist beef with a total of 620 farms (35.6% of total farms) involved. Tillage and dairying are also important in Co. Louth. Specialist tillage is carried out on 290 farms (16.7%) and specialist dairying is also carried out on 290 (16.7%) farms. Mixed grazing livestock accounts for 240 (13.8%) of farms. A total of 170 farms or (9.8%) of total farms are involved in Specialist sheep farming and mixed crops and livestock farming is carried out on 130 farms (7.4%).

Agriculture Along the Proposed Route

The proposed development will be located within the Electoral Division (E.D.) of Drummallagh, Co. Louth. The topography is rolling with rising elevations.

Current Farming Enterprises

Table 9.1 presents the category of farming enterprise in the affected Electoral Division (ED) and how they compare with the national percentages for each category.

The table indicates that grassland-based livestock enterprises predominate in the affected E.D. The level of specialist beef farmers in the affected E.D. area is lower to the national average. The level of specialist sheep and mixed grazing livestock is significantly higher than the national average. There is no specialist tillage-based, dairying, or mixed crops livestock enterprises within the affected E.D.

The distribution of farm sizes within the affected Electoral Division (ED) in comparison with national averages is presented in **Table 9.2**.

The figures indicate that almost all farms are below 20 hectares in size in contrast with the national figure of 44.3% for the same categories. As data is rounded to the nearest ten, farms of greater than 20 hectares in size are either at a very low level or are absent from the affected Electoral Division. This indicates that the affected farms are significantly smaller in size compared to the national average.

Table 9.1 The Number of Farms Classified by Farm Type within affected E.D. and Nationally

Farm/Enterprise Category	No. of Farmers within Farm Category[1]	Percentage of Total Farmers in Each Category	National % of Farmers in Each Category
Specialist Dairy	0	0	18.6
Specialist Beef Production	10	20	51.1
Specialist Sheep Production	30	60	8.6
Mixed Grazing Livestock	10	20	14.6
Specialist Tillage	0	0	3.3
Mixed crops & Livestock	0	0	2.6
Other*	0	0	1.2
Total	50	100%	100%

[1] The number of farms is shown to the nearest ten

* For example, horses, deer, alternative enterprises, fruit/horticulture, etc

Table 9.2 The Number of Farms Classified by Farm Size within affected E.D. and Nationally

Farm Size	No. of Farmers[2]	% of Farmers	National %
<10 Hectares	30	60	20.1
10 - <20 Hectares	20	40	24.2
20 - <30 Hectares	0	0	17.7
30 - <50 Hectares	0	0	20.9
50 - <100 Hectares	0	0	13.8
>=100 Hectares	0	0	3.3
Total	50	100%	100%

[2] The number of farms is shown to the nearest ten

Table 9.3 illustrates the breakdown of the agricultural land use and the comparison with the national averages

[1] , CSO Agricultural Statistics 2000
[2] Figures have been rounded up or down to the nearest ten and data was suppressed at DED level has been marked 0 which indicates that the amount of the item in question was actually zero in the DED.

There is a slightly higher level of land in pasture (60.3%) compared to the national average of 51%. There is also a higher level of hay (21.9%) compared to the national average of 9%. There is a slightly higher level of rough grazing in the area (17.8%) compared to the national average of 14%. There are no crops or tillage in the affected area. The route chosen will not cause a severe reduction in area of any particular crop type.

Table 9.3 Crop Types in Affected E.D. and the National Land Area

Crop Types	Area within D.E.D.'s (ha)	% of Area under Crops and Pasture	% of National Area under Crops and Pasture
Total Cereals, Crops	0	0	9
Total Pasture	360	60.3	51
Total Hay	131	21.9	9
Total Silage	0	0	17
Rough Grazing in use	106	17.8	14
Total	597	100%	100%

9.2.3 Predicted Impacts

The location of the proposed Narrow Water Bridge Project consists of moderate agricultural range and usage. The impact on agriculture will be limited to those farms directly affected by the proposed development. The main farming enterprise on the affected farm is the grazing of livestock.

Loss of Agricultural Land

Nationally there are approximately 3,936,567 hectares of agricultural land (excluding rough grazing) of which 3,535,443ha are in grassland based enterprises and 401,124ha of cereal and non-cereal crop production. Approximately 3.85 ha. of land will be lost to agricultural production as a result of this scheme. This loss while significant to individual farmers is not significant on a county or national level.

Individual Farm Impact

There are four farms directly affected by the construction of the proposed service area. An agricultural consultant from Philip Farrelly & Co. visited the landowners, in order to carry out the following tasks:

- to conduct an appraisal of the farm facilities and layout, and
- to gather data via a questionnaire to enable an assessment of the impact and mitigation measures required as a result of the road development.

Farms were categorised according to the following criteria:

- Total area of farm holding (Ha)
- Enterprise type(s)
- Degree of overall impact
- Under major/severe overall impact
- Degree of land severance
- Buildings/facilities to be acquired
- New access facilities requiring provision

Table 9.4 shows the summary details of the individual farm assessments and the anticipated impact of the new road on each farm.

There are four farms within the affected area. The affected farms are all in the 0 - 10 ha category and reflect the small size of farms on a local level. Two of the farms are involved in beef, one involved in an equine enterprise and one used for grazing a horse and pony.

Table 9.4 Summary of Individual Farm Assessments (Of 4 Farms Assessed)

Category	No. of Farms	% of Farms
Farm Size (ha): -		
<10	4	100%
10 – <20	0	0%
20 – <30	0	0%
30 – <50	0	0%
50 – <100	0	0%
>=100	0	0%
Farm Enterprises: -		
Dairy	0	0%
Equestrian Enterprises	1	25%
Beef	2	50%
Sheep	0	0%
Tillage	0	0%
Mixed Livestock*	0	0%
Mixed Tillage & Livestock**	0	0%
Forestry	0	0%
Leased (grazing)	0	0%
Other***	1	25%
Overall Impact on Farm		
Not Significant	0	0%
Minor	2	50%
Moderate	2	50%
Major	0	0%
Severe	0	0%
Of those with Severe/Major Impact (Of 0): -		
Dairy Farms	0	0%
Equestrian Farms	0	0%
Leased	0	0%
Mixed Dairying with Beef/ Sheep/Other	0	0%
Mixed Equestrian with Beef/ Sheep/Other	0	0%
Others - Mixed Livestock ****	0	0%
Land Severance: - (Total of 5 land parcels)		
None	5	100%
Minor	0	0%
Moderate	0	0%
Major	0	0%

Category	No. of Farms	% of Farms
Facilities to be acquired*****	0	0%
Access required to severed area (i)	0	0%
Access points to be restored	1	20%

* Mixed Livestock includes any combination of cows, cattle, horses or sheep enterprises. It consists of two farms primarily involved in dairying and one farm primarily involved in an equestrian enterprise.

** Mixed Tillage & Livestock includes any combination of cows, cattle, horses, sheep or tillage enterprises.

*** This category consists of two holdings, one used for grazing a horse and pony.

(i) Access is deemed to be required where it has to be provided to a severed portion of land or a parcel where the entire road frontage is removed. It does not refer to cases where the access point or gates have to be replaced or restored on a land parcel.

(ii) In the case of access required or facilities required, the figure refers to the number of land parcels in each case. It does not relate to the number of farms. In some cases access may be required on more than one land parcel within a holding.

Overall Impact on Individual Farms

Four holdings will be affected by the proposed Narrow Water Bridge Project. There are no farms on which the agricultural impact will be severe or major.

There are two farms which will have a moderate degree of impact and two farms which will have a minor degree of impact.

Impact on Individual Farm Parcels

Where the scheme has affected more than one land parcel on a farm, the land severance on each land parcel is assessed separately.

There is one holding where two individual parcels are directly affected by the proposed development both of which were assessed. Severance will not occur on the affected land parcels.

No animal-handling facilities or farmyard facilities will be affected by the proposed development.

9.2.4 Mitigation Measures

Mitigation measures detailed in this section relate to engineering accommodation works alone. Further measures to compensate farmers due to land acquisition, drainage works and loss of facilities will be agreed by the valuer as the project progresses.

Table 9.5 summarizes the level and nature of the impact the proposed development will have on the affected farms and proposed mitigation measures relating to accommodation works.

Table 9.5 Summary Table Narrow Water Bridge Project – Agriculture

Farm Ref. No.	Total farmed area (Ha)*	Farm Enterprise Impacted	Level of Overall Impact	L.P. Ref. No.	Landtake (Ha)	Nature of Impact	Mitigation Relating to Severance	Level of Residual Overall Impact
104 & 112	1.6	Beef	Moderate		0.544	Severance – None Significant reduction in area	None	Moderate
102 & 114	5.2	Beef	Moderate	a	2.221	Severance – None Significant reduction in the area Loss of road frontage	None	Moderate
				b		Severance – None Significant reduction in area Loss of access point Loss of road frontage	None	
101	1.4	Other – Horse and a pony	Minor		0.136	Severance – None Slight reduction in the area	None	Minor
105	1.4	Equine	Minor		0.037	Severance – None Slight reduction in the area	None	Minor

9.2.5 Residual Impacts

Following recommended mitigation works, two farms will have a residual impact of moderate and two farms will have a residual impact of minor. This represents no change in the level of impact on affected farms.

Table 9.6 shows the details of the individual farm assessments and the anticipated residual impact of the new road on each farm following recommended mitigation works being carried out.

Table 9.6 Residual Impacts on the Individual Farms

Category	No. of Farms	% of Farms
Residual Impact on Farm (Of 4 farm)		
Not Significant	0	0%
Minor	2	50%
Moderate	2	50%
Major	0	0%
Severe	0	0%
Of those with Severe/Major Residual Impact: (0)		
Dairy Farms	0	0%
Equestrian Farms	0	0%
Mixed Dairying with Beef/ Sheep/Other	0	0%
Mixed Equestrian with Beef/ Sheep/Other	0	0%
Leased	0	0%

9.2.6 Construction Impacts and Mitigation Measures

The main impacts on agricultural activity during the construction phase of the new road will be:

- Noise
- Dust
- Disturbance of drainage works

The nature of each of these specific impacts is as listed below.

Noise

The activity of earth moving machinery, transport lorries and other ancillary vehicles will generate noise in the immediate vicinity of the construction area. Noise is of significance for farm animals. In general animals become accustomed to regular noises and sounds. Intermittent noises can cause fright and distress. Blasting activity, which is sometimes necessary during road construction, can be of particular significance. Intermittent noises close to farm buildings particularly milking parlours can be of significance.

Mitigation Measures

Good communication with landowners during the construction phase will prevent disturbance due to noise. The contractor will work to a Code of Practice and working hours will be restricted.

Dust

The proliferation of dust during construction has a nuisance value and, if produced in high volumes near milking parlours and on-farm bulk milk storage tanks, may constitute a risk as a source of contamination in the milk.

Livestock are at risk of eye irritations from high levels of wind blown dust particles. This stress will reduce productivity and increase management difficulties, especially on dairy and stud farms as outlined above.

Mitigation

Measures to control the reduction of dust will be put in place by the contractor. Good communication between the contractor and farmers in the proximity of construction activities will facilitate on-going farm enterprises so that valuable livestock are kept as far away as possible from the construction work during critical times.

Disturbance of Drainage Works

It is to be expected that field drainage systems currently in situ will be disturbed and in places destroyed by the proposed construction. These systems will be restored as part of the completed works, but there may be impaired drainage in the period of time between initial disturbance and final reinstatement of such drainage works.

Mitigation

In cases where impeded drainage during construction will cause obvious difficulty to a particular landowner, temporary measures will be taken to allow waters to drain to less critical areas and so minimise the impact.

Provision of Ducting

Piped watering systems on some farms may be severed. Access to either piped water or drinking points on watercourses will be removed through severance on other farms. In some cases electric fencing will be required to help stock-proof non-roadside boundaries on severed land.

Mitigation

Where there are issues, new water and electricity supplies will be established or the landowner will be compensated.

9.3 Predicted Impacts on Residential Property

No residential property assets will be directly or indirectly impacted by the proposed road and bridge in County Down.

Similarly in County Louth there will be no direct impact on residential property. However there may be some temporary impact on the boundaries of the properties in the immediate vicinity of the proposed access and roundabout on the R173. If this is necessary agreement will be reached with the owner of the property and the boundary reinstated as far as possible to match the existing.

9.4 Predicted Impacts on Commercial Property

Warrenpoint Harbour and Carlingford Lough Commission

Warrenpoint Harbour plays an important role in the local and regional economy as the fifth largest commercial port in Ireland. Access to this port is provided by a maintained deep water channel and turning circle. Navigation along this route into the harbour is provided by a series of buoys and leading lights which are the property of Warrenpoint Harbour Authority (WHA). The maintenance and management of this navigation system is independently provided by the Carlingford Lough Commission (CLC).

The link road and bridge abutment in County Louth will have a significant impact on the operation of this leading light navigation system by interrupting and partly blocking the view of one of a pair of stone navigation beacons (see **Figure 3.2 and**

3.15 in Volume 3). To remedy this situation Carlingford Lough Commission and Warrenpoint Harbour Authority have been consulted with respect to the acceptability of replacing this leading light and on the proposed location and design of the new structure. Louth County Council proposes to construct a new structure and leading light to the satisfaction of WHA and CLC prior to the construction of the southern tower. This structure will be constructed immediately east of the bridge and in line with the two existing leading lights. See **Figure 3.2 and 3.15** in Volume 3.

Carneyhaugh Properties Ltd.

Carneyhaugh Properties Ltd control the land shown in **Plate 9.1** below and in 2010 received outline planning permission for a mixed use development. The proposed development as described within the outline application includes for provision of a hotel and restaurant, residential units and office and retail units. The property group have stated their full support of the project and have cooperated in the design of the Control Building and access as the proposed scheme will enhance their development. *(It should be noted that leave has been sought by Warrenpoint Harbour Authority for a judicial review of the decision to grant outline permission).*

The location and construction of the control building and access (refer to **Figure 3.2** in Volume 3) will result in a minor loss of lands over which outline planning permission has been granted for the proposed mixed-use development. The design and location of the Control Building and the access has been agreed with Carneyhaugh Properties Ltd. The existing buildings on the line of the access to the control building are also identified to be removed by the proposed development granted outline planning approval. As Carneyhaugh Properties Ltd. have stated their support to the project and willingness to allow lands to be acquired by agreement as well as the benefit of a direct access to the A2 being constructed, overall this is not considered to be a negative impact. The design and location of the Control Building and the access has been agreed with Carneyhaugh Properties Ltd. Finishes will be as per **Figure 3.16 to 3.19** in Volume 3 and will be sympathetic to the proposed development.

Plate 9.1 Carneyhaugh Properties Proposed Development

9.5 Predicted Impacts on Foreshore Property

Two small areas of foreshore are required for construction of the two main bridge embankments. In both instances the foreshore is not occupied for any financial purpose and as such the impact is not considered significant.

In County Louth these land are deemed to be in the control of the state (Department of the Environment, Community and Local Government have been identified as owner or reputed owner in the Compulsory Purchase Order.).

Further works on the foreshore in County Louth is required for the construction of the new Leading Light and for the proposed new roost site.

In County Down the Foreshore is owned by The Crown Estates. In this instance the area of foreshore is under lease to Newry and Mourne District Council. This area of foreshore will be acquired under a Vesting Order issued by Roads Service NI, or by agreement where possible.

Chapter 10

Cultural Heritage

Chapter 10 Cultural Heritage

10.1 Introduction

This Cultural Heritage chapter was prepared by Archaeological Development Services Ltd having been commissioned by Roughan & O'Donovan on behalf of Louth County Council.

The Cultural Heritage chapter relates to the proposed development of a combined road and pedestrian bridge to cross the Newry River at Narrow Water. The bridge will run from an existing roundabout on the A2 Newry to Warrenpoint road, across the Newry River to join a link road to the R173 to Omeath.

10.2 Guidelines and Policy

The Cultural Heritage Chapter is compiled so as to be compliant with the relevant guidelines and legislation in both Northern Ireland and the Republic of Ireland.

Northern Ireland

For guidance relating to Northern Ireland, the Planning Service document Planning Policy Statement 6: Planning, Archaeology and the Built Heritage (PPS 6) was consulted. The Planning Service has produced a series of Planning Policy Statements which set out the policies of the Department of the Environment on particular aspects of land-use planning. Each Planning Policy Statement applies to the whole of Northern Ireland and the policy contents are material considerations in the case of decisions on individual planning applications and appeals.

PPS 6 specifically sets out the planning policies of the Department of the Environment in relation to the protection and conservation of archaeological remains and other features of the built heritage and advises on the treatment of these issues in development plans. As such, it embodies the Department of the Environment's commitment to sustainable development and environmental stewardship (PPS6, 1999).

With respect to Archaeology, PPS 6 contains a number of policies relating to the preservation, protection and assessment of archaeological interest. The following is of particular relevance and requires consideration within the Impact Assessment:

Policy BH 1 The Preservation of Archaeological Remains of Regional Importance and their Settings

"The Department will operate a presumption in favour of the physical preservation in situ of archaeological remains of regional importance and their settings. These comprise monuments in State Care, scheduled monuments and other important sites and monuments which would merit scheduling. Development which would adversely affect such sites of regional importance or the integrity of their settings will not be permitted unless there are exceptional circumstances."

There is also a suite of policies which covers the protection and use of listed buildings. With respect to the built heritage and protected structures the following policy is relevant:

Policy BH 11 Development affecting the Setting of a Listed Building

"The Department will not normally permit development which would adversely affect the setting of a listed building.

Any proposals for development which by its character or location may have an adverse affect on the setting of listed buildings will require very careful consideration by the Department. This will apply even if the development would only replace a building which is neither itself listed nor immediately adjacent to a listed building. Development proposals some distance from the site of a listed building can sometimes have an adverse affect on its setting e.g. where it would affect views of an historic skyline, while certain proposals, because of the nature of their use, can adversely affect the character of the setting of a listed building or group of buildings through noise, nuisance and general disturbance."

Republic of Ireland

The relevant legislation in the Republic of Ireland is covered by three principal pieces of legislation that protect, recognize and have a bearing on the archaeological heritage. These are:

- National Monuments Act (1930) and Amendments (1954, 1987, 1994 and 2004)
- Planning and Development Act 2000-2010
- Strategic Infrastructure Act 2006

In addition, there are a series of guidelines:

- The NRA Guidelines for the Assessment of Archaeological Heritage Impact of National Road Schemes (May 2005)
- The NRA Guidelines for the Assessment of Architectural Heritage Impact of National Road Schemes (May 2005)
- Advice Notes on Current Practice (EPA, 2003)
- Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002)
- Code of Practice between the National Roads Authority and the Minister for Arts, Heritage, Gaeltacht and the Islands (2000)
- Framework & Principles for the Protection of the Archaeological Heritage (Department of Arts, Heritage, Gaeltacht and the Islands, 1999)

The principles as outlined in the document *Framework and Principles for the Protection of the Archaeological Heritage* (Dept of Arts, Heritage, Gaeltacht and the Islands, 1999) have also been taken into account in the compilation of this Cultural Heritage Chapter.

In summary the framework and principles document sets out the national policy with regard to the archaeological heritage. Its core principles are:

- The archaeological heritage is a finite, non-renewable resource.
- There should always be a presumption in favour of avoidance of developmental impacts on the archaeological heritage and preservation in situ of archaeological sites and monuments must be presumed to be the preferred option.

- Where archaeological sites or monuments have to be removed due to development then it is essential that the approach of preservation of record be applied.
- The carrying out of an archaeological assessment where appropriate (or where part of a planning condition) is the first step in ensuring that preservation *in situ* or preservation by record take place.
- The costs of archaeological work necessitated by development are a legitimate part of development costs.

Louth County Development Plan 2009 - 2015

Under the terms of the Planning and Development Act 2000 the inclusion in development plans of objectives for the protection of the archaeological and architectural heritage has moved from a discretionary basis to a mandatory one. Planning legislation prohibits a local authority from engaging in development that would be a material contravention of its development plan. This requirement is referenced and amplified in the Louth County Development Plan 2009-2015.

Archaeology

The County Development Plan considers archaeological remains, both known and as yet unidentified, important evidence of Louth's past. It also considers these remains a finite and fragile resource which is very vulnerable to modern development and land use changes.

As such, the planning authority considers the archaeological resource an important asset, the preservation of which, being a legitimate objective against which the needs of development must be carefully balanced and assessed.

In order to achieve these, it is the policy of the planning authority, under Policy CON 21 and CON 22, to:

- to ensure that any development, both above and below ground, adjacent to a site of archaeological interest shall not be detrimental to the character of the archaeological site or its setting and be sited and designed with care to protect the character and/or the setting of the site;
- to require that all planning applications for development that would impinge upon any building, structure, monument or architectural site listed in appendix 3 to be accompanied by an Historical, Architectural or Archaeological Assessment Report, together with a list of mitigating measures to protect the items so listed.

Architecture

The Development Plan also recognises the importance of protecting historic buildings which are a unique and special resource. The *Planning and Development Act 2000 – 2006* requires every development plan to include a record of protected structures (RPS) or parts of structures which are part of the architectural heritage and which are of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest.

In order to achieve this objective it is the policy of the planning authority, under Policy CON 23, CON 24 and CON 25, to:

- To permit the deletion of structures from the Register of Protected Structures and the demolition or significant modification of a protected structure, only in exceptional circumstances;
- To ensure that new development either adjacent to or at a distance from a protected structure shall complement and be sympathetic to the structure or its setting in terms of its design, scale, height, massing, alignment and use of material;
- To encourage the retention, sympathetic reuse and rehabilitation of protected structures and their settings.

10.3 Archaeological Assessment Methodology

The archaeological assessment for this proposed development consisted of two main components. An extensive desk based assessment was carried out, based on information held by bodies in both NI and ROI.

Information for the NI side of the proposed development was gathered at the Northern Ireland Sites and Monuments Record (NISMR) located within the Belfast headquarters of the Northern Ireland Environment Agency: Built Heritage (NIEA: Built Heritage), Hill Street. The First, Second and Fourth Edition Ordnance Survey maps were also consulted as were the cartographic records held by the Public Record Office Northern Ireland (PRONI). The topographical records of the Ulster Museum were also consulted and the aerial photograph collection held by Ordnance Survey Northern Ireland was also examined.

Information for the ROI side of the proposed development was gathered using the Record of Monuments and Places. The Record of Monuments and Places (RMP) were established under the National Monuments Acts (1930-94). It is based upon the older non-statutory Sites and Monuments Record and information from county archaeological inventories. It records known upstanding archaeological monuments, the original location of destroyed monuments and the location of possible sites identified through documentary, cartographic, photographic research and field inspections.

The topographical files of the National Museum of Ireland (NMI) were also examined. These identify all recorded stray finds held in the NMI archive that have been acquired by the state in accordance with national monuments legislation. The files sometimes include correspondence and reports on excavations undertaken by NMI archaeologists in the early 20th century. The amount and the usefulness of the information on each stray find vary considerably. The finds are listed by county and townland and/or street name.

This was followed by a field walking survey of the application site, the purpose of which was to verify the results of the paper search and to identify any previously unrecorded, above ground archaeological features. This also allowed for an assessment of the general archaeological potential of the local landscape to be made.

Once these baseline conditions were established, consultations were held with the statutory bodies in NI and ROI. In NI, NIEA: Built Heritage was consulted regarding the potential impact of the proposed development and appropriate mitigation measures while in ROI, members of the Department of the Environment, Heritage and Local Government were consulted.

Additionally, in NI, a consultation was held with the Centre for Maritime Archaeology which is based at the University of Ulster at Coleraine while local people from Warrenpoint with relevant knowledge were also interviewed regarding the development of the proposed area.

10.4 Existing Environment

10.4.1 Pre-History

The Archaeological Inventory for County Louth (OPW 1986, compiled by Buckley) records that the earliest archaeological evidence from County Louth was the chance find of a Palaeolithic flint flake from a quarry near Drogheda (Mitchell 1986). However the earliest substantial signs of human activity in the county appear to date from the Late Mesolithic period. Surface collection of worked flints from the vicinity of the White River in mid Louth suggests that by that period, hunter-gatherers were utilising the resources of the rivers which cut from west to east across the central plain. Late Mesolithic activity is also found along the raised beach at Rockmarshall, where shell middens indicate the exploitation of the natural seashore resources in that area.

Traces of early Mesolithic occupation (7000 - 6000 B.C.), identifiable by its distinctive microlithic industry, have been located in Co. Down. Microliths have been recovered from the plough - soil at Rough Island, Castle Espie, Ardmillan and several other coastal sites. These coastal sites have been interpreted as being seasonal camp sites, located to exploit the local environment - perhaps in acquiring fish for food or flint for tools. The results of the excavation at Mount Sandal, Co. Derry would suggest that a riverine location in more favourable areas was suitable for a more permanent occupation site. A riverine site at Ballymaglaff, near Dundonald along the River Enler has been discovered (Mallory & Hartwell. 1997).

The Later Mesolithic, with its heavy blade industry, typified with the Bann flake, is evidenced primarily by coastal shell middens. In Co. Down, these sites are located along the western and southern shores of Strangford Lough and some of its islands - Rough Island and Ringneill Quay. A model of short - term seasonal or specialist sites, have been attributed to these sites - both Rough Island and Ringneill Quay produced molluscs, the later also produced the remains of wild birds, but neither produced any evidence of red deer which is commonly found at a number of other coastal shell middens.

In County Louth, evidence for activity in the Neolithic period is substantial, with the remains of a number of megalithic tombs still extant in the foothills of the north Louth mountains. Evidence for settlement has also been found in the course of excavation at Townleyhall, prior to the site being reused for funerary purposes. While much of the archaeological investigations of Bru na Boinne has concentrated in County Meath, the extent of settlement along the County Louth banks of the river Boyne is much more limited. However, it is safe to suggest that owing to the fertile nature of the river valley, the entire length of the river may have been actively settled during the Neolithic. This fact is not limited to the Boyne valley, evidence for the concentration of Neolithic activity in other river valleys is also to be found in the north of the county along the Kilcurry and Castletown rivers. Most of the surviving megalithic tombs in County Louth, however, are in upland areas, where soils were lighter and therefore more easily tilled. Tree and scrub cover in the uplands would not have been as dense as in the lowlands, and settlement and farming in the Neolithic would have been easier in these areas.

There is little evidence for substantial Neolithic activity in Co. Down although recent excavations at Inch and Ballyrenan have uncovered possible disperse Neolithic activity within a predominantly Bronze Age landscape.

Passage tombs are conspicuously few in Co. Down, although the dual court tomb at Audleystown has produced 34 partly burned skeletons, the most abundant remains from this tomb type in Ireland. Another major ritual site is the long cist at Millin Bay, where the remains of skulls were grouped together with long bones, totaling 15 individuals. In addition to this a stone wall orientated north - south and seven further cists with cremated bone underlay the long mound or cairn of sand. Many of the stones used for the cists were decorated with pecked curvilinear and rectilinear motifs.

The Ballynahatty complex, 8km south of Belfast includes the Giant's Ring, the largest and best preserved of the hengiform enclosures in Ireland and is the most distinctive monument in Down. It consists of a bank up to 4m high encompassing an area 200m across with the remains of an earlier passage grave off centre. To the north and west of the ring, agricultural activity in the 18^{th} and 19^{th} centuries uncovered large quantities of cremated human bone both in stone cists and in simple subsoil cut pits. The area appears to have acted as a focal point for possibly hundreds of burials through the Late Neolithic and Early Bronze Age.

10.4.2 Bronze Age

The traces of the Bronze Age in County Louth are wide-ranging, both in type and in distribution. In the northwest of the county is a widespread group of petroglyphs or rock art, dating to the Early Bronze Age. This group extends into south County Monaghan and has parallels in counties Cork and Kerry as well as in southwest Scotland and northern England.

Funerary monuments such as isolated cists are found throughout the county, barrows and cairns are generally found in upland areas while larger barrows survive in the lowland central plain. Indicators of settlement such as *fulachta fiadh,* (ancient cooking places) or Burnt Mounds, which appear to be predominantly Bronze Age in date, are found in various parts of the county, but their recognition is largely due to sporadic survival and their proximity to other monuments. There is one burnt mound recorded within the area of the proposed development.

Unlike in many other coastal counties, the concentrations of early pre-historic sites generally lie inland away from the coast in County Louth, particularly in the northern half of the county. This is due to the fact that at these early times the sea level and climate were considerably different to what they are today. Eustatic and isostatic changes throughout prehistoric times have affected sea levels altering the shape and position of the Louth coastline. During the Mesolithic the climate was warmer and drier with average temperatures a couple of degrees higher than those of today (Mitchell & Ryan 1998). It is known at this time the sea came as far inland as Balmer's Bog near the Dublin Road, to the south of Dundalk (Gosling 1993). As the sea level gradually fell away this east coast became a marshy area, a fact that is still reflected in townland names such as Marshes Upper. By the Bronze Age the sea had retreated and the area became available for exploitation although the marshy, tidal nature of the area would still have provided a barrier to any settlement.

There is a general lack of Bronze Age settlement sites in Co. Down although two circular structures, c.4m and 7m diameter, have been excavated on the Meadowlands Housing Estate in Downpatrick and dated by the Cordoned Urn ware found. In addition to this, traces of Beaker settlement has been found in the form of scatters of beaker sherds found in the sandhills of Murlough (Dundrum) (Mallory & Mc Neill.1991).

Excavations at Inch and Ballyrennan have added significantly to our knowledge of the Late Bronze Age c.1200 - 300 BC in County Down. Until recently evidence for settlement was confined to an open settlement on top of Cathedral Hill in Downpatrick. The Inch and Ballyrennan sites span an extensive Late Bronze Age landscape and includes at least four houses and several ring ditches with central cremations (Excavations Bulletin, 1998).

As with County Louth, cist burials have been uncovered in County Down. Indeed, one of the largest Bronze Age cemeteries in Ireland has been excavated at Cloughskelt near Banbridge, where 23 graves were accompanied by bowls and Encrusted Urns. A single burial was excavated near Downpatrick and the accompanying grave goods included a bowl, a bronze knife a bronze awl and two flint scrapers (Mallory & Hartwell. 1997). Recent excavations along the A1 junction road scheme has uncovered an extensive Bronze Age funerary site with cremations, ring ditches and a timber circle at the Dromore junction. Two similar sites have along been found along the A1 dualling road scheme to the immediate northwest of Newry.

10.4.3 Iron Age

Evidence of the Early Iron Age in both counties is somewhat more scant. This period is regarded as marking the beginning of centralized community settlement throughout Western Europe and the introduction of large-scale defensive works, such as hillforts and promontory forts, linked to the creation of physical frontiers. The linear earthwork known as *the Dorsey*, which is now regarded as being a form of frontier control post, is located just north of the border in south Armagh. The Mourne Mountains which form the northern boundary of County Louth contain a number of passes leading into the central plains of counties Armagh and Down. Over the centuries this has led to cattle- raiding, made famous in the Tain.

Many of the large hilltop enclosures in County Louth probably date to the Iron Age, as does the coastal promontory fort near Giles Quay on the south side of the Carlingford Peninsula. These sites may have functioned as nucleated settlements and defended strong-points for the people in the locale, but they may also have had a ritual function as well as acting as fairgrounds and market-places. Many of the ring-ditches found by aerial photography in the county are thought to be ploughed-down ring-barrows. Excavation has shown that many of these are Iron Age in date (Raftery 1981). Ring-barrows are sometimes found in association with other barrows or on the periphery of barrow groups, which suggests that these sites held a long tradition of sanctity. Most ring-barrows, however, are found in isolation in less prominent locations, on relatively low-lying rises.

Only one site can be positively dated to the Iron Age within County Down. This site consists of circular hut sites located within an enclosure at Scrabo Hill near Newtownards. These have been securely dated to the period 180 BC - 340 AD. This site is almost unique in Ireland in that it shows the continuity of pottery making throughout the Iron Age in Ireland (Mallory & Hartwell. 1997).

10.4.4 Early Christian

Christianity was introduced to Ireland around the middle of the first Millennium AD. The Early Christian period 5th – 12th centuries, saw a range of new monument types while with the introduction of Christianity came writing and with this, the beginning of recorded history.

In County Louth monastic sites were founded at Monasterboice, Dunleer, Louth village, Dromiskin and Termonfeckin. A number of smaller monastic sites such as at Proleek supplement the distribution of known ecclesiastical foundations of this period. These sites were wealthy, being well endowed by local patronage, and were not only centres of learning but functioned as centres of crafts and probably had a large secular community in close attendance. Traces of monastic enclosures have not only been found at Faughart but also at Monasterboice, where the enclosing fosse contained a much larger area than is represented by the small cluster of Early Christian remains which are visible today.

There are several hundred ecclesiastical Early Christian sites in Northern Ireland. How they survive today varies widely, some churches remain in use, some sites are still being used for burial, some are preserved as monuments while others are only known from ecclesiastical records and memoirs with no above surface remains. While the earliest church organisation was diocesan, monastic organisation developed from the 6th and 7th centuries. These monastic buildings ranged greatly in size and complexity depending on the services offered to the local community - ministering, education, hospital, hospitality and shelter. The earliest buildings were often constructed from timber and can only be recovered during careful excavation. Stone churches, often built over earlier foundations, generally date from the 9th century and can be associated with stone carved crosses, bullaun stones, round towers and water mills.

Perhaps one of the best examples of a pre - Norman monastic site can be found at Nendrum. Traditionally, it is associated with St. Mochaoi who died at the end of the 5th century, but references to the monastery began in the 7th century and continued until a fire in 976 (HMSO 1987). The site consists of three concentric walled enclosures with circular hut foundations suggestive of craft workshops. T he church and graveyard was located in the inner cashel and includes cross incised stones and a stone sundial. Excavations at Nendrum have uncovered an Early Christian tide mill, landing quay and mill ponds (McErlean, 2007).

The monastic sites are probably the closest thing to towns that existed in the Early Christian period until the founding of coastal ports and trading centres at amongst other places Dublin and Waterford, by the Vikings. By and large Ireland was a rural society, as evidenced by the large numbers of isolated enclosed settlements which are characteristic of this period.

Early Christian secular sites are generally known as ringforts in ROI and as raths in NI. They have been interpreted as being the enclosed farmsteads of a nucleated family, usually occurring in small clusters. The total number of raths found across Ireland is estimated to be around 30 - 40,000, though this is probably an underestimate. A typical rath would be delineated by a bank c.35m in diameter with an outer ditch, though variations of this include a platform rath, a raised rath, bivallate and trivallate raths. Excavations have dated raths to 500 - 1100 AD and have uncovered houses of wattle, plank, stone, mud or sod, sometimes with a series of outbuildings.

There are several known rath sites within the vicinity of the proposed development on both sides of the Newry River. Recent excavations on the A1 road scheme uncovered two previously unidentified raths in Carmeen townland, northwest of Newry.

Additionally, the number of raths may be supplemented by traces of levelled sites which were either marked on historic cartographic sources and have since been destroyed or have been located through examination of aerial photography.

These levelled sites are known as enclosures in both NI and ROI and there is one such site recorded within the vicinity of the proposed development. While it is likely that many of these enclosures are levelled raths or ringforts, there are some whose size and shape does not conform to the standard pattern of rath/ringfort and secondly, it is sometimes possible to see the attached field systems which supplied the economic basis for the settlement in the surrounding modern fields.

Many of these raths and enclosures had associated souterrains which were generally stone lined tunnels built for storage and refuge. These tunnels could be either short simple passages or a complex maze. Souterrains have been found without enclosures however, which could be evidence that not everyone in the Early Christian period could afford the privilege of a high - banked, defensive farmstead.

There are over 150 confirmed examples of souterrains in County Louth and a further 139 possible examples, with the highest concentration between the Castletown and Fane rivers. NIEA: Built Heritage has a record of 119 souterrains within County Down.

While there are no recorded souterrains within the area of the proposed development on both sides of the Newry River, it is likely that the recorded raths and enclosures may have associated souterrains. Indeed a souterrain was discovered at each of the recently discovered rath sites at Carmeen. It is also possible that undiscovered isolated souterrains are located within the area.

Another type of settlement, the crannog or lake-dwelling, is also prevalent in the Early Christian period and can be seen as the lacustrine equivalent of the ringfort. This type of monument is obviously frequently found in lakeland counties such as Monaghan and Fermanagh. However, only a few examples are known from County Louth, mainly owing to the small number of lakes in the county. Likewise, there are only 49 recorded examples in County Down.

The Vikings appear to have had a minimal effect on County Louth. A base or *longphort* is recorded as being established at Annagassan, as early as AD 831 and existed until at least AD 926. This longphort was used as a base to pillage mid Louth during this period. Traditionally, a cliff fort close to Anagassan, has been suggested as this base, but to date no archaeological evidence is available to support this suggestion. It is recorded, however, that around AD 968 the Scandinavians occupied the monastery of Monasterboice as a base of operations.

There are no known Viking settlements such as longphorts or towns in County Down. However, the Vikings did raid in the county and there are reports of monastic houses such as Nendrum and Bangor being attacked. Despite the lack of physical evidence, the Vikings did leave their mark on the area through place names with Carlingford being a prime example.

In the final centuries of the Early Christian period, northern kingdoms were pushing south and east; this led to pressure on the local kingship around Dundalk, and they in turn certainly must have expanded into central and southern Louth. The synod of Rath Breasail in AD 1111 fixed diocesan boundaries which in many cases were tribal boundaries and the frontiers of major kingdoms. At the synod the line of the diocesan boundary between Meath and Armagh was on a line running roughly from

Collon to Clogherhead. However, the final settlement of the boundary, in the 13th century by Pope Gregory IX, probably agreed as a result of political and military pressures from the kingships around Armagh, defined the boundary in contention as being 'between the water of Carlingford and the mid-water of the Boyne' (Gwynn 1954).

10.4.5 Anglo-Norman

From the 12th century the Irish landscape reflected the political and social changes of the time. The Anglo - Norman invasion saw the introduction of the motte and bailey, for example at Duneight where a conical flat - topped mound was enclosed with a ditch and had an attached enclosure to one side. There is a motte located within the immediate vicinity of the proposed development.

The Anglo-Normans further fortified their position as stone castles, tower houses and keeps were constructed as important military and administrative centres. Dundrum castle was fortified by John de Courcy in 1177 as one of his coastal castles, while Greencastle was fortified in the 13th century and was strategically located along the narrow entry to Carlingford Lough (McErlean et all 2002). In turn, native Irish Lords also built their own fortifications in the form of castles and tower houses.

English power waned in Ireland during the 14th century and was replaced by a number of local Irish Lordships such as the O'Neills of Clandeboye in County Down. These local Lordships came into conflict with England during the 16th century as the Tudor monarchy sought to re-assert control over Ireland (Mallory & McNeill, 1991).

This led to warfare which lasted from 1560 to 1603. Ulster was heavily involved in these wars and the strategic nature of the Narrow Water area led to Narrow Water tower house and bawn being built by the English around 1560.

The result of the wars was that in the late 16th and early 17th century, Elizabeth I and James I tried to control the rebellious native Irish aristocracy by confiscating their lands and dividing it among new settlers - planters, brought specifically over from Scotland and England. The plantation period saw the introduction of strong houses and enclosures to house the new settlers in their unfamiliar and potentially hostile surroundings. Town defences were usually provided by earthen ramparts, stone walls and enclosing ditches such as at nearby Newry or Dundalk.

10.5 Recorded Sites within the Environs of the Proposed Development

10.5.1 Sites and Monuments

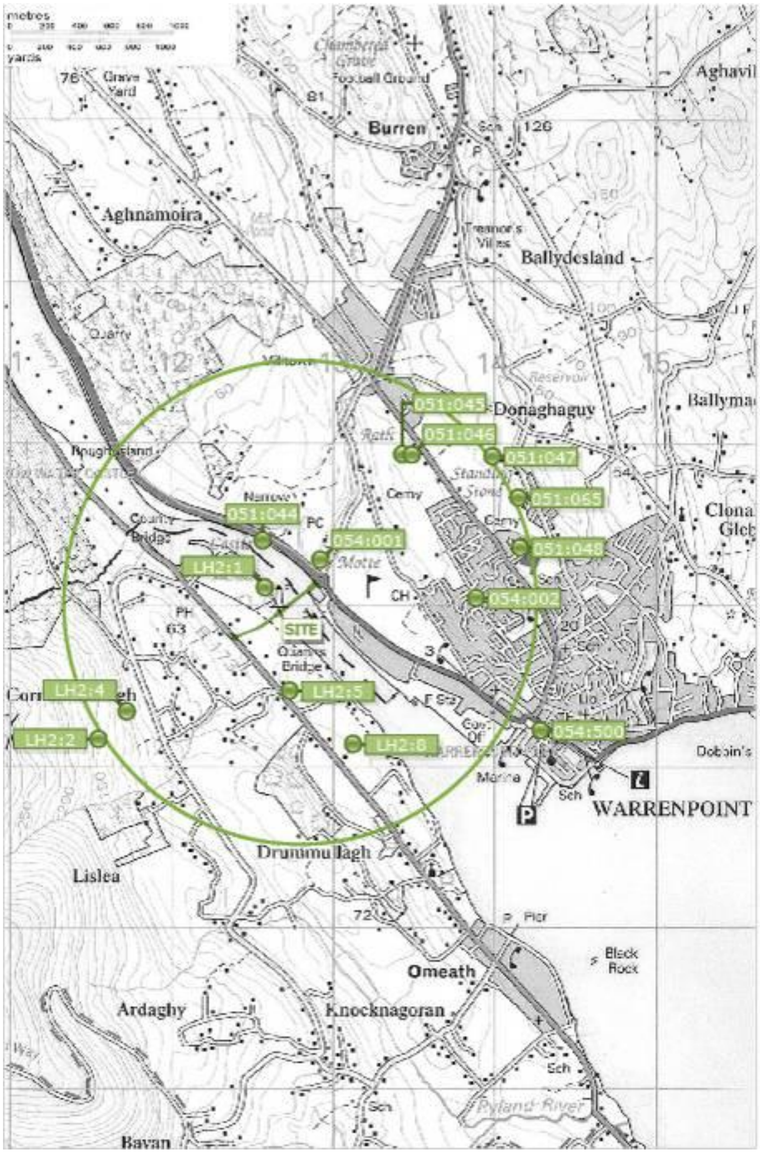


Plate 10.1 Location map of known archaeological sites within a 1.5km radius

The results of the paper search revealed that the proposed bridge lies within an archaeologically sensitive area (Plate 10.1). There are no known archaeological sites within the boundaries of either the bridge or associated road take, however a motte (Dow 054:001) is located directly adjacent to the roundabout on the A2 Newry Road (Plate 10.2).

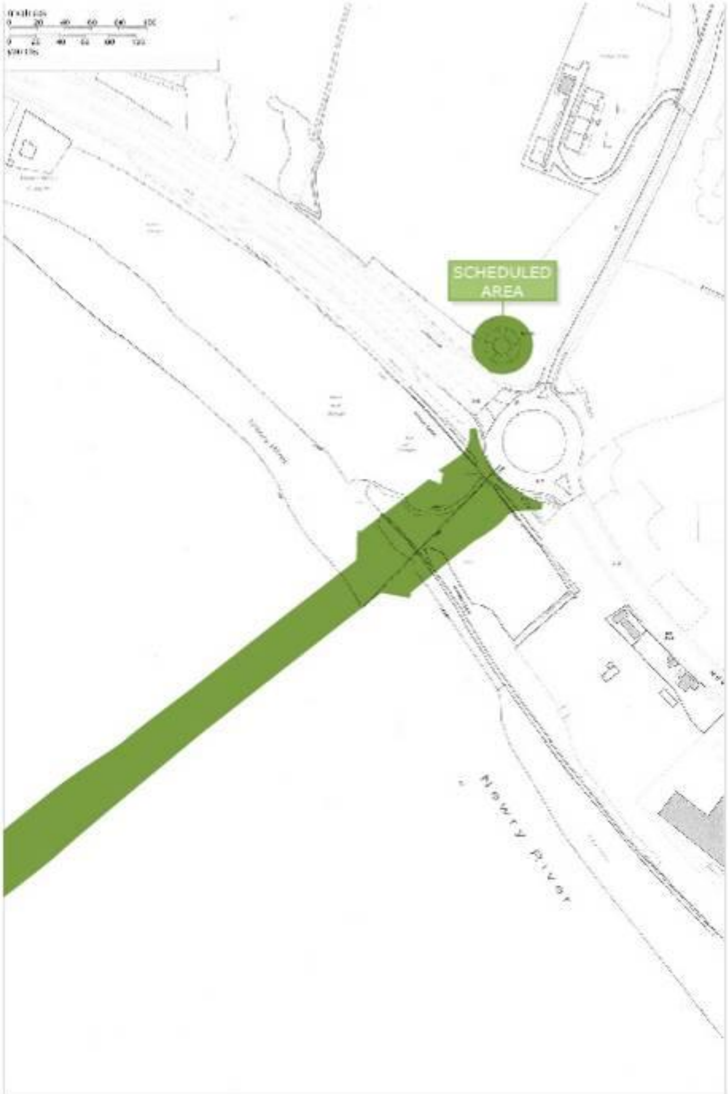


Plate 10.2 Scheduled area of motte (DOW 054:001) adjacent to proposed development.

This motte (DOW 054:001) is located at the southern end of a scarp which overlooks the entrance to the Newry River from Carlingford Lough. The motte consists of a mound which utilizes the natural scarp on the south and east sides to stand 10m high at these locations. Elsewhere, it is only 4.5m high.

There are traces of a ditch running northwest to north to east which measures 6m wide and 0.75m deep where best preserved. The summit of the motte is flat and measures 12m in diameter.

The motte is located in a strategic location guarding the mouth of the river and also the route into the hinterland. King John crossed Carlingford Lough using a pontoon bridge in 1210 and the motte may have been a defensive feature associated with this. However, there is no current evidence to support this.

It is an impressive feature and NIEA: Built Heritage has awarded it scheduled protected status. This includes an area around the motte which measures approximately 15m in diameter. The A2 Newry Road runs immediately along the southwestern edge of the Scheduled area effectively forming a barrier between it and the proposed development.

Mountains on both sides of the Newry River act as barriers to north-south travel and effectively funnel the major impulses of trade and communications through the Newry corridor to the west (Proudfoot, 1997). The Newry River and Carlingford Lough also acted as physical barriers though the Newry River could be forded at Narrow Water.

A 'swimming ford' was located at Narrow Water where it was possible to swim horses and men over the relatively short distance across the river. This naturally gave Narrow Water strategic importance which is evidenced by the presence of the motte (DOW 054:001).

Further evidence of this strategic value is shown in Narrow Water Castle (DOW 051:044) which is located approximately 300m from the proposed location of the bridge. This is a highly visible site located between the A2 Newry Road and the Newry River.

It is believed to have been built by the English around 1560 to defend the entrances to the Newry River and Carlingford Lough at the narrowest point on the river, though it is possible that the current monument replaced an earlier stone castle which may have stood on the site. This earlier castle is believed to have been built in 1249 by Maurice Fitzgerald (Canavan, 1989). The current castle consists of a tower-house and surrounding bawn both built of split-stone rubble with wrought granite quoins.

The tower measures 11.2m by 10.1m and stands three storeys and an attic high. The entrance was guarded by a small forebuilding which no longer exists though a machicolation is still extant. The rectangular bawn measures 36m square with 0.6m thick walls which stand 2m high internally. The walls stand higher externally due to sloping inter-tidal shoreline.

The site changed hands several times during its life and it was used for industrial purposes during the late 18th century. The bawn was considerably restored during the 19th century. The existing entrances are modern as is the gateway to the north. The site is a State Care monument owned by NIEA: Built Heritage.

The remaining recorded sites on the County Down side of the proposed development will now be discussed. The next closest recorded site to the location of the proposed bridge is located approximately 1km to the east-northeast. This is the Coronation Stone (DOW 054:022) which was the inauguration site for the Clan McGuiness. The NISMR has no further information regarding the site.

The next closest sites to the location of the proposed bridge lie approximately 1.1km to the north-northeast. These are a rath (DOW 051:045) and an enclosure (DOW 051:046) which are located in close proximity to one another. The rath (DOW 051:045) is located on a ridge northwest and overlooking the enclosure (DOW 051:046).

The rath has been mostly removed as part of a land improvement scheme but survives as a low platform in a field with a 3m long stretch of bank surviving in the field boundary. A previous NIEA: Built Heritage site visit in 1993 noted the bank measuring 5.1m wide, 0.6m high internally and 0.9m high externally which enclosed an area approximately 37m in diameter. The interior had been stripped bare at the time of the site visit as it provided cover for foxes which were attacking free range chickens in a field to the south.

The enclosure (DOW 051:046) is located near the bottom of the slope on which the rath (DOW 051:045) is located. There are no visible remains of this site though the NIEA: Built Heritage site surveyor noted a slight height to the northwest which rose 0.4m above the surrounding ground level. The interior of the site was slightly dished and the ground level sloped east to southeast. The site may have extended to a field boundary at the south, though half of this had been removed at the time of the site visit.

The next closest recorded site to the location of the proposed bridge is a rath (DOW 051:048) which was located on the summit of a drumlin approximately 1.4km to the northeast. The site has been removed by a building development though a rescue excavation was carried out prior to this in 1992.

The site was previously surveyed and was described as being largely ploughed out though a low circular platform was still extant. This was surrounded by a wide ditch running south to west to north. The rescue excavation uncovered four phases of activity with the earliest being possibly prehistoric and predating the rath. The excavation recovered souterrain ware pottery, fragments of lignite, a polished stone axe, slag and whetstones.

The two remaining recorded northern sites within the 1.5km search radius are located practically on the search perimeter. The first of these is a rath (DOW 051:047) which has also been removed during a land improvement scheme. A previous site visit by NIEA: Built Heritage surveyed the site prior to its destruction. The interior sloped to the south west and measured 37m north to south by 38m east to west with a higher area standing 0.5m above the rest of the interior at east and southeast.

The rath sat proud of the adjacent field at the north, west and south with the bank preserved at the south and west. The north perimeter had been modified however, and was quite straight. There was no evidence for either a ditch or an original entrance.

The last recorded site within the 1.5km search radius is a standing stone (DOW 051:065) which is located on a swell and consists of a large, irregular limestone block measuring 1.83m high to the northwest sitting on a small knoll measuring 0.57m high. This knoll has been created by cattle trampling around the base while parts of the stone have been worn smooth by cattle rubbing against it.

The stone measures 1.5m wide at northwest, 0.6m wide at northeast, 1.45m wide at east and 0.58m wide at south. The stone is a very noticeable landmark and NIEA: Built Heritage has awarded it Scheduled protected status.

The last recorded Northern Irish site to be included here, lies just beyond the 1.5km search area. The site consists of the well preserved stump of a windmill (DOW 054:500) which dates to 1802 and is located to the southeast of the location of the proposed bridge.

The windmill is abutted by buildings at the northwest, west and southwest with these portions of the building whitewashed by the occupants of the adjoining properties. The mill stump is in very good condition with two ground floor doors and a first floor door. The main ground floor door providing access to the interior has a cut stone arch displaying the date of construction.

NIEA: Built Heritage considers the windmill to be an important element to the historic core of Warrenpoint and has awarded it Scheduled protected status.

An examination of the County Louth side of the proposed development showed that this area is also archaeologically sensitive. The closest of these to the location of the proposed bridge is a Cillin (LH002:001) which is located within Ferry Hill approximately 200m to the northwest. This graveyard was used to inter unbaptised infants and the remains of unidentified persons drowned in Carlingford Lough.

The Cillin is situated beside the reputed site of the monastery of Killansnamh which was located on the east side of a natural ridge southwest of the Newry River. The only remains of this site are a low, sub-rectangular platform of stones measuring 20m by 17m east to west and 0.35m high.

Some remains of the monastery were reputedly still extant in 1837 and it was said to have stood opposite Narrow Water castle (DOW 051:044).

The next closest recorded site to the proposed bridge is a ringfort (LH002:005) which is located approximately 500m to the south. This was surveyed in 1970 and found to have an internal diameter of 32.5m which was enclosed by the remains of an earthen bank. No trace of an entrance was visible.

Approximately 500m southeast of the previous site is another ringfort (LH002-008). This site is approximately circular measuring 33m north to south by 31m east to west. It appears as a flat area demarcated by a low embankment while the west side has been slightly quarried. A modern facing has been added to this embankment. Cultivation ridges also run northwest to southeast across the site.

The remaining two recorded sites within the study area are located to the southwest of the location of the proposed bridge. These sites are an isolated settlement (LH002:002) and a *Fulacht Fiadh* (LH002:004).The *Fulacht Fiadh* (LH002:004) is located approximately 1250m southwest of the location of the proposed bridge. It was identified during fieldwork in 1966 and consisted of a horseshoe shaped mound measuring 3.4m by 2.4m which was located beside a stream.

The last recorded site is located just outside the 1.5km search radius to the southwest of the location of the proposed bridge. This is an isolated settlement (LH002:002) consisting of a hut site. The hut consisted of a circular area measuring approximately 4m in diameter which was enclosed by a low stone wall with an entrance at the southeast.

10.5.2 Industrial Heritage

A search of the NISMR Industrial Heritage Record (IHR) was carried out. There are eight recorded Industrial Heritage sites within the 1.5km search radius with a further two located just outside it (Plate 10.3). Additionally, the former Dundalk, Newry and Greenore railway ran across the County Louth extent of the site.

This railway line ran to the Port and tourist destination of Greenore and was operational until the 1950s when the closure of ferry services from Greenore to Great Britain made the railway line economically unviable. The railway line has been dismantled though, as mentioned above, the former line did run within the area of the proposed development and traces could still be evident.

There is no other recorded Industrial Heritage sites within the actual boundaries of the proposed development though the Great Northern Railway Branch Line from Goraghwood to Warrenpoint ran directly adjacent to the area of the County Down side of the proposed bridge.

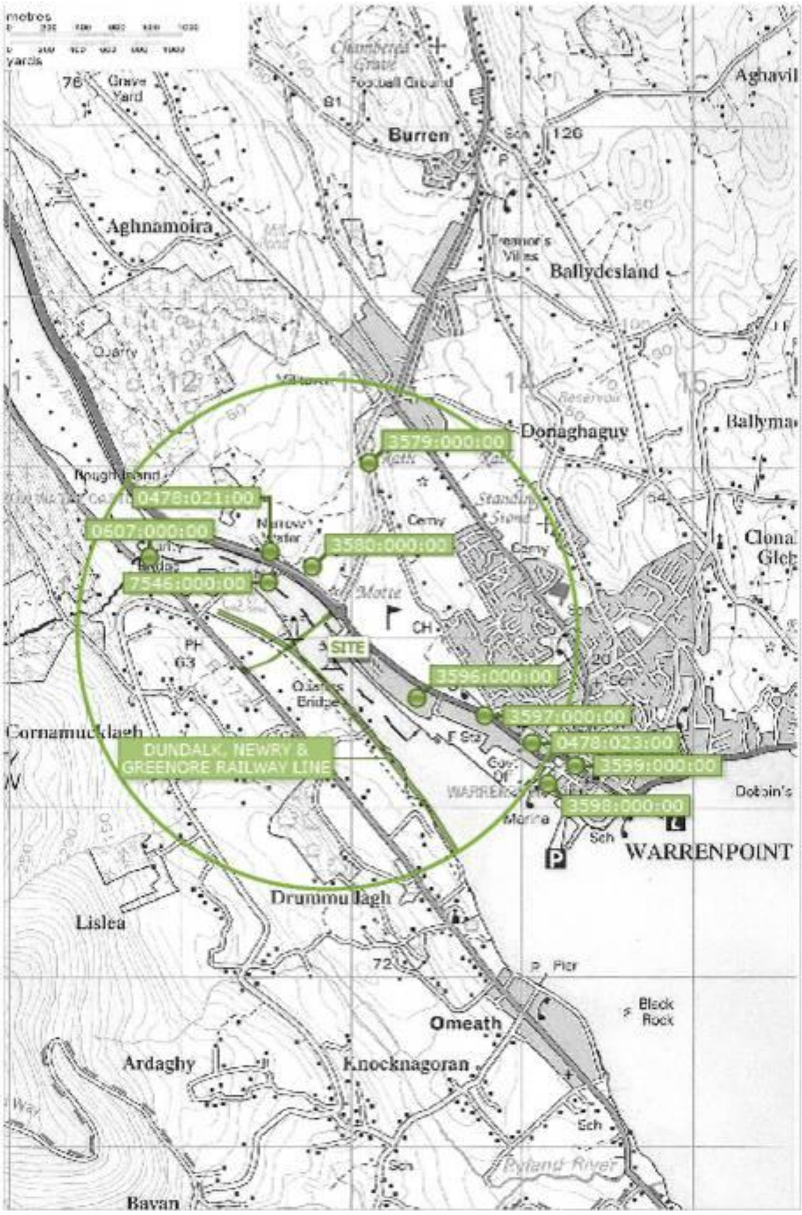


Plate 10.3 Location map of Industrial Heritage sites within a 1.5km radius.

The closest located Industrial Heritage site within the study area is located approximately 500m from the proposed bridge. This was a corn mill (IHR 3580) which was shown on the First Edition Ordnance Survey map sheet (1834) and marked as the Narrow Water corn mill on the subsequent Second Edition map sheet (1861).

The Third Edition Ordnance Survey map sheet (1904) marked the site as disused and it was not shown on the Fourth Edition map sheet (1950). The mill had an associated mill pond which was shown on all Ordnance Survey map editions from 1834 onwards while the mill was powered by a mill race running from a flax mill/saw mill (IHR 3579) which was located to the northeast.

Approximately 250m to the west-northwest of the previous site is the former site of Narrow Water railway station (IHR 478:21) which was part of the Great Northern Railway Branch line from Goraghwood to Warrenpoint. This station was marked from the Second Edition Ordnance Survey map sheet (1861) onwards. The line has since closed and there are no visible remains.

The next recorded site was located approximately 150m due south of the previous site and 1250m from the location of the proposed bridge. This is a navigation beacon (IHR 7546) which is located within the Newry River.

The last site to the northwest of the location of the proposed bridge is the County Bridge (IHR 607) which is located approximately 1300m away. This bridge is on the County Armagh side of the Newry River and carries the R173 Omeath Road over a stream that forms the boundary between Northern and Southern Ireland.

The remaining Industrial sites are located to the north and southeast. The site to the north is a flax mill/saw mill (IHR 3579) which is located approximately 1km to the north-northeast. The site was first marked on the Second Edition Ordnance Survey map sheet (1861) as a flax mill and as a saw mill on subsequent map editions.

The mill had an associated mill race which also served the Narrow Water corn mill (IHR 3580) to the southwest. The mill race was marked from 1834 which would suggest that it predated the flax mill (IHR 3579) and was originally associated with the Narrow Water corn mill (IHR 3580). The flax mill/saw mill site (IHR 3579) also had three associated mill ponds.

The remaining recorded Industrial Heritage sites were all located to the southeast towards Warrenpoint. The closest of these is a modern pre-cast concrete works (IHR 3596) which is located beside the river approximately 650m southwest of the location of the proposed bridge.

Approximately 400m east of the previous site is another modern industrial site. This is a fibre board site (IHR 3597) which was marked on the Fourth Edition Ordnance Survey map sheet (1950).

The next recorded Industrial site is another railway related feature. This is Warrenpoint Station (IHR 478:23) which was also part of the Great Northern Railway Branch line from Goraghwood to Warrenpoint. The station was shown from 1861 onwards though the railway line has since closed.

The remaining two recorded Industrial Heritage sites are located on the 1.5km search radius. These are Warrenpoint Docks (IHR 3598) and Ringmackilroy windmill (IHR 3599). The docks were marked on all Ordnance Survey map editions from 1834 onwards and remain in use today.

The windmill (IHR 3599) was only marked on the First Edition Ordnance Survey map sheet (I834). However, this site is also recorded on the SMR (DOW 054:500) and has already been mentioned. The site survives as a stump and has been awarded Scheduled protected status.

10.5.3 Historic Buildings

There are four buildings within the vicinity of the proposed development which NIEA: Historic Buildings have noted on the Historic Buildings Record (Plate 10.4). None of these buildings will be affected by the proposed development.

The four buildings are all associated with Narrow Water Castle and are located approximately 800m northwest. Narrow Water Castle (HB 16/11/019A), itself, is a two and a half storey mid 19th century Country House built in a Tudor Revival style and should not be confused with the nearby towerhouse (DOW 051:044). The house belonged to the Hall Family who purchased the area during the 17th century and constructed Mount Hall (HB 16/11/019B) in 1707. Narrow Water Castle was built in 1837 and was the family residence until 1999 while it is now used as a hotel/conference centre.

NIEA: Historic Buildings judge the building to be an imposing mansion which was designed by Tomas Duff of Newry and retains all of its original external character with splendid internal detailing also surviving intact. It is located within an attractive informally landscaped demesne and, with its associated buildings, forms an important and substantial group of buildings. It has been awarded Grade B2 Listed protected status.

Immediately adjacent to Narrow Water Castle are the former servants quarters (HB 16/11/019B). This is a long linear two storey building enclosing the west side of the domestic yard and abutting the north elevation of Narrow Water Castle.

This building was formerly Mount Hall which, as previously mentioned, is the original Hall residence which was erected in 1707. It was converted into servant's quarters when Narrow Water Castle was built and the architect Thomas Duff remodeled the exterior to compliment the new house. It has been converted into apartments recently. NIEA: Historic Buildings awarded the building Grade B1 Listed protected status in 1975.

Immediately to the north of the servant's quarters is the stable yard (HB 16/11/021). This is a rectangular stable yard located to the immediate north of the domestic yard. The rear stable block has a date stone of 1816 which suggests that the stable block predates Narrow Water Castle (HB 16/11/019A) and was constructed to serve the adjacent Mount Hall (HB 16/11/019B). As with Mount Hall (HB 16/11/019B), the stable block was remodelled when the new house was built.

This remodelling came in the form of shouldered gables, lattice windows and Tudor Finials. NIEA: Built Heritage believes that the stable block retains its external character and has awarded it Grade B2 Listed protected status in 1982.

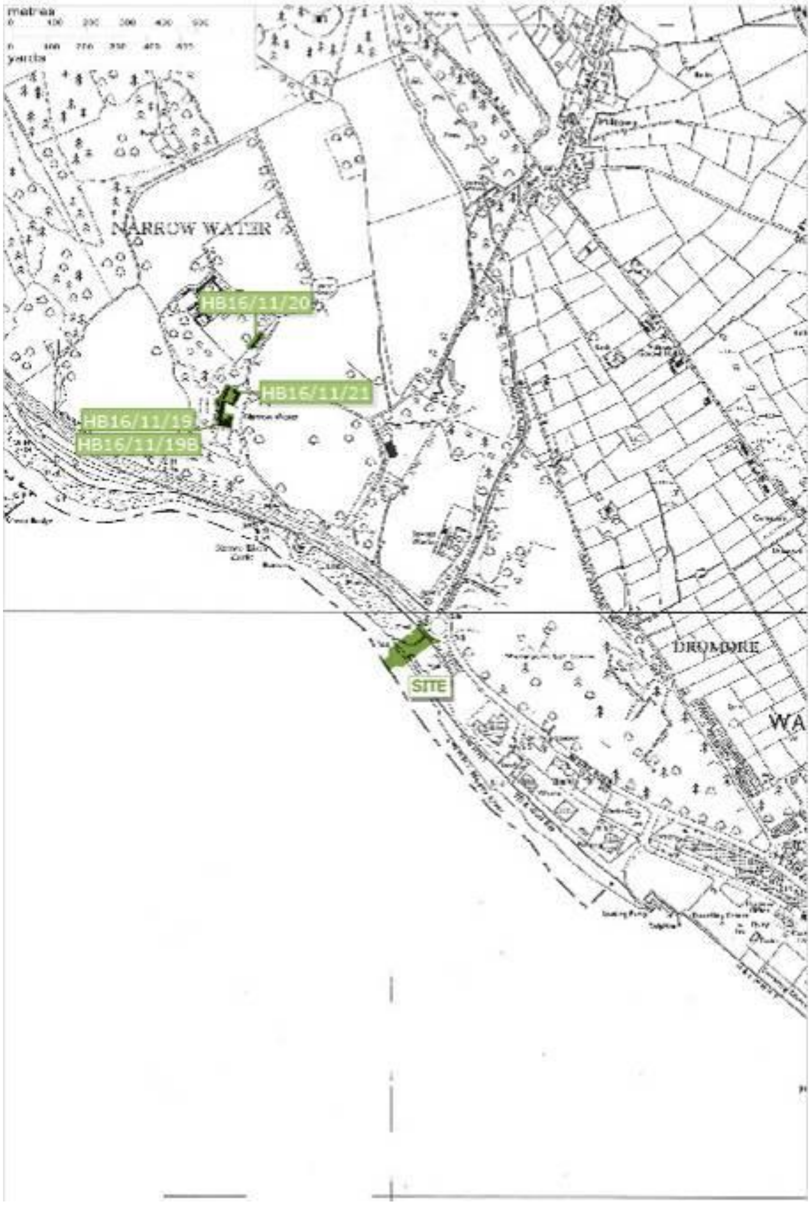


Plate 10.4 Historic Buildings within the vicinity of the proposed development.

The final building within the Narrow Water Castle complex is the former gardener's house (HB 16/11/020) which is located to the north of the main Narrow Water Castle complex. It consists of a walled garden with the gardener's house located on its southeast boundary.

The former gardener's house (HB 16/11/020) was associated with Mount Hall (HB 16/11/019B) and was shown in its present form on the First Edition Ordnance Survey map sheet (1834). The building has been altered recently but NIEA: Historic Buildings still considers it to have strong character and to be a part of the overall estate grouping. As such, it has been awarded Grade B2 Listed Protected status in 1981.

An examination of the Record of Protected Structures in the County Louth Development Plan 2009-2015 revealed four structures within the vicinity of the development, a church, a vernacular house and two light beacons. St Andrew's Church of Ireland Church, LHS002-001, is located in Drummullagh townland and is dated 1838. It is a three-bay nave, three-stage pinnacled square tower centrally located at west end, single-bay chancel to east end with lean-to vestry projecting from south side. The vernacular house, LHS002-009, is in Cornamucklagh townland and consists of a detached three-bay two-storey house, built c. 1920. It has slightly projecting flat-roofed single-storey entrance porch flanked by full-height canted bay windows with a single-storey pitched roof wing to east. Finally the two light beacons LHS002-007 and LHS002-008, are both in Cornamucklagh. The two, built as a pair, are recorded as freestanding light beacons, built c. 1880. They are circular in plan, tapering shafts, conical ashlar granite roofs with projecting eaves and corbel strings. They are constructed with uncoursed rubble granite walling. None of these structures will be directly affected by the proposal.

10.5.4 Historic Gardens

There is one Historic Garden within the 1.5km search radius (Plate 10.5). This is the demesne surrounding Narrow Water Castle (D/041). The original Mount Hall (HB 16/11/019B) had a garden, grove, shrubbery, orchard, pasture, woods and parkland associated with it and it is thought that Sir Joseph Paxton planned the surroundings of Narrow Water Castle (HB 16/11/019A).

Plate 10.5 Historic Gardens within 1.5km radius of the proposed development.

The demesne has an Italian Garden with grass terraces, balustrading, cut stone steps and urns. Grassed horizontal ground was once flower beds and a wild garden was located in the Pleasure Grounds to the northwest of the house. This was said to have been created by Thomas Smith of Newry but is no longer maintained.

The site still has a folly summer house which survives on high ground in woodland and there are extensive plantations of trees. However, the walled garden is no longer cultivated and the glasshouses have been removed. The site is now part of the hotel complex and the southeast corner is now a golf course.

10.5.5 Topographic and Cartographic Records

The topographic records of the Ulster Museum and National Museum of Ireland were also consulted. However, neither institution had records of artefacts being recovered from the townlands associated with the proposed development (Narrow Water in County Down and Cornamucklagh in County Louth). A search of the Ulster Museum's topographic records using the general term 'Newry River' was also carried out though this, too, provided no results.

The cartographic records held by the Public Record Office Northern Ireland (PRONI) were also consulted. The following cartographic records were examined:

- 1580 Map of the east coast of Ireland from Carlingford Lough to the barony of Lecale (PRONI T/1493/45).
- 1580 Map of Ulster with annotations by Lord Burghly (PRONI T/1493/6).
- 1580 Map of North Leinster and south east Ulster including counties Down, Tyrone and Fermanagh (PRONI T/1518/4).
- 1602 Map of south Down including Carlingford Lough and part of County Louth (PRONI D/167/1).
- 1700 Cartes des Routes de Lisburne a Dublin comprising the country between Kiltullagh, Antrim and Donaghadee in the north and Athlone and Dublin in the south drawn by a French artist. Scale 4.5 miles to 1 inch (PRONI T/2528/32).
- 1739 Map Of County Down by Oliver Sloane (PRONI T/1763/2).
- 1767 Map of County Down with chart of sea coast by Kennedy (PRONI T/1245/1).
- 1804 Volume of Maps and surveys of estate of the Marquis of Downshire in the barony of Upper Iveagh by Brownrigg, Longfield and Murray (PRONI D/671/M7/23).
- 1810 Map of County Down by James Williamson (D/616/1).
- 1820 Map of proposed improvements in the navigational facilities along the tidal approaches to the Port of Newry (T/1515/1).

None of the above maps revealed any significant information regarding the area of the proposed development. Narrow Water Castle (DOW 051:044) was a significant fortification in a strategic location during the 16th and 17th centuries and naturally was shown on the early maps. However, little other detail was shown apart for the fact that the County Louth side of the river was densely wooded.

The Map of County Down with Chart of sea coast by Kennedy was produced in 1767. It did not show any detail at Narrow Water though interestingly did show a road running north from the location into the Mournes.

Plate 10.6 First Edition Ordnance Survey Map (1834).

First Edition Ordnance Survey Mapping

The First Edition Ordnance Survey map sheet (1834) showed the area towards the middle of the 19th century (Plate 10.6). The area was largely rural at this time though Narrow Water House (HB 16/11/019A) and demesne (D/041) were clearly visible to the northwest.

The Newry to Warrenpoint Road was clearly shown and this formed the shoreline to the northwest of the proposed development. The motte (DOW 054:001) was clearly marked adjacent to the road and Narrow Water Castle (DOW 051:044) was also clearly marked. This sat on an area of ground actually within the inter-tidal zone and was joined to the shore by either a bridge or thin strip of ground.

The majority of the area of the proposed development consisted of intertidal ground. The channel was marked within the centre of the river and this also formed the county boundary. Work was ongoing within the intertidal area as banks were shown in the process of construction.

The County Louth side of the proposed development was largely undeveloped though a laneway was shown running towards the river from the Omeath Road. The area to the northwest of the proposed development was occupied by a wood and a ferry crossing was marked running between the northwest corner of the wood and the County Down shoreline.

The Newry to Omeath road was in existence at this time though portions were shown as dotted lines suggesting that it was little more than a track in these locations. Properties were marked on the road though these were all concentrated on the southwest side of the road. The only archaeological site shown within the vicinity of the proposed development on the County Louth side was the ringfort (LH002-008).

Second Edition Ordnance Survey Mapping

The Second Edition Ordnance Survey map sheet (1861) showed the layout of the proposed development approximately 27 years later (Plate.10.7).

This map was drawn in much greater detail than the previous map sheet and showed features such as field boundaries. Both sides of the Newry River had seen development with railways built and training walls constructed within the river while a road now ran north from beside the motte (DOW 054:001).

The Newry and Warrenpoint Railway (IHR 478) now ran adjacent to the shoreline and actually cut across the strip of land which linked Narrow Water Castle (DOW 051:044) to the shore. Narrow Water Station (IHR 478:21) was located directly opposite the castle on the northern side of the road.

The railway continued southeast on an embankment across the intertidal area before joining a spit of land located to the southeast of the proposed development. The map clearly showed that the railway was located well into the intertidal area away from the shoreline.

Plate 10.7 Second Edition Ordnance Survey Map (1861).

A training wall had been created on the County Down side of the river. This was orientated northwest to southeast and was located on the southwest side of the spit of land. It effectively closed in part of the intertidal area creating a small 'bay'. A tidal pole was marked at the northwest end of the training wall.

Likewise, the training wall had been constructed on the County Louth side of the river. This had been shown in construction on the previous map sheet but now ran northwest to southeast across the line of the proposed development. This training wall was located adjacent to the wooded area which was now labelled 'Ferry Hill'. The Narrow Water Ferry was still in existence.

The Newry and Greenore Railway ran across the proposed development with a road bridge shown crossing the railway to the southeast of the proposed development. As previously mentioned, the field layouts were now shown and these were depicted as narrow, linear fields running between the Omeath Road and the river.

The laneway previously marked running between the road and the river was not clearly shown though its former line could still be traced. The railway appeared to run through this area via a cutting and a ground level crossing was shown on the railway along the former line of the laneway.

The Omeath Road was now illustrated as a solid route and several domestic properties were now shown to the north of the road. However, none of these were located within the area of the proposed development.

The rath (LH002-008) was shown within the vicinity of the County Louth side of the proposed development as was the ringfort (LH002-005) and the hut site (LH002-002). Narrow Water Castle (DOW 051:044) and the motte (DOW 054:001) were clearly marked as was Narrow Water House (HB 16/11/019A), its associated buildings and the main demesne (D/041).

Narrow Water Corn mill (IHR 3580) was now extant as was the flax mill (IHR 3579) to the north. Both were located within the grounds of the demesne.

Fourth Edition Ordnance Survey Mapping

The Fourth Edition Ordnance Survey map sheet showed the layout of the proposed development in the middle of the 20th century (Plate 10.8). The area was largely as depicted on the previous map sheet. Both railways were still extant though Narrow Water station had been moved slightly further to the west.

The training walls were also clearly marked and the area behind the northern training wall was now industrialised with the pre-cast concrete works (IHR 3596) now constructed. The corn mill (IHR 3580) was no longer shown while the flax mill (IHR 3579) had become a saw mill.

Navigational aids were recorded. Two beacons were shown on either side of the river with the corresponding colours of their lights indicated while two lighthouses were shown on the County Louth side. Both of these structures are protected, with one located on the shoreline (LHS002-008) and the other set at the southeast end of the training wall (LHS002-007). The intertidal area adjacent to the training wall was identified as an oyster bed. The post was still marked at the northwest end of the training wall on the County Down side.

Plate 10.8 Fourth Edition Ordnance Survey Map (1950).

The field system and Omeath Road were clearly marked though the area of the proposed development appeared to be largely as shown on the previous map sheet. Ferry Hill was still clearly shown to the northwest and the ferry was still in existence. The three archaeological sites shown on the previous map sheet were still marked though there was no sign of the Cillin (LH002-001) in Ferry Hill.

The County Down side of the proposed development was also largely unchanged. The motte (DOW 054:001) was clearly shown as was Narrow Water Castle (DOW 051:044). Narrow Water House (HB 16/11/019) and its associated demesne (D/041) still occupied the ground to the northwest of the Newry to Warrenpoint Road while a golf course had been constructed to the southeast of Mound Road.

The aerial photographic collection held by Ordnance Survey Northern Ireland was examined in relation to the area of the proposed development. The appropriate aerial photograph (RMK Col 7 F327) was taken in July 1999 at a scale of 1:10,000. However, this did not show anything of a potential archaeological nature within the proposed development.

The proposed development is located on the Newry River which provides access to Newry from Carlingford Lough. With the development of the Newry Canal during the 18th century, it was hoped that Newry could become a major port. However, the nature of the Newry River meant that it was not naturally deep enough to accommodate large ships.

Plate 10.9 View of Narrow Water in 1772 as depicted in a painting by Jonathan Fisher. (Courtesy Warrenpoint Harbour Authorities.)

To counter this, the Newry Navigation Company appointed the engineer John Rennie to improve access to Newry from Carlingford (Canavan, 1989). This had a direct impact upon Narrow Water.

The channel at Narrow Water contained rocks and islets which blocked the channel. These can be seen in this painting which dates to 1772 (Plate 10.9)

The rocks are shown jutting well out into the channel with Ferry Hill and the County Louth shoreline close by to the left. The painting also showed several other details such as the Narrow Water Ferry itself convening passengers to the County Down side and Narrow Water Castle (DOW 051:044) is clearly visible set in the river.

Rennie's work involved the removal of the rocks and islets. This took place over 12 years from 1830 with the obstructions being blown up. In 1835 Rennie wrote to the Chairman and Committee of the Newry Navigation Committee and stated that he had removed the obstructions from the shoals and eddys whilst also increasing the depth of water at Narrow Water by approximately one foot and increasing the current taking away muds from beyond Narrow Water Castle to Newry and increased the tidal flow up the river (Ordnance Survey Memoirs 1834-6). This activity would no doubt have impacted on any archaeological features, if they existed, within the area.

Additional information was gathered from several local sources who know the area well. For ease of discussion, this information will be included as part of the site walkover.

A site walkover was carried out by ADS Ltd in July 2008. This included an intertidal walkover and metal detector survey which were carried out in ROI under licence from DoE: HLG (Intertidal survey licence 08D50, Metal Detection licence 08R153).

The walkover will be discussed from west to east with the County Louth side of the proposed development discussed first. The access lane will run from the R173 Omeath Road (Plate 10.10) across agricultural ground to the east (Plate 10.11).

This agricultural land slopes away from the road down to a drain. Beyond the drain, the ground rises into a small ridge before levelling off again to the boundary with the adjacent field. The only feature within this field is a thorn tree which a local farmer maintained had no folklore associations.

Plate 10.10 Area where access road to bridge will run from the R173 Omeath road.

Plate 10.11 Looking Southeast across farmland where the access road will run.

Plate 10.12 Infill material in area of former cutting for Greenore to Newry Railway.

The adjacent field is set at a much high level with parts clearly made up with fill material (Plate 10.12). The former Newry to Greenore Railway line ran across this area, though there are no traces of the actual railway line within the area of the proposed development.

A former railway bridge is still extant to the southeast of the proposed development (Plate 10.13). This bridge clearly shows that the railway line was cut into the hill side and evidently was filled in once the railway was closed.

Plate 10.13 Former railway bridge on Greenore – Newry railway line. Note depth of cutting.

The ground slopes downhill to the river from the area of the former railway (Plate 10.14).

Plate 10.14 Area where access road will join the embankment for the bridge.

The intertidal area is relatively level and shows evidence of navigation activity. The training wall is a very evident feature as is the leading light, protected structure LHS002-008, set on the shoreline (Plate 10.15).

Plate 10.15 Looking along foreshore within area of proposed development. Note training wall and leading light (LHS002-008).

The leading light is the property of the Warrenpoint Harbour Authority and was erected during the 1880s. It was originally lit with an oil lamp but is now electrically powered. The other leading light, also a protected structure LHS002-007 is located at the end of the training wall (Plate 10.16). It dates from the same period and both leading lights are still operational navigation beacons for ships using the channel. It is however proposed to construct a new navigation beacon to the south of the proposed bridge so that the line of the leading lights will not be interrupted by the bridge. This beacon will be constructed to a similar style and finish as the leading light (LHS002-008) whose function it will replace. LHS002-008 will remain in place and be protected during construction as described elsewhere.

A beacon was marked within the intertidal area on the Fourth Edition Ordnance Survey map sheet (1950). This has largely been removed though part of its base is still extant (Plate 10.17). The intertidal area is covered in mussels which are placed in this location by the mussel fishermen who use the Narrow Water area as a nursery.

Approximately seven mussel boats operate within the area regularly dredging the channel and intertidal area. The County Down side of the proposed development consists of an area known locally as 'The Gut' (Plate 10.18).

'The Gut' runs between the spit of land to the southeast of the proposed development and Narrow Water Castle (DOW 051:044) and would appear to be the area featured in the painting from 1772. It is a disturbed area containing a large amount of silt and mud.

Plate 10.16 Looking Southeast along training wall to second leading light (LHS002-007)

Plate 10.17 Remains of former beacon in intertidal area.

This material was apparently imported during the 1960s by Kellys Coal Merchants. Work in the coal yard was generally slack during the summer so Kellys would use their cranes to excavate material from the old harbour in Warrenpoint and deposit it in 'The Gut'.

'The Gut' is partially enclosed by the training wall (Plate 10.19) and the remains of the navigation post are still evident at the end of the training wall (Plate 10.20). Also evident are the remains of a fixed navigation light in the channel (Plate 10.21).

Plate 10.18 Looking Northwest over the 'The Gut' on County Down side of the proposed development. Note Narrow Water Castle (DOW 051:044) in the background.

Plate 10.19 Training wall partially enclosing 'The Gut' on the County Down side.

Plate 10.20 Remains of navigation post within intertidal area on County Down side.

Plate 10.21 Remains of former fixed navigation beacon within channel.

'The Gut' is bounded to the northeast by the embankment for the A2 Newry to Warrenpoint dual carriageway (Plate 10.22). This embankment includes an outflow from a nearby waste water treatment works which runs into the river (Plate 10.23).

Plate 10.22 Embankment of roundabout on A2 Newry to Warrenpoint Road.

Plate 10.23 Sewage outfall pipe running across 'The Gut' to the Newry River.

The A2 Dual carriageway runs along the line of the former railway embankment which was set well out from the original shoreline. Fence posts and other features within 'The Gut' are believed to be associated with the railway.

The proposed bridge will join a roundabout located on the A2 (Plate 10.24). The motte (DOW 054:001) is located adjacent to the northeast corner of this roundabout though this monument is currently completely obscured by thick tree cover.

Plate 10.24 Roundabout where bridge will join the A2. Note tree cover in background. The motte (DOW 054:001) is located behind this cover.

The proposed development is located close to Narrow Water castle (DOW 051:044) which is a State Care monument. The castle will have a direct view to the southeast and the bridge (Plate 10.25).

Plate 10.25 Looking Southeast from location of Narrow Water Castle (DOW 051:044)

Narrow Water Demesne (D/041) is located to the northwest of the proposed development. The demesne includes Narrow Water House (HB 16/11/019) which is a Historic Building with listed protected status (Plate 10.26).

Plate 10.26 The Historic Building, Narrow Water House (HB 16/11/019)

It is possible that the proposed development could impact visually upon this property and the demesne. However, Narrow Water House (HB 16/11/019) has been scarped into the terrain which reduces views from the property. Additionally, the demesne is lined with mature tree cover which blocks views towards the proposed development (Plate 10.27).

Plate 10.27 Looking Southeast from Narrow Water Demesne (D/041) towards location of proposed bridge. Note dense tree cover.

10.6 Predicted Impacts

The location of the proposed bridge and access road is in an archaeologically sensitive area with 14 recorded sites within a 1.5km radius. Recorded archaeological features within the area show activity from the Prehistoric through the Early Christian, Medieval and Post Medieval periods. (See **Figure 10.1** in Volume 3)

Narrow Water is, as its name suggests, the narrowest point on the Newry River which would have been a major route into Ulster from Carlingford. Therefore, the area would have been naturally used as a crossing point throughout history. This made the area strategically important as is evidenced by the motte (DOW 051:044) and Narrow Water Castle (DOW 054:001) which are located within the immediate vicinity.

Neither of these monuments will be physically impacted upon by the proposed development. However, there is a direct line of sight between the proposed development and Narrow Water Castle (DOW 054:001).

Narrow Water Castle (DOW 054:001) is a State Care monument which means that it is regarded by NIEA as a monument of great importance within Northern Ireland. As such, it is important that it is left *in situ* and within an appropriate setting.

Accordingly NIEA will operate a presumption against a proposed development that could affect the setting of a State Care Monument. This includes:

- the critical views of, and from the site or monument;
- the access and public approaches to the site or monument; and
- the understanding and enjoyment of the site or monument by visitors.

The physical impact of the development will be largely terrestrial though parts of the intertidal zone will be affected as well. The County Down side of the bridge will sit on an embankment which will run from the roundabout on the A2 out level with the training wall. The river will be completely spanned by the bridge apart from a series of slim concrete piers at the opening bascule. Another embankment will be built on the foreshore area on the County Louth side. An anti-collision Dolphin system will be anchored in the channel to the river bed by means of mono piles driven into the river bed. A new navigational beacon will also be erected on the foreshore to the south of the bridge.

An access road will then link the bridge to the R173 Omeath Road and this will cross agricultural ground. Additionally, a compound and access will have to be created in this area during the construction phase. Given that this is the only readily accessible land within the proposed development, it is likely that the bridge will be constructed from the County Louth side.

The access road will largely be set on an embankment though a small part will cut through the top of the ridge on its passage to the shoreline. It is likely that the ground under the embankments will be top soil stripped in advance of these being constructed.

The area of the proposed development has seen large scale disturbance in the past. On the County Down side, the A2 Newry to Warrenpoint dual carriageway has been built on the original road and adjacent railway. This means that the original shoreline has already been severely disturbed and will not be impacted upon by the proposed development.

The proposed bridge embankment on the County Down side will be located within 'The Gut' which is an area which has seen previous disturbance with the building of the training wall, railway and the subsequent dual carriageway. It is also likely that Rennie's obstacle clearance work during the 1830s also affected this area.

Despite this, there is the possibility that archaeological features or artefacts could still exist within this area. Groundworks associated with the construction of the embankment could impact upon such remains. This is especially true of the cofferdam which will be erected in advance of excavation and piling.

The main channel within the river was cleared by Rennie during the 1830s while subsequent dredging work has been carried out by Warrenpoint Harbour Authority and the local mussel fishermen. These actions will have had a major impact upon any archaeological artefacts, if they exist, lying on the river bed.

That said, there is the possibility that archaeological features or artefacts could still exist within this area and work associated with the construction of the bridge and the single concrete pier could impact upon such remains as could the piling associated with the anti-collision Dolphin structure.

The intertidal area on the County Louth side of the river has been disturbed by the construction of the training wall and possibly by the subsequent activities of mussel fishermen. However, this area remains largely undisturbed compared to the County Down side of the bridge. Therefore, there is a good possibility that archaeological features or artefacts could exist within this area. Such remains or artefacts will be impacted upon by the construction of the cofferdam and subsequent excavation.

Additionally, construction of the proposed bridge embankment could impact upon the training wall. This is an intertidal feature built during the 19th century and has some local maritime and industrial significance. However, only a portion of the training wall will be affected with the majority of this feature remaining extant.

The protected structure, the light beacon (LHS002-008) lies immediately north of the proposed new bridge. Whilst it will not be directly impacted upon by the proposed development, the abutment of the bridge on the western bank of the river will interrupt the views between this light beacon and its counterpart, the light beacon to the south-east, the protected structure (LHS002-007). There will therefore be a visual impact on both structures. The practical side of the visual impacts can be readily ameliorated by the construction of a new beacon, along the same sight-line, immediately to the south of the bridge, ensuring continued navigational safety. The visual impact, aesthetically on the protected structure LHS002-008 will remain. However, the fact that the beacon will remain in situ and protected both during and after construction goes some way to reduce the overall negative impact. Groundworks associated with the construction of the new beacon will impact upon the intertidal area and any archaeological features or artefacts that may be located within the footprint of the beacon.

The construction of the access road to the R173 has the greatest potential to impact upon sub-surface archaeological features since it will run through ground largely only disturbed by agriculture. This ground is a ridge overlooking the river which would have been a good location for a settlement with ready access to the river for communications and a food source.

This area has also seen some disturbance when the railway cutting was dug through part of the hill during the 19th century though this would only affected the line of the railway. The railway cutting has since been in-filled and it is unlikely that the proposed groundworks will impact upon any railway related industrial heritage remains.

10.7 Proposed Mitigation Measures

The proposed bridge will be sited within view of Narrow Water Castle (DOW 051:044)) which is a State Care Monument. This could visually impact on the setting of Narrow Water Castle and a visual impact appraisal including photomontages of the proposed bridge within its settings has been prepared to consider the potential impacts. (Refer to Chapter 8 Landscape and Visual Impact).

10.7.1 Pre-development Mitigation Measures

Given the archaeological sensitivity of the environs of the proposed development, it is proposed that pre-development mitigation measures are put in place.

As previously mentioned, statutory consultations were carried out with the Heritage Authorities in both NI and ROI. Both are fully aware of the potential archaeological impact of the proposed development and have stipulated a series of mitigation measures which must be adhered to in advance of any groundworks commencing. This includes geo-technical testing.

The Heritage Authorities stipulated that the geophysical testing should take the form of non-invasive surveys within the intertidal and riverine line of the proposed bridge and within the terrestrial line of the bridge, link road and compound. These surveys have been carried out with the results detailed below.

Marine Geophysical Survey

A comprehensive marine geophysical survey was carried out within the riverine line of the proposed route. This survey was carried out by Irish Hydrodata Ltd with the resultant marine geophysical data acquired archaeologically interpreted by the Archaeological Diving Company Ltd (ADCO).

The area surveyed included the 70m wide footprint of the bridge extending across the river and also extended 80m upstream and 60m downstream to provide a useful buffer area in which to observe the local context of the survey data. The total area covered with approximately 250m long by 135m wide (Plate 10.28, below). The geophysical survey was carried out using a side scan sonar and magnetometer under detection licence 10R133 issued by DoE: HLG (ADCO 2010).

The survey lines ran at 20m intervals parallel with the river bank and at 40m intervals at right angles to the banks. Two other lines were surveyed in free form fashion to get survey cover within a shallow area on the County Down side. The shallows on the County Louth side were inaccessible to the survey vessel and this area was not examined.

Bathymetric data gathered during the survey substantiated the regularly dredged nature of the active river channel which is approximately 50m wide with straight sides. It drops to -2m chart datum (Warrenpoint) with slightly deeper hollows -3m in places in the centre of the channel with the shallows on either side indicating the constant build up of river silts travelling downstream from Newry. The side-scan sonar data traces revealed that the river bed is sandy and muddy and generally featureless apart from small boulders lining the riverbank areas.

Thirteen side-scan sonar anomalies were indicated in the data traces with six of these (SS5-SS8, SS10 & SS11) located within the 70m wide footprint of the bridge (Fig 10.9). Four of these anomalies (SS5-SS8) were located on the County Down side of the river approximately 12-13m from the river's edge to the east and approximately 12m from the active dredged river channel to the west. The four anomalies were between 0.7m-1m in size and stood between 0.1m-0.6m above the surrounding silts. They also appeared to form a line extending over 36m north-northwest to south-southeast. The remaining two anomalies (SS10 & SS11) were located to the southwest within the active channel. SS10 has been interpreted as probably rock or debris while SS11 consists of a small irregular anomaly 0.5m long.

The magnetometer survey also revealed 26 magnetic anomalies, 14 of which were located within the 70m wide footprint of the bridge. Two of these corresponded with anomalies SS6 & SS11 indicated by the side-scan sonar survey which suggested that these have a ferrous metal content. The remaining 12 magnetic anomalies did not correspond to features indicated by the side-scan sonar survey which suggests that they are buried beneath the silt and not visible as upstanding features.

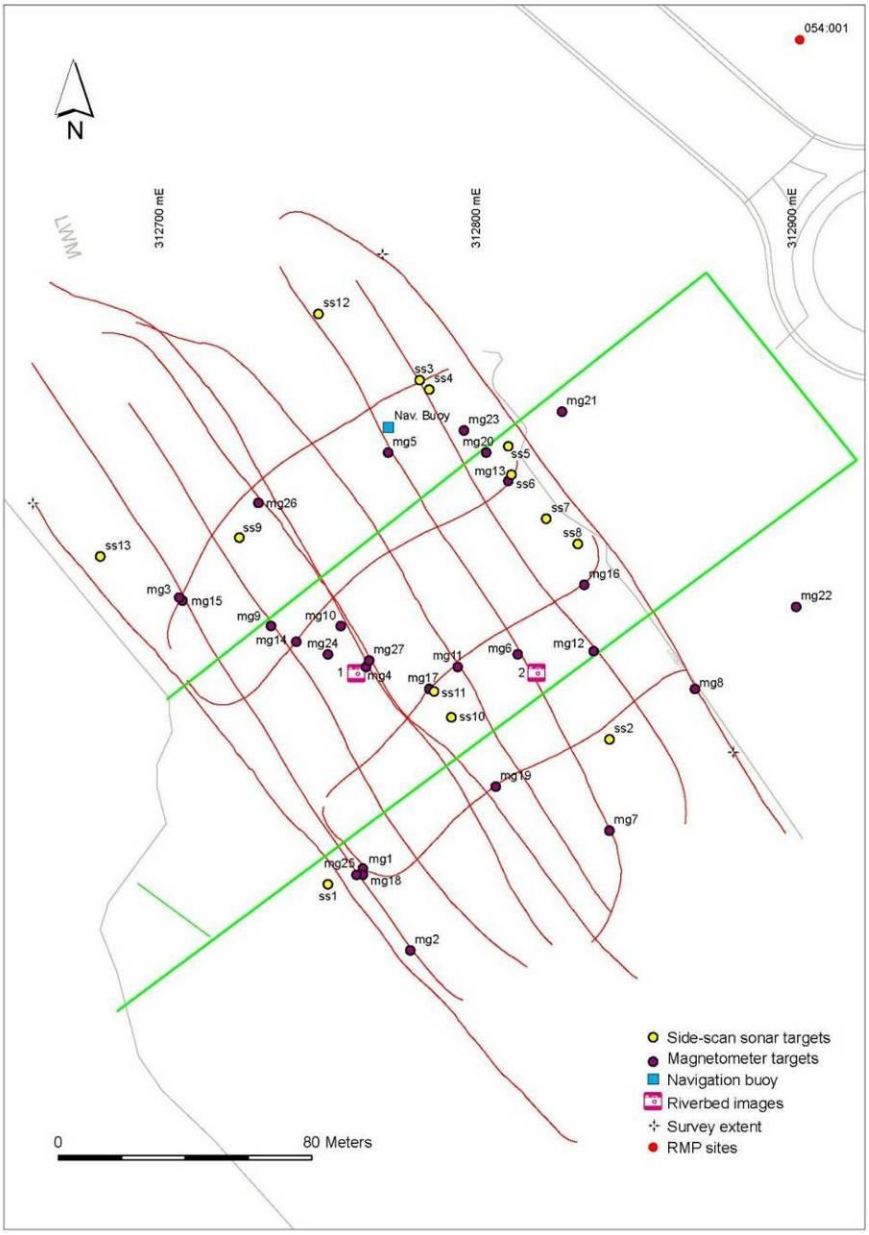


Plate 10.28: Results of Marine geophysical survey showing distribution of side scan sonar and magnetometer anomalies within line of proposed bridge. Terrestrial Geo-Physical Survey

The geophysical survey of the terrestrial line of the project within County Louth has been carried out by J.M. Leigh surveys under licence 10-R-128 issued by DoE: HLG. It took the form of a detailed fluxgate gradiometer survey with data collected with a sample interval of 0.25m and a traverse interval of 1m on 20m by 20m grids (Leigh, 2010).

The survey area consisted of three fields and, for the purpose of the survey, these were noted as Areas A, B and C (Plate 10.29). The three fields incorporate an area of 1.1 hectares. The west extent of the proposed road encroaches upon two fields to the immediate west of the R173 road from Newry to Greenore. These areas of field were located on a steep slope with dense field boundaries. Considerable magnetic disturbance was noted within these areas and this, added to the poor ground conditions, meant that a detailed gradiometer survey could not be undertaken within this area.

The detailed gradiometer survey revealed a high background magnetic variation within the area due to the local geology. However, potential archaeological responses were identified within each of the three areas. See Table 10.1 below.

Table 10.1 Potential Archaeological Responses from marine Geophysical Survey

Area	Response Number	Description	Interpretation
A	1	Series of responses and linear trend forming curvilinear pattern orientated northwest to southeast.	Possibly archaeological though more likely field boundary or drain
A	2	Cluster of broad responses with no clear pattern or form	Possibly archaeological pit-type features though may be natural variations in sub-soil
B	3	Broad negative response with no clear archaeological pattern	Probably natural in origin and may be related to flooding
B	4	Linear trend with several associated ferrous responses	Most likely a former field division and not considered of archaeological potential
B	5	Magnetically weak rectilinear trends with a broad response to the south similar to Response Number 2.	Possibly archaeological in nature though could be agricultural/natural
C	6	Area of increased magnetic response in west extent of Area C. May be related to Response Number 7 adjacent to east	Could be archaeological though just as likely geological
C	7	Series of responses forming a curvilinear pattern	Shape of responses suggestive of archaeological feature. However, may be natural geological variations
C	8	Distinct area of magnetic disturbance associated with the dismantled Newry to Carlingford railway. Number of large responses lacking any clear form detected to east of former railway	Distinct area of magnetic disturbance modern though may mask archaeological features in area. Nature of large responses uncertain though probably modern

Area	Response Number	Description	Interpretation
C	9	Broad, magnetically strong response located towards east extent of Area C. Curvilinear in form	Magnetic response possibly suggests modern feature though archaeological interpretation must be considered

As can be seen from the above table, the survey area has a broad magnetic background variation. Many of the responses have no clear pattern which could be linked to potential sub-surface archaeological features and most likely represent natural variations in the local sub-soil and geology. However, a number of potential responses were identified.

The nature of the responses uncovered in Areas A & B are uncertain with several suggestive of former field divisions and agricultural activity. However, several of these consist of curvilinear, rectilinear and clusters of responses. These may represent sub-surface archaeological features.

A number of responses of potential interest were noted within Area C including an area of increased magnetic response (6) while responses 7 and 9 suggest curvilinear features. Area C also showed a broad area of magnetic disturbance linked to the dismantled Newry to Carlingford railway which response 8 may be associated with. However, this is uncertain and it is also possible that modern magnetic disturbance is masking archaeological responses.

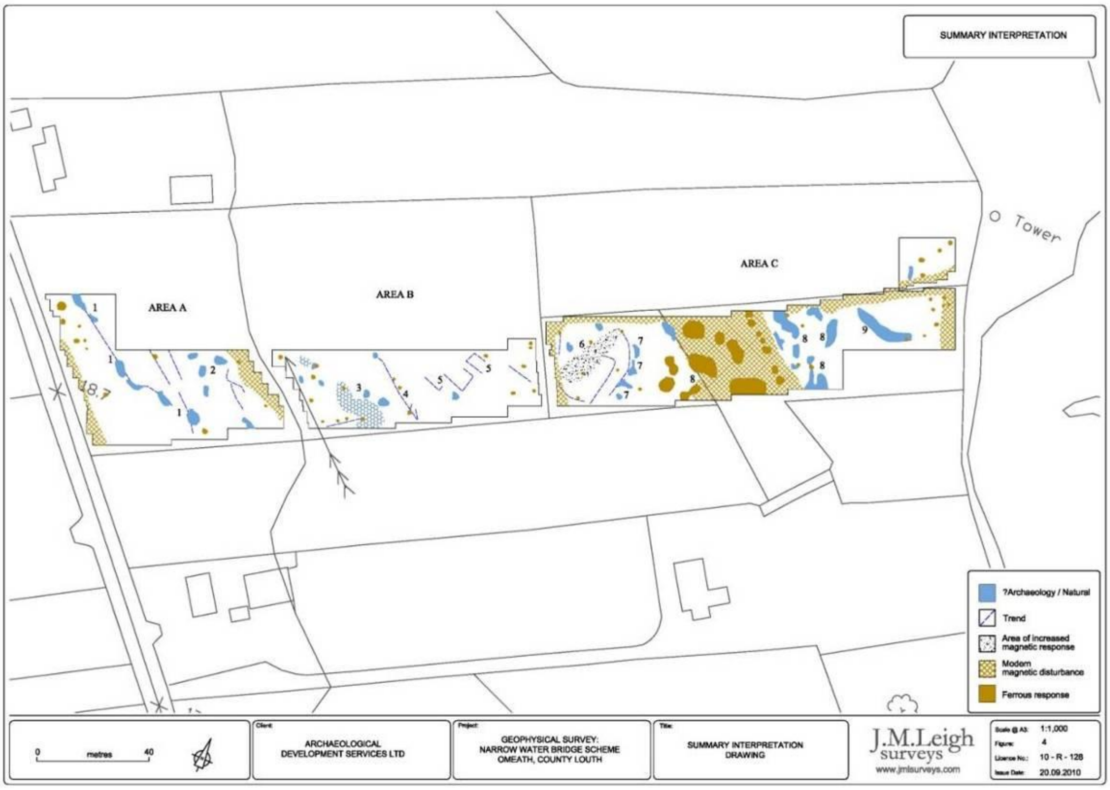


Plate 10.29: Area of terrestrial geophysical survey showing responses including potential archaeological features.

10.7.2 Proposed Mitigation Measures

Given the archaeological sensitivity of the environs of the line of the proposed bridge, non-invasive pre-development testing has been carried out in accordance with mitigation measures as stipulated by the Heritage authorities in NI and ROI. This pre-development testing took the form of geophysical, non-invasive surveys within the riverine line of the proposed route and within the terrestrial line of the project. These surveys have been carried out by appropriate specialists who have made recommendations for further work.

Marine Investigations

The marine geophysical survey carried out within the riverine line of the proposed route revealed several target features of interest. These include upstanding features and buried metallic objects. The nature of these target features is currently unknown and it is recommended that they are subject to archaeological diver inspection prior to construction work commencing (ADCO, 2010).

Additionally, the geophysical survey cannot claim to fully identify material of archaeological significance as the ability for different materials, both buried and exposed, to provide a suitable reflection for deployed geophysical devices does vary. Given this, it is recommended that archaeological diver inspection takes place within the section of river bed selected for development.

It should be noted that the marine geo-physical survey did not cover the mudflats and inter-tidal areas on either bankside. These areas will be impacted upon by the proposed development and, as such, it is recommended that these areas are subject to intertidal survey. Any features observed during the inter-tidal survey should be measured and described in detail with the archaeological record supported by photographic and metrically-accurate survey.

The construction of the embankment on the County Louth side of the proposed bridge has the potential to impact on part of the 19th century training wall within that location. It is, therefore, recommended that this section of the training wall is recorded by photography and metrically-accurate survey prior to disturbance.

The line of the proposed new bridge may interrupt views between the existing leading lights (LHS002-007 & LHS002-008). The leading lights are operational navigational beacons constructed during the 1880s which have since been included on the Record Protected Structures for County Louth. Neither leading light (LHS002-007 & LHS002-008) will be impacted upon by the proposed development though the leading light (LHS002-008) is located in close proximity to the north of the proposed bridge.

The siteworks associated with the construction of the bridge could potentially impact upon the leading light (LHS002-008). As such, it is recommended that appropriate mitigation measures are put in place to protect the leading light (LHS002-008). These mitigation measures should be agreed in advance with the appropriate statutory bodies but will include an exclusion zone being created around the leading light (LHS002-008). This exclusion zone would be defined by semi-permanent fencing which would physically prevent access to the immediate environs of the leading light (LHS002-008) thereby protecting the feature against accidental damage during siteworks.

Given the impact upon the line of sight between the navigational beacons, it is proposed that a new navigational beacon will be constructed to the south of the bridge to fufill the function currently carried out by leading light (LHS002-008). The construction of the new navigational beacon will involve groundworks within the intertidal zone that have the potential to impact upon any archaeological features or artefacts that may exist within the footprint of the beacon. Given this, it is recommended that groundworks associated with the new navigational beacon are carried out under the constant supervision of a suitably qualified archaeologist under licence to DoAHG.

Terrestrial Investigations

The terrestrial line of the project was also subject to geophysical survey which revealed a number of responses across the survey area (Leigh, 2010). The nature of these responses is uncertain and it is possible that they represent archaeological features.

Given this, it is recommended any potential features noted by geophysical survey should be resolved with archaeological testing prior to development work starting. This should include the broad area of magnetic disturbance associated with the former railway line as this modern disturbance could potentially mask the magnetic responses of archaeological features.

As with marine geophysical survey, terrestrial geophysical survey cannot claim to fully identify material of archaeological significance with the result that unidentified sub-surface archaeological features could potentially exist in situ. Given this, it is also recommended that the terrestrial line of the proposed link road and compound be top soil stripped under archaeological supervision before development work commences.

This top soil stripping should be carried out by a backacting excavator equipped with a toothless bucket which is under the constant supervision of a suitably qualified archaeologist under licence to DoAHG (formerly DoE: HLG).

Topsoil should be removed until either glacial subsoil or the top of archaeological features are encountered.

10.8 Summary/Conclusion

The development proposes the construction of a bridge and access road across the Narrow Water near Warrenpoint in County Down and Omeath in County Louth. The proposed location of these bridge is close to a known monument, a motte (DOW 054:001) and in the direct line of sight of another, Narrow Water Castle (DOW 051:044).

Additionally, an examination of the recorded archaeological sites within a 1.5km radius revealed evidence of activity dating to the Prehistoric period. Therefore, there is the possibility that groundworks associated with the proposed bridge and access road could impact upon sub-surface archaeological features both within the river channel and adjacent grounds.

Geophysical surveys have been carried out as part of pre-development mitigation measures as stipulated by the statutory Heritage bodies both in the line of the bridge within the channel and also within the line of the access road. These surveys have revealed several target features of interest which could represent archaeological features.

Given this, it is recommended that the features revealed during the marine geo-physical survey be subject to pre-development archaeological diver inspection and that the terrestrial responses be targeted for archaeological testing prior to the commencement of development. The line of the link road and area of the proposed compound shall also be top soil stripped under archaeological supervision prior to development work commencing.

It is further proposed that the mudflat areas and associated bankside areas are subject to inter-tidal survey. Features observed within these areas should be recorded in detail supported by photographic and metrically-accurate survey. These features will include the 19th century training wall within the County Louth intertidal area that will be affected by the construction of the bridge. This inter-tidal work should take place before development work commences.

The construction of the bridge will impact upon sight lines between the leading lights (LHS002-007 & LHS002-008) and, as such, a new leading light will be constructed to replace function carried out by the leading light (LHS002-008) which lies immediately north of the proposed new bridge. The construction of this new leading light could impact upon possible archaeological features or artefacts located within the intertidal area. Given this, it is recommended that these groundworks are carried out under archaeological supervision.

The leading light (LHS002-008) is noted on the Record of Protected Structures as maintained by Louth County Council and will not be impacted upon by the proposed development. However, this feature is located to the immediate north of the proposed bridge and there is the possibility that it could be accidently impacted upon during groundworks associated with the development. Given this, it is proposed that an exclusion zone be physically defined around the leading light (LHS002-008) to prevent accidental damage during siteworks. The limits and nature of this exclusion zone should be agreed in advance with the appropriate statutory bodies.

The proposed locations of the bridge is also in view of Narrow Water Castle (DOW 051:044) which is classed as a State Care Monument by NIEA Historic Buildings. It is possible that the proposed bridge could impact visually upon Narrow Water Castle (DOW 051:044). A visual impact assessment is available as Chapter 8.

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APPENDIX 10.1:
SITES AND MONUMENTS (COUNTY DOWN)

SMR NO: *DOW 051:044* ***GRID REFERENCE:*** *J12561939*

GENERAL TYPE: *Tower House and bawn: Narrow Water Castle* ***GENERAL PERIOD:*** *Late Medieval*

TOWNLAND: *Narrow Water* ***STATUTORY PROTECTION:*** *State care*

SPECIFIC TYPE/PERIOD: *Bawn/Late medieval, Tower House/Late Medieval*

BIBLIOGRAPHY: *A.S.C.D. 1996, 241-3, Fig. 158 & 158; PL 60,61,64 & 65. O.S. Mem Vol 3, 1990, 116, 119 & 124. PSAMNI, 1940, 136-7& PL.35. Salter, M. 1993, 155. Waterman, D.M. Guide, 1962*

CONDITION: *Substantial remains*

SITE DESCRIPTION:

This castle, protecting the entrance to a part of Carlingford Lough, is thought to have been built by the English c1560. After James II's defeat in 1691 it was confiscated & granted to the Halls. It is a tower 11.2m x 10.1, standing 3 storeys & an attic high. The entrance is defended by a machicolation. The tower stands within a rectangular bawn, c.36m square with walls 0.6m thick & 2m high internally, but more on the outside where is rises from the shore. There is a modern gateway through the bawn at N

SMR NO: *DOW 051:045* ***GRID REFERENCE:*** *J13401991*

GENERAL TYPE: *Rath* ***GENERAL PERIOD:*** *Early Christian*

TOWNLAND: *Dromore* ***STATUTORY PROTECTION:*** *No entry*

SPECIFIC TYPE/PERIOD: *No entries*

BIBLIOGRAPHY: *No entries* ***CONDITION:*** *Traces only*

SITE DESCRIPTION:

On a ridge with excellent views all round & overlooking DOW 051:046 to SE. At present, the site has had its interior stripped bare - trees removed & gorse burnt off & the interior closed off with impenetrable sheep wire at S & SW. The bank still survives around the site. At S it is 5.1m wide, 0.6m high internally & 0.9m high externally. The interior is c.37m E-W & slopes to W. It was cleared as it provided cover for foxes which preyed on the free range chickens in the field to S [N.C. 3/6/93].

NB Since this report was written most of the site has been removed as part of a land improvement scheme. There are few remains but the area of the rath can be seen as a low platform in the field and a stretch of bank, approx. 3m long, survives in the field boundary.

SMR NO: *DOW 051:046* ***GRID REFERENCE:*** *J13501990*

GENERAL TYPE: *Enclosure* ***GENERAL PERIOD:*** *Uncertain*

TOWNLAND: *Dromore* ***STATUTORY PROTECTION:*** *Not defined*

SPECIFIC TYPE/PERIOD: *No entries*

BIBLIOGRAPHY: *No entries*

CONDITION: *No visible remains*

SITE DESCRIPTION:

Near the bottom of the slope on which DOW 051:045 is located, with excellent views all round. There are no visible remains of this site, apart from a barely discernable height at NW, where the site is 0.4m above the external field surface. This site is slightly dished &

would have sloped E-SE. It may have touched the field boundary at S, half of which has now been removed.

SMR NO: *DOW 051:047* ***GRID REFERENCE:*** *J13951997*

GENERAL TYPE: *Rath* ***GENERAL PERIOD:*** *Early Christian*

TOWNLAND: *Donaghaguy* ***STATUTORY PROTECTION:*** *Not defined*

SPECIFIC TYPE/PERIOD: *No entries*

BIBLIOGRAPHY: *No entries*

CONDITION: *Destroyed*

SITE DESCRIPTION:

On top of a swell with excellent views all round, including Carlingford Lough. The site had been very overgrown, but was "tided up" a few years ago. The interior, 37m N-S x 38m E-W, slope to SW. There is a higher area at E & SE, 0.5m above the rest of the interior. The site sits proud of the field at N, W & S. The bank is best preserved at S & W; the N perimeter has been straightened somewhat. There are no ditch remains & no definite evidence for the original entrance (N.C. 3/6/93).

N.B. Sometime after this report was made the site was removed as part of a land improvement scheme and there are now no traces left of the rath.

SMR NO: DOW 051:048 **GRID REFERENCE:** J14141936

GENERAL TYPE: *Rath (destroyed)* ***GENERAL PERIOD:*** *Early Christian*

TOWNLAND: *Ringmackilroy* ***STATUTORY PROTECTION:*** *Scheduled*

SPECIFIC TYPE/PERIOD: *No entries*

BIBLIOGRAPHY *See SM7 for preliminary excavation report* ***: CONDITION:*** *Excavated*

SITE DESCRIPTION:

Situated on the summit of a drumlin with extensive views all round. This site was totally removed by a building development, but prior to this, a rescue excavation was carried out in 1992. Earlier surveys describe the site as largely ploughed out, surviving as a low circular platform with a wide ditch S-W-N. Excavation revealed 4 phases of activity, the earliest of which was pre-rath, possibly prehistoric. Finds included Souterrain ware, lignite fragments, a polished stone axe, slag & whetstones.

SMR NO: *DOW 051:065* ***GRID REFERENCE:*** *J14161972*

GENERAL TYPE: *Standing stone* ***GENERAL PERIOD:*** *Prehistoric (uncertain)*

TOWNLAND: *Donaghaguy* ***STATUTORY PROTECTION:*** *Scheduled*

SPECIFIC TYPE/PERIOD: *No entries*

BIBLIOGRAPHY: *No entries* ***CONDITION:*** *Well preserved*

SITE DESCRIPTION:

The stone is set on a swell with panoramic views SE-S-W & is a very noticeable landmark. It is a large irregular limestone block with natural weathering pockmarks on its S face. It sits on a small height or knoll created by cattle trampling to close to its base. It is 1.83m high at NW & the knoll is 0.57m high. At base, the stone is 1.5m wide at NW, 0.6m at NE, 1.45m at E & 0.58m at S. It has been worn smooth in places by cattle rubbing against it.

SMR NO: *DOW 054:001* ***GRID REFERENCE:*** *J12901923*

GENERAL TYPE: *Motte* ***GENERAL PERIOD:*** *Medieval*

TOWNLAND: *Narrow Water* ***STATUTORY PROTECTION:*** *Scheduled*

SPECIFIC TYPE/PERIOD: *No entries*

BIBLIOGRAPHY: *A.S.C.D 1996, 195. McNeill, T.E. UJA 38, 1975 53 No.107. PSAMNI,1940, 137*

CONDITION: *Substantial remains*

SITE DESCRIPTION:

At the S end of a natural scarp which overlooks the mouth of the Newry River, clearly defensive in nature guarding the route into the hinterland. The site consists of a man- made mound which uses the natural scarp on the S & E sides to form an impressive motte standing 10m high on these 2 sides. Elsewhere, it stands 4.5m high, with traces of a ditch which runs NW-N-E & is at best 6m wide & 0.75m deep. The flat summit of the motte is 12m in diam.; due to the dense undergrowth it was impossible to discern if there were any structures on the summit.

SMR NO: *DOW 054:022* ***GRID REFERENCE:*** *J13891905*

GENERAL TYPE: *Inauguration site: The coronation stone of the clan McGuinness*
GENERAL PERIOD: *Uncertain*

TOWNLAND: *Dromore* ***STATUTORY PROTECTION:*** *Not defined*

SPECIFIC TYPE/PERIOD: *No entries*

BIBLIOGRAPHY: *No entries*

CONDITION: *Well preserved*

SITE DESCRIPTION:

No related documents

SMR NO: *DOW 054:500* ***GRID REFERENCE:*** *J14281822*

GENERAL TYPE: *Windmill* ***GENERAL PERIOD:*** *Modern*

TOWNLAND: *Ringmackilroy* ***STATUTORY PROTECTION:*** *Scheduled*

SPECIFIC TYPE/PERIOD: *No entries*

BIBLIOGRAPHY: *No entries*

CONDITION: *Well preserved*

SITE DESCRIPTION:

This is the well preserved stump of a C19th tower mill, which is abutted by buildings at NW, W & SW. The stonework is in very good condition and the portions of the building in certain properties are now whitewashed. The mill has at least 2 good ground floor doors and one first floor door which is brick-lined. A fine cut stone arch above the SE door displays the date of construction - 1802. The interior is accessible via this door. The mill is an important element of the historic core of Warrenpoint village and was recorded photographically between 18565 & 1880.

COUNTY LOUTH ARCHAEOLOGICAL SITES

RMP NO	**LH002-001**
Townland	Carnamucklagh
Parish	Carlingford
Barony	Lower Dundalk
Classification	Childrens Burial
Cartography	
Description	Situated on the E side of a natural ridge to the SW of the Newry River consisting of a subrectangular low platform of stones measuring 20m (N-S) by 17m (E-W), H= .35m. Reputedly the site of the monastery of Killansnamh which is said to have stood opposite Narrowwater Castle (CLAJ 1908, 73). About 150 years ago (about 1837) some remains of the abbey survived and was visible. The graveyard is located beside the abbey site. It was customary to inter unbaptised infants and unidentified remains of persons drowned in Carlingford Lough.
References	Murray, L. 1908 CLAJ, 2, p73

RMP NO	**LH002-002**
Townland	Cornamucklagh
Parish	Carlingford
Barony	Lower Dundalk
Classification	Isolated Settlement
Cartography	
Description	Hut site: Circular area approximately 4m in diameter enclosed by a low stone wall with an entrance at the south east.
References	

RMP NO	**LH002-004**
Townland	Cornamucklagh
Parish	Carlingford
Barony	Lower Dundalk
Classification	Fulacht Fiadh
Cartography	
Description	Horseshoe shaped mound (maximum dimensions 3.4m by 2.4m) located at the side of a stream.
References	

RMP NO	**LH002-005**
Townland	Lislea
Parish	Carlingford
Barony	Lower Dundalk
Classification	Ringfort

Cartography	
Description	Field Notes 1970:
	Ringfort, circular area (internal diameter 32.5m) enclosed by a much degraded earthen bank. No visible trace of fosse or ancient entrance.
References	

RMP NO	**LH002-008**
Townland	Lislea
Parish	Carlingford
Barony	Lower Dundalk
Classification	Ringfort
Cartography	OS 1863, 1907
Description	Field Notes 1970:
	The ringfort is sited on a small low ridge overlooking Carlingford Lough. It has a diameter of 33m (N-S) by 31m (E-W). Covered with ferns, approximately circular in plan, it is a flat area demarcated by a low embankment. The W side has been quarried slightly and there has been modern facing to the embankment. Cultivation ridges run NW-SE through the interior.
References	

APPENDIX 10.2: INDUSTRIAL HERITAGE

IHR NO: 00478:021:00
SITE TYPE: Station
TOWNLAND: Narrow Water
COUNTY: Down
GRID REFERENCE: J12471948
LOCATION: GNR Branch Line, Goraghwood -Warrenpoint

DESCRIPTION: None given

MARKED ON OS MAPS: 1834: ----

1861: Narrow Water Station

1904: Narrow Water Sta

1950: Narrow Water Sta

IHR NO: 00478:023:00
SITE TYPE: Warrenpoint terminus
TOWNLAND: Ringmackilroy
COUNTY: Down
GRID REFERENCE: J14031833
LOCATION: GNR Branch Line, Goraghwood - Warrenpoint

DESCRIPTION: (IHR 3602) NOTE Warrenpoint and Rostrevor Tramway runs along shore side road. Rail line runs beyond this Terminus on to the Dockside

MARKED ON OS MAPS: 1834: ----

1861: Railway Station

1904: Terminus

1950: Terminus

IHR NO: 00607:000:
SITE TYPE: Bridge
TOWNLAND: Fathom Upper
COUNTY: Armagh
GRID REFERENCE: J11751946
LOCATION:

DESCRIPTION: Carrying road over stream/ river – this is the border

MARKED ON OS MAPS:

1835 : County Bridge,

1861 : County Br,

1909 : County Br,

1956 : County Bridge

IHR NO: 03579:001:00
SITE TYPE: Flax mill-Saw mill site
TOWNLAND: Narrow Water
COUNTY: Down
GRID REFERENCE: J13022001
LOCATION: Not given

DESCRIPTION: None given

MARKED ON OS MAPS: 1834: ----

1861: Flax Mill

1904: Saw Mill

1950: Saw Mill

IHR NO: 03579:002:00
SITE TYPE: Mill race
TOWNLAND: Narrow Water
COUNTY: Down
GRID REFERENCE: J13022001
LOCATION: Not given
DESCRIPTION: Also serves Corn mill (IHR 3580)
MARKED ON OS MAPS: 1834: Shown
1861: Shown
1904: Mill race
1950: Mill race

IHR NO: 03579:003:00
SITE TYPE: Mill ponds
TOWNLAND: Aghnamoira/Narrow Water/Burren
COUNTY: Down
GRID REFERENCE: J13022001
LOCATION: Not given
DESCRIPTION:
MARKED ON OS MAPS: 1834: northernmost one only shown
1861: Mill Pond x2
1904: Mill Pond x3
1950: Mill pond x3

IHR NO: 03580:001:00
SITE TYPE: Corn Mill site
TOWNLAND: Narrow Water
COUNTY: Down
GRID REFERENCE: J12701939
LOCATION:
DESCRIPTION: Millrace IHR3579 serves this site
MARKED ON OS MAPS: 1834: Shown
1861: Narrow Water Corn Mill
1904: Narrow Water Corn Mill (dis)
1950: ----

IHR NO: 03580:002:00
SITE TYPE: Mill pond
TOWNLAND: Narrow Water
COUNTY: Down
GRID REFERENCE: J12701939
LOCATION:
DESCRIPTION:
MARKED ON OS MAPS: 1834: Shown
1861: Mill pond
1904: Mill pond
1950: Mill pond

IHR NO: 03596:000:00
SITE TYPE: Precast concrete works
TOWNLAND: Dromore
COUNTY: Down
GRID REFERENCE: J13341861
LOCATION: Warrenpoint
DESCRIPTION:
MARKED ON OS MAPS: 1834 :-----
1861 :-----
1904 :-----
1950 : Pre-cast Concrete Works

IHR NO: 03597:000:00
SITE TYPE: Fibreboard factory
TOWNLAND: Dromore
COUNTY: Down
GRID REFERENCE: J13691854
LOCATION: Warrenpoint
DESCRIPTION:
MARKED ON OS MAPS: 1834 :-----
1861 :-----
1904 :-----
1950 : Fibreboard Factory

IHR NO: 03598:000:00
SITE TYPE: Warrenpoint dock harbour
TOWNLAND: Ringmackilroy
COUNTY: Down
GRID REFERENCE: 14111814
LOCATION:
DESCRIPTION: By 1861 edit railway is shown running right onto Dockside
MARKED ON OS MAPS: 1834: Dock
1861: Dock
1904: Dock
1950: Dock

IHR NO: 03599:000:00
SITE TYPE: Windmill
TOWNLAND: Ringmackilroy
COUNTY: Down
GRID REFERENCE: J14111814
LOCATION:
DESCRIPTION:
MARKED ON OS MAPS: 1834: Windmill
1861: ----
1904: ----
1950: ----

IHR NO: 07546:000:00
SITE TYPE: Navigation Beacon
TOWNLAND: Narrow Water
COUNTY: Down
GRID REFERENCE: J12471932
LOCATION:
DESCRIPTION:
MARKED ON OS MAPS:

APPENDIX 10.3:
Historic Buildings

HISTORIC BUILDINGS REFERENCE NUMBER: *HB 16/11/019A*

ADDRESS: Narrow Water Castle
Newry Road
Warrenpoint
Co. Down
BT34 3LE

SURVEY 2**:** B2

DATE OF LISTING: 23/09/1975

DATE OF RESURVEY: 16/10/1999

DATE OF CONSTRUCTION: 1820-1839

CURRENT BUILDING USE: Hotel

PRINCIPAL FORMER USE**:** Country House

OWNER CATEGORY: Private

DESCRIPTION:

Two and a half-storey mid19th C country house with basement, built in Tudor Revival style. It is roughly L planned with the base of the 'L' facing E. The roof is a composition of multiple gables, towers, finials, chimneys and pinnacles creating a picturesque skyline. Roof has numerous pitches, all natural slated with similar over its attic windows. Chimneys are tall Tudor style ashlar granite stacks on common plinths in groups of twos, threes and fours. Other details will be mentioned in the text below. Parapet gutters drain into cast iron down pipes with plain hoppers. Principal elevations are E and S facing. Both these are constructed in ashlar granite. The basement is slightly advanced under a chamfered basecourse. There is a moulded cornice at eaves level and a prominent saddle copped parapet. All sash windows have horizontal glazing bars. Basement windows are pairs of 4/2 sliding sashes with a masonry mullion between them and two vertical bars over each. All ground and first floor windows are of the transom and mullion variety, some are masonry and some are timber framed. All contain sliding sashes, the top sash of each window being the smaller transom. Those to ground floor are a mixture 2/3 and 1/3 sashes and those to first floor are all 1/3 sashes and diminished in height. The small attic windows are as those to basement but containing 4/4 sashes. E elevation. East elevation is three bays wide with the central bay wider than the other two. The left and right bays advance forward slightly, and their outer corners have clasping octagonal buttresses. Right bay is the grandest of the three and its detailing is more ornate. It is three storeys high and contains the main entrance. There is no basement to front and the ground floor level drops to accommodate this. Its front wall is framed by massive clasping octagonal buttresses, of which five and two half faces are exposed. Each buttress has a moulded chamfered basecourse (in line with that to basement). At first floor level of each buttress two moulded stringcourses form the top and bottom of a frieze. Each full face of the buttress in this frieze has a plain granite shield applied. The stringcourses continue across the front of this bay (see later). Each buttress is plain above this frieze until half way up third floor level. From this point, each full face has a cusped Tudor lancet panel, which rises to the parapet base. From here the buttresses continues as a pinnacle, which enclose the roof parapet. Each face of the pinnacle (including the internal ones) has a similar but taller cusped lancet panel terminated by a stringcourse. Over the stringcourse each face of the pinnacle has a Gothic quatrefoil panel with incised spandrels. Over, each pinnacle is crowned by a ribbed ogee cap with a large foliated finial. At ground floor four ashlar granite steps lead up a shallow recessed porch containing the main entrance. At the buttress to either side of the bottom step is a chamfered square-in-section granite bollard, with moulded diminished head. Porch entrance fills space between the clasping buttresses. It is a deeply chamfered Gothic-headed opening, the hood mould over on decorative stops. Porch has a granite-flagged threshold; its walls are rendered and painted with advanced shallow basecourse. Its narrow ceiling arches with the head of the Gothic opening and at join with its front and rear wall is ribbed moulding, which follows the line of the arch and has foliated stops. Wall ahead in porch contains the main entrance. This consists of a pair of timber doors, each has four cusped panels (the top two are taller than the bottom two) and four smaller and narrower (but similar) panels to its head. Each door has a decorative brass Tudor door pulls. To immediate left and right of the heads of these doors are square cusped stucco panels each containing a moulded heraldic shield. That to left is the shield of Roger Hall and to right is the shield of Barbara Savage (his wife). Each of these has a moulded hood on mask stops. The hoods continue across the head of the door and around its large transom light. The transom light is Gothic headed and is as wide as the doorway and its two heraldic shields. It has a chamfered opening with a splayed cill and contains five cusped lancet lights with timber mullions, all diminishing in height from the central one. All have etched glazing with coloured margins all in stiff metal cames. On wall to left of door is bronze bell pull. Back to front wall. On front wall, in each spandrel of the porch opening is an ashlar shield emblazoned with the head of a muzzled bear erased (the Hall family charge). Immediately over the porch opening at first floor is canted oriel window. It is two windows wide to front with single windows on each cheek. The base of the oriel corbels out in three moulded stages and rests on a stout chamfered shaft, which rises from the head of the porch archway. The moulded stringcourses of the clasping buttresses cross at this point framing the top and bottom of the apron panels of the windows. The lower one also is the window cill. The front apron panel has the Hall family coat of arms, carved in sandstone and surrounded in foliated arabesques. The aprons of the canted sides each have a square panels with a recessed diamond inset and etched spandrels, with a plain shield applied. The 2/2 oriel windows have Tudor heads and masonry transoms and mullions. Over the windows heads is a thin astragal over which a cornice carries an open fretted lozenge parapet. The roof behind is a balcony serving the second floor. To second floor level a former window opening (the head of which shows it had a masonry mullion) has been enlarged into a doorway. Recessed in the opening is a pair of later (this century) glazed timber French windows. The roof of this bay (over) has an ornate fretted embattled parapet with open cusped lancets to each panel. The exposed left cheek of the advanced right bay is blank and rises higher than the central bay. It has a fretted parapet as the front wall, which is terminated by the common base of four chimney stacks. Roof of this three storey block seems to be flat. The right cheek of the exposed right bay is part of the N elevation of the house (see later). Central bay is wider than the outer two bays and has three window openings to each floor. The central one to the basement is set in the base of a canted bay window that rises to first floor level. The bay window front is three windows wide with one window each cheek. All have masonry transoms and mullions. Each ground floor window is a 2/3 sliding sash. Between ground floor and first floor are the apron panels of the first floor windows, framed by stringcourses each panel containing a plain ashlar shield. First floor windows are 1/3 sashes. The roof of the canted bay window has fretted lozenge parapet (as the parapet of the oriel on the right bay). Above the bay window to attic level of main block is a small gabled wall-head dormer. Its gable is coped as the parapet from which it rises. It has a typical attic window with masonry mullion. Over is a heavy cylindrical masonry finial with ogee cap resting on panelled plinth, which ties into the gable apex. At parapet level similar slightly larger finials resting on octagonal plinths rise from above the left and right cheeks of the bay window. All remaining windows to this elevation have timber transoms and mullions and masonry hood moulds. The ground floor left window is four 2/3 windows wide. Ground floor right has a pair of 2/3 windows. To first floor left and right are pairs of 1/3 windows. Left bay advances forward slightly and is flanked by octagonal clasping buttresses, which are smaller and more plainly detailed than those to right bay are. Each buttress has a chamfered base and plainly panelled frieze between ground and first floor, which is framed to top and bottom by a stringcourse. Buttress continues to base of parapet were it becomes a panelled pedestal rising above parapet and supporting a cylindrical ogee capped pinnacle with foliated finial. Left bay at ground and first floor has a bay window (detailed as the canted one to the central bay), but four windows wide to front. Above it has an attic dormer (as that to central bay). S elevation This elevation fronts the formal gardens and is four bays wide. The second bay from right is double the width of the left and right end bays and the second bay from left is narrower than the left and right end bays. The right bay is detailed as the left bay of the front (E) elevation. The buttress to its right corner is on the SE corner of the building and its left buttress is shared with the central bay. The second bay (from right) is detailed as the central bay of the front elevation with the exception that its ground floor left and right windows are both pairs of 1/3 sashes and the bay window is four windows wide with 1/3 sashes to each floor. Its left buttress is shared with the second bay from left. The second bay from the left has a single opening on each floor. A typical basement window and those to ground to first floor each contain three 1/3 windows with timber transoms and mullions and hood moulds over. The left bay advances slightly and is detailed as the right bay. Its front corners have clasping buttresses (as others) the left one of which is on the SW corner of the building. W elevation The W elevation is mostly lined rendered with ashlar granite to cill level of ground floor windows at right. The eaves stringcourse and parapet continue from S elevation. Its narrow left bay advances, the advancing portion meeting a raised true ground level allowing external access from its ground floor rooms. The right bay has two windows on each floor. Those to ground floor are 2/3 sashes and those to first floor are 1/3 sashes, all have timber transoms and mullions. Between these windows at parapet level is a wall head chimney on a slightly advanced corbelled plinth. Plinth has a plain ashlar shield and carries a pair of chimneystacks. The exposed right cheek of the advancing left bay has two basement windows and a single window to each upper floor (as those to right bay). Its front (SW) end has a chamfered corner. The narrow end wall of the advanced left bay is abutted to left by an octagonal four-storey tower. The remaining wall to its right has a ground and first floor window as those to its exposed right cheek. The ground floor window is a French window allowing access into the garden. The octagonal tower has six exposed cheeks; the remaining two are tied into the main block. It is lined rendered with a moulded stringcourse between ground and first floor levels and similar between second and third floors. Its third floor is slightly taller than the others and has a machicolated ashlar parapet with stepped battlements. At ground floor on its N face there is a semicircular-headed door with decorative Tudor nail heads. Each remaining cheek on each floor has a chamfered arrow-loop containing a very narrow 3/3 sash window. From second floor level the tower rises above the rest of the elevation and its two formerly abutted faces stand free. The E facing one of these is abutted by a cylindrical stair-tower, which rises from a square base (exposed to N cheek with arrow-loop windows from ground floor level). It has a small nail studded door at basement level on its N cheek. Its walls are lined rendered and its cylindrical part has narrow unglazed arrow-loops. It rises beyond the parapet of the octagonal tower (with doorway on its W cheek onto the octagonal tower roof); and has an embattled ashlar granite parapet concealing a masonry roof, which the spiral staircase rises into. To left of the stair tower is the N elevation of the main house. N elevation The N elevation is lined rendered and has parapet and stringcourses as other elevations. It faces the domestic yard. Its right bay is abutted by the servant's block (HB16/11/019B). The central bay has an advancing stairwell gable and an abutting square tower. Its left bay advances forward, partially enclosing the domestic yard on the E side. Right bay on N elevation is abutted to right by the servant's block. Over to left and right of roof are small two-paned windows. On parapet above is a rendered plinth with applied decorative shields, plinth supports four Tudor chimneystacks. The exposed section of the right bay (to left of where servant’s accommodation abuts) is abutted by a three storey square tower (see later). Remaining wall has a pair of boarded up basement windows to left (of tower) and a single one to right. At ground floor there is a pair of 2/3 sashes to left with a pair of 1/3 sashes above to first floor. All have stucco hoods and timber transoms and mullions. At basement right there is a single basement window. At ground and first floor to right (of tower) there are single narrow arrow loops containing 2/2 sliding sashes. The square tower is lined rendered and has a door on its left cheek at basement level. It has an arrow-loop (containing a narrow 2/2 sash window) to each cheek at ground and first floors. It carries the eaves stringcourse and above (it is now exposed on all three sides) it has a single (boarded up) round headed arrow-loop window on its N, W and E faces (S not inspected). It has a corbelled eaves course and an ogee leaded roof with ball finial. The basement area at this point is enclosed by Coade stone walling as that to front garden, with a wrought iron gate and stone steps down. Central bay of N elevation has a large abutting gabled return (containing the stairwell) set to left of centre. It has a chamfered basecourse but no basement to its end gable. It has clasping buttresses with plain frieze between ground and first floors and cylindrical, ogee capped pinnacles. Its gable is saddle coped and embattled where it meets the buttresses. It is topped by an apex cylindrical pinnacle on a corbel. To centre of its main gable is a large ashlar granite oriel window serving half landing of the main staircase. Oriel has a moulded corbelled base and is three windows wide and single windows wide to each of its canted cheeks. Each window has two narrow fixed Tudor lancets (1/1) with masonry transoms and mullions. The glazing is stained glass (see interior description). Oriel has an embattled parapet and in gable over there is a pair of small 4/4 sash windows with masonry mullion. The left cheek of this advanced gable has two basement windows and two brick dressed (rendered off) wall recesses to ground and first floor levels. The right cheek is identical. The exposed section of the N wall to left of the stairwell gable is narrow and has a pair of windows to basement, a pair of 2/3 sashes to ground floor and a pair of 1/3 sashes to first floor. All have stucco hoods and timber transoms and mullions. The left bay of the N elevation advances, partially enclosing the E side of the domestic yard. Its exposed right cheek is the rear wall of the central and left bays of the E elevation. It is two bays wide; the left one is part of the entrance tower and three storeys high. The right bay is two storeys high. At basement level it has a pair of basement windows at left and a door at right. There are two windows to each upper floor. At ground floor they are 2/3 sashes with timber transoms and mullions, the left sash of each pair has a large heating pipe abutting. Second floor windows are 1/3 sashes; the left one has been remodelled into a doorway and is served by a large two stage metal escape stair. The basement passage here is again encloses by Coade stone walling and has a wrought iron gate. Basement area has a large metal fuel tank. The left bay advances with clasping stucco buttresses (as those to main entrance tower) on each corner. It has a canted bay window at ground floor, containing a pair of basement windows in its basecourse. The bay window is three 1/1 fixed lights wide with a single one to each cheek. Each top pane of each light has a cusped lancet head with pairs of similar transoms over; all are painted and leaded glass. Over is an embattled parapet enclosing its flat roof. At first floor level there is a pair of 1/3 sashes flanked by arrow loops, all have hood moulds, the left one is blank and the right one contains a narrow 3/3 sash window. At second floor level there is a pair of 1/1 sashes with hood mould over. Parapet to main roof over is as rest to tower but is not fretted. Its end (N facing) wall has clasping octagonal buttresses. That to left is the right one on the N elevation and that to right is a stucco version but devoid of the shield panels between ground and first floors. This elevation has a chamfered ashlar granite basement, which is blank and partially abutted by ground level. Ground floor is blank but for two Tudor recesses set to centre. Between ground and first floors an apron panel is formed by two stucco stringcourses which continue from the right bay of the east elevation. At first floor there are four 1/3 sashes with masonry transoms and mullions under a common stucco hood. To left and right of which are narrow 3/3 sliding sashes with common hoods over. At second floor there are three 4/4 sashes with masonry mullions under a common stucco hood to left and right of which narrow 2/2 sashes with hoods over. Over is a fretted embattled parapet (as that to right bay of E elevation). Estate context Narrow Water is a large informally landscaped demesne outside Warrenpoint. Its boundary to S is Newry Road. Its boundary to W is Narrow Water Forest, to the E is Mound Road and to the N is Greenan Road. S boundary is enclosed by a random rubble wall with a shelterbelt of mature trees behind. On this boundary, just opposite the old Narrow Water Castle are the main gates (HB16/11/018). From here there is a serpentine main driveway which winds W through hillocks then turns NW revealing (at a distance) the principal facades (S and E) of the main house (HB16/11/019A) raised up on the hillside ahead. The driveway then runs N to the front (E) elevation of the main house. The main house (Narrow Water Castle) has a driveway to its E, a formal garden to its S and W and a domestic yard to its N. Abutting its N elevation and enclosing the W side of the yard is Mount Hall (HB16/11/019B), the former house prior to the present main house. E side of the domestic yard is open to the main driveway and to its N side is the stable yard. Stable yard (HB16/11/021) is square in plan, with its SW boundary enclosing the N side of the domestic yard. The main driveway continues W and N from the front of the main house. Its W route takes it towards the modern farmyard (of no interest) and S again to the front entrance. Its N route runs up the side of the stable yard (with an access lane to its NE side) and continues N to a large walled garden, to the centre of the SE wall of which is a gardeners house, and both of these are HB16/11/020). To the NE of the E corner of the walled garden, in a copse, is the former icehouse (HB16/11/043). On NW boundary of the walled garden is the old farmyard (HB16/11/045), accessed from the main driveway, which leads to its NE side. A lane running from the gateway on its SW side leads to the derelict stewards house and its associated ruinous outbuildings (HB16/11/044). Also in the demesne is the former N lodge on Mound Road (HB16/11/023).

Architects:

Thomas Duff

Historical Information:

The Hall family is of English extraction. William Hall is believed to have arrived in Ireland in 1640, settling in Red Bog, Co Antrim. His son Francis Hall is said to have purchased the former Narrow Water Castle estate, which included the town of Warrenpoint, in the 17thC for £1,500 and constructed Mount Hall (HB16/11/019B), the main house prior to the current Narrow Water Castle, in 1707. Over the years the house passed down the family line from father to son, Francis Hall, Roger Hall, Toby Hall to Savage Hall. By 1820 it was the property of Roger Hall. In the early 1830s he employed Thomas Duff of Newry to enlarge Mount Hall, and erect gate lodges and screens. The new house (Narrow Water Castle) was completed in

1837, with Mount Hall remodelled as servants accommodation. The main house and servants accommodation is shown in its present form on the 1834 OS 6 inch map. Roger Hall was married to a Barbara Savage whose family crest and initials appear with his own, throughout the house and on some of its purpose made furniture which was constructed by Curren and Sons of Lisburn. Joseph Paxton and Thomas Smith were employed to landscape the demesne with serpentine walks and formal gardens. Byrne states that, ' A mound on the NW of the castle is crowned with seven gigantic oaks in a circle, inside of which are rustic seats. â€¦ A little northward of the house is a tastefully constructed rustic bower, inlaid with seats all round, with a circular rustic table in the centre. The floor is paved with variegated pebbles. The bower is surmounted with a carved golden eagle with outspread wings. Roger Hall was also responsible for the erection of Warrenpoint Shambles in 1834 (HB16/11/049) and the gallery in Warrenpoint Parish Church (HB16/11/001). When he died in 1853, the property passed to his son Samuel Madden Hall. On his death it passed to his nephew William James Hall who erected the farmyard to NW of the walled garden (HB16/11/045). He died in 1896 (a memorial tablet and the chancel window of Warrenpoint Parish Church were installed in his memory). The estate passed to his son Roger Hall (one of the nave windows in Warrenpoint Parish Church was installed in his memory). It passed to Toby Hall early this century and on his death in 1939 the estate became controlled by Trustees but remained occupied by the Hall family. During WW2 the upper floors and basement of the house were used by British and American Troops and so too was the demesne. The house was vacated as a family residence in October 1999. It is presently used as a function/conference centre. Primary Sources: 1. Information from the Hall family (October 1999). 2. Photograph no.11269 in Lawrence Collection. 3. Photograph no.3451 in W. A. Green Collection. 4. Date and makers name on right side of Library chimney piece (behind the carved figure). 5. OS 6â€☐ map, 1834, Co Down sheet 51 (PRONI, OS/6/3/51/1). Secondary Sources: 1. T. Bradshaw, 'General Directory', Newry, 1820, p.36. 2. J. A. K. Deane, 'The Gate lodges of Ulster' UAHS 1994. 3. J. Keane, 'Lord's brother moves wife off his posh estate while mistress lives in the stables.' Sunday World Newspaper 19/09/1999, p.12-13. 4. P. Byrne, 'Handbook to Carlingford Bay', Newry 1846, p.64, 65. 5. A. Day, 'Ordnance Survey Memoirs of Ireland, Parishes of County Down 1, 1834-6, South Down, Vol.3. QUB, 1990. p.121.

Criteria for Listing:

Architectural Interest
A. Style
B. Proportion
C. Ornamentation
D. Plan Form
H-. Alterations detracting from building
I. Quality and survival of interior
J. Setting
K. Group value

Historical Interest
V. Historical Association/Authorship
W. National/International Interest

Evaluation:

This imposing mid 19thC Tudor Revival-style mansion (designed by Thomas Duff of Newry, 1830s), is set within an attractive informally landscaped demesne. It retains all of its original external character, and the splendid internal detailing survives intact. Along with the servant's accommodation (HB16/11/019B), Gardener's House and walled garden (Hb16/11/020), Stable yard (HB16/11/021), Ice house (HB16/11/043), Steward's House (HB16/11/044) Old farmyard (HB16/11/045) and Gate screen (HB16/11/018) it forms an important and substantial group of buildings.

HISTORIC BUILDINGS REFERENCE NUMBER: *HB 16/11/019B*

ADDRESS: Former Servants Quarters to Narrow Water Castle
Newry Road
Warrenpoint
Co. Down
BT34 2PN

SURVEY 2**:** B1

DATE OF LISTING: 23/09/1975
DATE OF RESURVEY: 16/10/1999
DATE OF CONSTRUCTION: 1820-1839
CURRENT BUILDING USE: House
PRINCIPAL FORMER USE**:** House
OWNER CATEGORY: Private
DESCRIPTION:

Long linear two storey building enclosing the W side of the domestic yard and abutting the N elevation of Narrow Water Castle. Pitched natural slate roof (new) with half round metal rainwater goods. To centre of roof ridge is an octagonal lantern with swept leaded roof. Its cardinal faces have Tudor lattice glazing (possibly cast iron) and its remaining faces have similar openings containing painted timber louvres. There are five chimneys. Each is stuccoed and consists of a common plinth supporting three tall octagonal Tudor style stacks. All are spaced out along the main ridge, with two to left half and three to right half, the furthest one being one the right gable. There are eight irregularly spaced wall head dormers to front elevation; the fourth one (from left) being to centre of the elevation. The first, fifth and seventh from left are small and the others are slightly larger and they advance with their slightly advanced ground and first floors. All dormers have shouldered gables with pitched copings and are terminated in an octagonal masonry plinth carrying a cylindrical pinnacle with an ogee coping. Those to the advanced dormers are massive compared to those on the others. Walls have a chamfered basecourse and are lined rendered. Majority of openings have stucco hood moulds. Windows are timber framed and Tudor headed with incised spandrels and flush cills. Those to ground floor are the transom and mullion variety and those to first floor are much smaller and have mullions only. All have cast iron lattice glazing unless otherwise stated. Openings are as follows: At ground floor left under the extreme left dormer is a window opening containing four 1/1 lights, with plainly glazed margin-paned leaded glazing. Over to first floor are three single paned lights in a smaller opening and with similar glazing. To right at ground floor is an original four panelled painted timber door with pair of Tudor transoms over. There are two matching first floor lights in a common opening, but without a stucco hood. To right of these openings is the second wall head dormer (advancing forward slightly), its left and right cheeks are blank. Its front gable has three 1/1 lights to ground floor and two single paned lights (taller than those to its left) to first floor. On main wall to its right at ground floor is a pair of 1/1 lights with a pair of single paned lights above (no hood). On roof ridge to their right is the first of the chimney stacks and on main wall to their right is a similar window to each floor. To right of these is the third wall-head dormer. It has four 1/1 lights to ground floor and three (tall) single paned lights to first floor. To its right at ground floor is a doorway (former window) with a modern six panelled door set to right and two narrow side lights to its left (inappropriate), over are a pair of lattice glazed transoms. At first floor is a pair of single lights (no hood). On roof ridge to right of these openings is the second of the chimney stacks. On main wall to right of these openings at ground floor is a pair of 1/1 lights and to first floor a pair of single paned lights (no hood). To right of these openings is the fourth wall-head dormer (advancing) to centre of the elevation behind which is the lantern light. Left and right cheeks of gable are blank and it has three 1/1 lights to ground floor and a pair of single paned lights to first floor. To its right at ground floor is a doorway (former window) with a modern six panelled door set to left and two narrow side lights to its right (modern), over are a pair of lattice glazed transoms. At first floor is a pair of single lights (no hood). On roof ridge to right of these openings is the third of the chimney stacks. On main wall to right of these openings is the fifth wall head dormer, it has three 1/1 lights to ground floor and a pair of lights at first floor. To its right is the sixth wall head dormer (advancing). Its left and right cheeks are blank and its openings are as those to its left. The seventh wall head dormer is to its right. This one has a doorway to ground floor (former window). It has a six panelled door flanked by sidelights with three Tudor transoms over. At first floor there are three single paned lights. On roof ridge to right is the fourth of the chimney stacks. On main wall to right is the eighth (final) wall head dormer, at extreme right end of this elevation. It has a pair of 1/1 lights to ground floor and a pair of lights with Tudor headed transoms to first floor. The right gable of this block has a shouldered coped skew and carries the last of the chimney stacks. It is rendered and has an infilled doorway to ground floor left. At first floor left there is a 1/1 sash window. Rear elevation is unrendered uncoursed random rubble. Its left third advances forward slightly. The right end of its central third advances under a hipped roof and rest of central and right thirds are abutted at ground floor by a lean-to. Most openings have stepped red brick architraves and granite cills. Left portion advances slightly under a cat-slide of the main roof. It has a pair of 4/4 sliding sashes at ground floor left. To right of centre at ground floor is a modern painted timber door with glazed top panes with a narrow four paned transom and a 4/4 sash window to its immediate right (in same opening). At first floor above the window is a modern door under a modern wall-head dormer with plain timber bargeboard. Door is served by a flight of galvanised metal stairs rising from ground floor left. The right cheek of this advanced left portion is blank. Central portion of this elevation is abutted to right end by the stairwell return under a hipped natural slate roof, which ties into the main roof. Its walls are as main block. Remainder is abutted to ground floor by a single storey lean-to with mono-pitched natural slate roof and painted metal rainwater goods. This lean-to has a modern flush timber door (part glazed), with sidelights to left, at left end. To centre is a tripartite window consisting of a 6/6 sash window flanked by narrow 2/2 sashes. To right end there is a pair of 6/6 sashes in a common opening and a second door. Above the lean-to at first floor of main block there is a small 3/3 sash window to left and a pair of similar windows (in common opening) to right. On the roof ridge to the centre of this bay is the lantern, which marks the centre of the elevation. The left and right cheeks of stairwell return are blank, and that to first floor of right one is slate-hung. Its rear wall is blank to ground floor, abutted to left by a small lean-to with rubble walls and mono-pitched natural slate roof. At first floor it has a tripartite window in a segmental headed opening consisting of a 9/6 sliding sash window flanked by narrower 3/2 sashes. The top panes of the top sashes curve with opening head. The right portion of the rear elevation is abutted to ground floor by a single storey lean-to with mono-pitched natural slate roof. The remaining wall to first floor is slate hung and has a pair of 3/3 sashes (in a common opening) at left and a single 3/3 sash at right. The lean-to has a 6/6 sash at left and a pair of 6/6 sashes to left of centre. To centre is a metal oil tank and to right is another pair of 6/6 sash windows. The left gable of the main block is completely abutted by the N elevation of Narrow Water Castle. Vaults to W To immediate W of the rear elevation, built into the hillside, are four vaulted stores. They have rubble stone walls with doorways and earth covered barrel vaulted brick roofs aligned W-E. The S most one is two storey. Its first floor has a segmental headed window E wall and a similar opening on W wall is a loading door from the hillside at rear. It has an additional pitched natural slate aligned N-S over its brick vault.

Architects:

Thomas Duff

Historical Information:

This building was known as Mount Hall and is believed to have been erected by Francis Hall in 1707. It was the main house prior to the erection of Narrow Water Castle, built by Roger Hall in 1835 to designs by Thomas Duff. Duff remodelled the exterior of Mount Hall to complement the new house). Internally it was converted to servants' accommodation. Shown in present form on the 1834 OS 6 inch map. In the recent past it was refurbished and converted into apartments. Primary sources: 1. OS 6 inch map, 1834, Co Down sheet 51 (PRONI, OS/6/3/51/1). Secondary Sources: 1. T. Reeves Smith, Irish Castles (Belfast, 1995) p.36.

Criteria for Listing:

Architectural Interest

A. Style

B. Proportion

C. Ornamentation

H-. Alterations detracting from building

J. Setting

K. Group value

Historical Interest

X. Local interest

V. Historical Association/Authorship

Evaluation:

This, the earliest building on the site, remodelled in the 19th C in the Tudor style, is both of historical and architectural interest.

HISTORIC BUILDINGS REFERENCE NUMBER: *HB 16/11/020*

ADDRESS: Former Gardener's House
Narrow Water Castle
Newry Road
Warrenpoint
Co. Down
BT34 2PN

SURVEY 2: B2

DATE OF LISTING: 22/09/1981
DATE OF RESURVEY: 27/11/1999
DATE OF CONSTRUCTION: 1800-1819
CURRENT BUILDING USE: House
PRINCIPAL FORMER USE**:** House
OWNER CATEGORY: Private
DESCRIPTION:

Walled garden with gardeners house on its SE boundary. Walled garden is located to the NW of the stable yard and SE of the farmyard. (1) Walled garden Covering 2.3 acres (1.4ha), this garden is enclosed by a high rubble stone wall, uncoped and brick lined internally. It has numerous infilled openings on its SE elevation, and an open doorway on its NE and NW elevations. SW elevation is blank. (2) Two storey/ three bay gardeners house. Hipped natural slate roof with advanced eaves and exposed timber rafter tails carrying half-round cast-iron rainwater goods. Rendered granite coped wallhead chimney to each end elevation. Walls are dry dashed with stepped stucco quoins. Principal elevation faces SE. Central bay is slightly narrower than the other two and has a single concrete step up to the shallow entrance porch. It has a pitched natural slate roof, modern boxed timber eaves and cement dashed walls. Porch cheeks are blank and its front gable contains the semi-elliptical headed doorway. Timber door is reproduction and double-leaf; each leaf has two raised and fielded panels with bolection mouldings. To either side of door is a plain glazed sidelight with timber apron. Framing each sidelight is a timber pilaster with console bracket supporting the moulded timber cornice over the door. Above, recessed in the opening, is a semi-elliptical headed fanlight. At ground floor the left and right bays each have a 6/6 exposed-box sliding sash window with horns and granite cill. All windows as this unless otherwise stated. First floor has a single window to each bay. These are 6/3 sashes and are diminished in height. Left (SW) elevation is abutted by a single storey/ four bay return (see later). The exposed section is blank and cement dashed. Rear elevation (facing NW into the walled garden) is rendered as the facade. Ground floor has a 2/2 sliding sash window to left and right bays and two tiny 1/1 sashes to central bay (the left one being set higher in wall). First floor has a 2/2 sash window to each bay. Right (NE) elevation is abutted by a single storey/ two bay outbuilding (see later). The exposed section is blank and cement dashed. (3) Return abutting left elevation of the house This building has a pitched natural slate roof, hipped at SW end, with advanced eaves and plain timber eaves board. Half-round cast-iron rainwater goods. Walls are rendered. Its front elevation faces SE. It is four openings wide, the entrance being contained within the third bay (from left). Four-panelled (raised and fielded) reproduction door is recessed with smooth rendered reveal. The remaining openings diminish in size from left to right and contain a 2/2 exposed box sliding sash window, with horns and granite cill. Left gable of roof advances forward to right side with exposed t+g sheeted soffit and timber rafter tails. The walls are cement dashed. The left part of S gable has a pair of modern timber glazed French doors with granite flagged threshold. To their right is an octagonal painted masonry opening containing a picturesque quatrefoil window. Rear (NW) elevation has rubble stone walls (forming part of walling to garden) with a mixture of cement and lime render. There is an infilled window opening with granite cill to the right-end and a 2/2 sash window to extreme left-end. (4) Outbuilding (abutting right elevation of house) Pitched natural slate roof with a small rendered chimneystack to centre. Advanced eaves course and plain timber eaves board carry half-round cast-iron rainwater goods. Walls are lime rendered with painted basecourse over rubble stone. On front (SE) elevation, below eaves level are three circular ventilation holes, infilled with rendered bricks. Left bay has a 2/2 sash window with granite cill. Right bay has a t+g sheeted door with modern strap hinges. Left (SW) gable is completely abuts the house. Rear (NW) elevation is blank. Right gable (NE) of outbuilding is abutted by a lean-to. It has corrugated metal roof. Walls are rendered with brick dressed openings, its eaves, rainwater goods and ventilation openings detailed as those to the outbuilding. To centre of its front (SE) elevation is a fixed two paned (horizontally divided) timber framed window with margins. Right (NE) gable face of lean-to has a flat-headed opening. Its rear (NW) elevation is blank.

Architects:

Not known

Historical Information:

The estate was created c 1707 when Francis Hall erected Mount Hall (HB16/11/019B). This structure is shown in present form on the 1834 OS 6 inch map. The HMBB slide (1970) shows the porch of the house with a decorative fretted 19thC timber bargeboard and decorative finial. It shows the front door to be a four-panelled and bolection moulded. It has a transom with rounded top corners and two paned round-headed side lights which rise up to flank the transom. Primary sources: 1. OS 6 inch map, 1834, Co Down sheet 51 (PRONI, OS/6/3/51/1). 2. HMBB first survey slide dated 23/01/1970.

Criteria for Listing:

Architectural Interest	Historical Interest
A. Style	X. Local interest
B. Proportion	
C. Ornamentation	
H-. Alterations detracting from building	

Evaluation:

Although somewhat altered in the recent past, this building is still of strong character and, with the walled garden, forms part of the overall estate grouping.

HISTORIC BUILDINGS REFERENCE NUMBER: *HB 16/11/021*

ADDRESS: Stable Yard at Narrow Water Castle
Newry Road
Warrenpoint
Co. Down
BT34 2PN

SURVEY 2**:** B2

DATE OF LISTING: 22/09/1981
DATE OF RESURVEY: 27/11/1999
DATE OF CONSTRUCTION: 1800-1819
CURRENT BUILDING USE: House
PRINCIPAL FORMER USE**:** Outbuildings
OWNER CATEGORY: Private
DESCRIPTION:

The rectangular stable yard is situated to immediate N of the domestic yard. It is enclosed to E by a front stable block and to W by a rear one. It is enclosed to N by a plain high wall with pair of gates and to S is a more elaborate wall with Tudor detailing forming the boundary with the domestic yard. The yard itself is cobbled and the front elevation of each block faces onto it. The front (E) block. This two storey five bay block encloses E side of the yard. It has a pitched natural slate roof with steep gabled pediment to central bay, under a pitched natural slate roof which ties into main roof and has a higher ridge level. Pediment has a central roundel (with modern light fitting). There are two small cement rendered chimneys, one to right of centre on extreme left bay and another to right of centre on second bay from left. Rear (E) pitch has two wall head dormers and two modern roof lights. Front (E) elevation is exposed random rubble stone with red brick jack arches to openings. All windows are exposed box 4/8 sashes with horns and dressed granite cills. All but the central bays are three windows wide to first floor. The extreme left bay has three ground floor windows too, but right one is offset to right by a four-panelled door, which shares its opening. The second bay from left has three windows to ground floor. The central bay, which is narrower than the others, has a large segmental headed coachway, with t+g sheeted infilled head and brick architrave. The walls show that this feature is a later addition as the jack arches of previous windows can be seen to its left and right at first floor level. The two right bays are identical; each has a central door at ground floors flanked by single windows and all in line with the first floor openings. Both doors are t+g sheeted and double leaf, each with a fixed glazed inset. The right (S) gable of the E stable block fronts the domestic yard and is lined rendered. Its gable is shouldered and it has a pitched coping and large octagonal Tudor pinnacle (as the servantants block HB16/11/19b). At ground floor there is a pair of casement windows, each is a cast iron lattice, and both are in a common opening. At first floor is a similar window with additional crudely constructed side hung timber lights. The rear (E) wall of the E stable block is lined rendered and unpainted. The left two bays (as viewed from E) each have a single 4/8 sliding sash window to each floor. Those to ground floor are separated by small buttresses (with same to either end) and those to first floor have shouldered wall head dormers over, with plain panels inset into their gables. The central bay has an infilled coach arch (smaller than that set to the yard), flanked by buttresses and with a 4/8 sash to first floor. The right two bays each have a 4/8 sliding sash at ground floor, again separated and flanked by buttresses. There are no first floor openings and a modern plastic soil pipe abuts. The left (N) gable of the E stable block is lined rendered and unpainted. The gable shouldered and has a pitched coping with a large Tudor finial to gable apex. It is abutted to ground floor by a single storey porch with hipped natural slate roof, terracotta ridge and hip-knob. Porch has a cement rendered base wall. All its faces have vertical fixed timber frames windows, four each to front and left cheeks. The right cheek has two fixed lights and a part glazed four-panelled door. On gable over porch there is a 4/8 sash window. The rear (W) block of stable yard. This two storey/ three bay block encloses W side of the yard. It has a hipped natural slate roof with gabled pediment to central bay, under a pitched natural slate roof, which ties into main roof. Pediment has harled and painted walls with a central roundel (infilled with timber boards). There is a small cement rendered chimney to either side of the central bay. Front (E) elevation is exposed random rubble stone with red brick jack arches to openings. All windows are 6/3 sashes with horns and dressed granite cills. All doors are modern six panelled with modern sidelights to one side only. The left and right bays are each four openings wide. Left bay has a door to left and right at ground floor and the rest of the openings contain windows. The right bay has a door in the first and third openings from the left, the rest of the openings are windows. The central bay is filled to ground floor by three large coach arches which are grouped closely together and share finely dressed granite architraves. All have slightly advanced keystones, with central one having ‘1816’ incised. The right gable is rubble stone and blank. The rear elevation is three bays wide and has a number of modern plastic soil pipes abutting. Left bay is abutted to left of centre by a modern dashed chimney stack that tapers at eaves level with slated shoulders. There are four windows at ground floor, one to left of chimney stack and three to right. The extreme right window is rectangular and has been infilled with concrete block work internally only. The remaining three are 4/4 fixed panes in a brick dressed segmental headed opening, the top four panes of each curving with the segmental head. There are three 4/8 sash windows to first floor; the left one is set to left of the chimney breast. The central bay has three windows to ground floor. The central and right ones are boarded up and the left one is larger and contains a pair of margin paned 1/1 sashes. There are two first floor windows. That to left is a modern fixed timber light with top hung transom. The other is a 4/8 sliding sash. The right bay has three windows to each floor. To left of centre and right at ground floor are 6/6 sashes and to left end is a 4/8 sash. There is a similar window above it to first floor left and two 1/1 sashes, one to right of centre and another at right end. The left gable is rubble stone and has a single window at ground floor to right of centre. The N boundary of the stable yard A high random rubble wall with pitched copings encloses the N boundary of the stable yard. To its centre are two dressed granite gate piers supporting a pair of large wrought iron gates with dog bars and main verticals all with wrought spear-head finials. The S boundary of the stable yard A high rendered wall with a pitched coping encloses the S boundary of the stable yard. Its S face (to domestic yard) is divided into four bays by three applied single stage buttresses with sloping coping, with similar buttresses to left and right ends. The right end of the wall is flush with the S gable of the front (E) stable block. Each bay has a narrow arrow loop window containing a fixed cast iron lattice light (left one is out of its opening). The two right bays each have a Tudor headed doorway with chamfered reveal and head. The right one has a flat-iron gate and serves a lean-to shed on N side of wall. The other doorway has no gate and also serves a shed. The N side of the wall (in stable yard) is rendered and painted. Its left end is abutted by the lean-to, which has a lean-to natural slate roof (cat-sliding out to centre) and coursed rubble stone walls. It has a small central return under the cat-slide roof and two doorways, each with brick dressings.

Architects:

Not known

Historical Information:

Mount Hall was erected by Francis Hall in 1707. Mount Hall was replaced and remodelled by Roger Hall in 1835 when he constructed the present house (Narrow Water Castle) to designs by Thomas Duff. The remodelling of Mount Hall came in the form of shouldered gables, lattice windows and Tudor finials, these details have also been used on the S and E boundaries of this stable yard, suggesting they too have been remodelled. The rear (W) stable block has a datestone of 1816 which shows it must have been constructed to serve Mount Hall. It is likely that the rest of the yard, which is similarly detailed, also dates from this time. Two parallel blocks are shown on the 1834 OS 6 inch map; the return at the E end of the E block is shown on the 1860 map. Primary Sources: 1. OS 6 inch map, 1834, Co Down sheet 51 (PRONI, OS/6/3/51/1). 2. OS 6 inch map, 1860, Co Down sheet 51 (PRONI, OS/6/3/51/2). 3. Datestone on central coach arch of W (rear) stable block. Secondary Sources; 1. T. Reeves Smith, Irish Castles (Belfast, 1995), p.36

Criteria for Listing:

Architectural Interest	Historical Interest
A. Style	X. Local interest
B. Proportion	
C. Ornamentation	
H-. Alterations detracting from building	
J. Setting	
K. Group Value	

Evaluation:

Two attractive and well proportioned stable blocks in enclosed cobbled yard of value as part of the Narrow Water demesne. They retain their external character and, although internally subdivided, some historic detail remains.

APPENDIX 10.4:
Historic Gardens

D/041 Narrow Water Castle

The present house was built during the years 1831 to 37 to the designs of Thomas Duff of Newry (listed HB 16/11/19). It replaced an earlier house, known as Mount Hall (the name of the occupants), of which a wing survives. A map of 1800 shows this house with garden, grove and shrubbery, orchard, pasture, woods, and parkland trees. It is thought that Sir Joseph Paxton made plans for the surroundings of the new house. The Italian Garden has grass terraces, balustrading, cut stone steps and urns. Horizontal ground was once filled with flower beds, remembered in photographs but now grassed. Early 19th century photographs also show the wild garden in the Pleasure Grounds to the north west of the house, said to have been created by Thomas Smith of Newry. This is no longer maintained. Articles in garden journals at the end of the 19th century mention the garden and remarkable trees are noted in *Trees of Great Britain and Ireland* of 1909 and 1910. A folly summer house survives on high ground in woodland. There are extensive plantations of trees. The parkland trees are few and far between. The walled garden is not cultivated and glasshouses have gone. The Head Gardener’s House (or Steward’s House) is very impressively large (listed HB 16/11/20). 18th century outbuildings are listed (HB 16/11/21). Two gate lodges survive, Castle Gate and Tudor Lodge by Duff (listed HB 16/11/23) and contemporary with the house. However Duff’s Newry Gate has gone and the earlier rear gate. SMR: DOWN 51:38 enclosure. The south east corner of the demesne is a golf course. Private.

Chapter 11

Construction Phase

Chapter 11 Construction Phase

11.1 Introduction

The significant environmental effects that may arise during the construction phase and the proposed mitigation measures have been primarily considered in the relevant previous chapters. This chapter looks at the possible impacts, not previously described, which may arise during on-site activity.

11.2 Timescale for Construction

The period of time required to complete the Narrow Water Bridge and approach roads is anticipated as being approximately 18 to 21 months.

11.3 Potential Impacts of Construction Activities

11.3.1 Site Construction Compound

A main site construction compound will be required during the construction phase to provide office, canteen, washroom and toilet facilities. The compound will also provide facilities for materials and plant storage and the maintenance of same. The principal site construction compound will be established at the commencement of the contract and remain in place throughout the construction period. The site for the compound will be within the lands alongside the route of the proposed road from the R173 to the foreshore. It will be located away from the main body of the Newry River in order to prevent water pollution or contamination (refer **Figure 11.1** in Volume 3).

A satellite compound will be required for the construction works that will take place on the north side of the river. Temporary lands have been provided to the south west of the Roundabout as shown in **Figure 11.1** in Volume 3.

Where compounds are located close to watercourses, the compounds will be designed and managed so that run-off from the compounds is collected and bunded to prevent contamination of any watercourses or the Newry River estuary.

The site compounds are likely to have the following temporary impacts:

- Increase in traffic flows, particularly larger vehicles.
- Increase in local noise levels during working hours.
- Visual intrusion.

Other potential impacts that need to be guarded against include:

- Accidental spillage of pollutants into watercourses.
- Dirt, mud and other materials being dropped from lorries and plant or spread onto approach roads by traffic travelling to and from the site.

The exact location and mode of operation of the site construction compounds selected by the contractor will be subject to approval. Furthermore, the sites of the compounds will be cleared, reinstated and landscaped upon completion of the works to the satisfaction of Louth County Council in the Republic of Ireland and Northern Ireland Environment Agency in Northern Ireland.

11.3.2 Earthworks Operations

Earthworks operations involve the excavation and transportation of excavated cut material along the route and the use of this material for the construction of road embankments and noise/landscape bunds. Overall the road alignment is on embankment thus allowing any cut material to be used as fill on site. The construction of embankment will require material to be imported onto the site. In addition the bridge structure will be imported to the site.

The transportation of these materials to and within the site could have an impact on the environment due to the following:

- Traffic noise along haul roads.
- Dust generated along site haul roads.
- Crossings of public roads, the R173 and the A2, where traffic management and safety measures will be required.

11.3.3 Construction of Bridge Structure

One of the most important issues of the chosen engineering design is related to the ease of fabrication and construction of the complete bridge. The cantilever method of construction for the proposed bridge is readily suitable for construction across such an environmentally sensitive area. This form of construction permits deck segments to be erected and supported from above rather than from below, thus removing the need for physical access over the inter-tidal area.

The construction process outlined below has been specifically designed to minimise the potential impacts of the construction process on the aquatic ecology and cultural heritage. The proposed bridge will be constructed over an 18 to 21 month period following the outline construction process detailed below (and illustrated on **Figures 11.2 to 11.7** in Volume 3):

Stage 1 – Construct Embankments

- On the south side, access will be provided across agricultural lands following the proposed road alignment. The proposed road alignment is substantially on embankment although there is a small portion in cut through a small ridge on the passage down to the shoreline.
- On the north side, access will be provided off the existing A2 roundabout. Ground improvement measures, such as piling and use of geotextile, are likely to be required before construction of embankments can commence.

Stage 2 – Coffer Dam Installation

- A temporary cofferdam will be constructed around the site of both anchorage abutments to allow for the construction of same in this tidal environment.
- To minimise any possible impact on existing hydrodynamics, the cofferdam sizes will be minimised as much as possible to provide the minimum working area required around the reinforced concrete pile caps.
- When the cofferdam is constructed the section of the river bed it encloses will require excavation. Due to the size of the site it will not be possible to construct a settlement pond and the excavated material will have to be moved off-site.

Stage 3 – Drive Piles

- There are two steel tubular piles being used to support the central pier within the in-river environment. These piles are driven to bedrock by the driving rig that will be situated on a barge or jack-up rig (methodology to be finalised by appointed Contractor).
- The supporting piles for the southern and northern anchorage abutments are to be driven to bedrock.

Stage 4 – Construct Pile Cap

- An in-situ reinforced concrete pile cap will be cast at the location of the southern and northern anchorage abutments following the piles being driven to bedrock.

Stage 5 – Construct Abutments and Central Pier

- After the pile caps have been poured, both anchorage abutments will be constructed. The material extracted shall be used as infill or removed from site.
- In addition, a barge or jack-up rig will be required to place a precast concrete pile cap over the steel piles located in the river channel. The bottom of the precast pier will be sealed to prevent erosion of the steel piles.

Stage 6 – Construct Tower Base

- Both the main pylon and the bridge deck are to be constructed in sections. The lower portion of the tower, which connects the pylon with the abutment, will be constructed initially as will the associated deck.
- Once complete the cofferdam which encloses the anchorage abutment is extracted.

Stage 7 -13 – Construct Tower and Main Span

- The steel pylon with concrete infill shall be constructed in stages using a crane located on the southern bank of the river.
- Once a section has developed sufficient strength additional weight will be added to the tower to counterbalance the deck.
- The stiffened steel orthotropic box girders with cantilevers are to be assembled offsite. The deck sections are likely to be transported to site along the river where a crane, which will be located on the permanent structure, will lift the section into place.
- The installation of the cable stays and the bridge deck can now begin.
- Sections of the steel deck are progressively added as the tower rises using the cable stays to support them.
- The cables shall be pre-stressed and also readjusted as each new section of the deck cantilevers out. This is to ensure the deck levels remain as per the design.

Stage 14 – Construct Moveable Span

- The cable-stayed rolling bascule section will be constructed offsite and brought to site on a barge.
- Once the northern abutment has been completed the lifting mechanism can be assembled prior to the arrival of the moveable span.

- The moveable span is to be lifted into place following the completion of the fixed cable-stayed span.

Stage 15 – Finishes

- Once the deck has been progressively cantilevered across the river, the installation of the parapets, surfacing and other finishes can be completed followed by the final tensioning of the bridge cable-stays.

The above construction methodology has been developed to minimise the impact on the aquatic environment. However, in addition the need for only four slim tubular in-river piles minimises any potential high level temporary noise due to piling and also minimises the impact on water quality / sediment release.

11.3.4 Construction of the Drainage System

The proposed mainline road drainage system shall be designed in accordance with the NRA DMRB and the current best practice guidance for drainage i.e. “Sustainable Urban Drainage Systems” or SUDS. The drainage system from the road and the bridge will be directed to an attenuation pond (refer **Section 3.7** and **Figure 3.13** in Volume 3 for detail).

No streams will be impacted by the construction of the drainage system and thus specific water pollution prevention measures are not required during the construction of the drainage system. Pollution prevention best practice measures such as that outlined in the mitigation measures under Section 7.3 shall be adhered to.

11.3.5 Construction of the Control Building

The proposed control building will be situated north of the river and approximately 200m south east of the bridge crossing. A gravel access road is proposed from the Newry Road to serve the building. Ground improvement measures such as the use of a geotextile is likely to be required as part of the construction of the access road.

The control building will consist of a single storey masonry building with timber pitched roof finished in slate. It is envisaged that it will be constructed on piled foundations with integral ground level slab and ground beams followed by the masonry wall construction with reinforced concrete beam and columns framing the large window facing the river estuary. It is proposed that the roof will drain to a soakaway and that foul drainage will discharge to a foul sewer along the Newry Road.

11.3.6 Impact of Construction on Utility Services

The utilities present are described in Section 3.8 and are illustrated on **Figure 3.14** in Volume 3.

Telecommunication services exist along the R173 and the A2. Where construction operations impact these services, the service provider will be consulted and the works will be undertaken as directed by them.

The most significant impact on services occurs as a result of the northern embankment approach. This abutment will encase the drainage culverts which pass through the A2 roundabout. As a consequence these will have to be re-routed prior to the construction of this embankment. These works will require significant traffic management and will hence be undertaken as directed by the Roads Service and the service provider (The Rivers Agency).

11.4 Mitigation Measures for Construction Activities

The contract for the construction of the road scheme will include provisions to minimise any temporary nuisance that may occur and the management of the construction site. The undertaking of the works will be monitored to ensure compliance with the requirements of the contract. Such measures will include restricting site working hours and noise levels (refer to the mitigation measures outlined in Section 7.4 Noise and Vibration) and provision of engineered temporary traffic management schemes.

Temporary Traffic Management

In order to minimise inconvenience to road users, the contract will require the contractor to put in place measures to maintain all roads and accesses affected by the works, or their replacements, and to maintain traffic flows and existing accesses until such time as the permanent works have been completed. As the proposed road and bridge are primarily off line there should be minimal severance or disruption for the local community.

The most significant impacts to traffic flows will occur at the tie-ins at both ends of the scheme, where new road construction / roundabouts etc. could cause disruption to traffic. Temporary traffic management and careful planning of the works will be required to minimise this disruption. This will be agreed with the relevant authorities prior to commencement (Louth County Council; The Roads Service).

Temporary Community Severance

As stated the primary impact will occur during construction of the roundabouts at the tie-ins. It is envisaged that it will be possible to manage the construction process so as not to cause any temporary severance or separation of communities from existing facilities or services. Disruption due to traffic management will occur but this will be minimized as far as possible.

Temporary Land Severance

As outlined in Chapter 9, a number of farms will be affected by the scheme. However no severance, either permanent or temporary, will occur as a result of the land acquisition (refer **Figure 9.1** in Volume 3).

Site Security and Public Health

Both the site compound and the bridge construction site will be provided with permanent boundary treatment from the outset or where this is not possible with temporary secure fencing. This is essential to protect the public from the works which will, at stages, be highly dangerous elevated structures over the Newry River and inter-tidal area.

Impact of Construction on Public Utility Services

As highlighted above (11.3.5) some alterations and diversion works will be required to the existing utility services as a result of the scheme. This may cause a small interruption to some local services and in the case of the diversion of the drainage culverts, significant traffic management. These will be planned in advance and agreed with the authorities directly affected.

Impact on Navigation

Prior to the main tower construction works on the southern shore it is important that the new navigation beacon is constructed so that navigation into Warrenpoint Harbour and up the Newry River is not affected by the obstruction of the existing beacon. The new beacon has been designed to imitate the existing beacon whose function it will replace, however Warrenpoint Harbour Authority and Carlingford Loughs Commission will be consulted through the design and construction process to ensure their requirements are met.

Mitigation Measures for Construction Operations

The main mitigation measures to minimise impacts arising from construction will be:

- Disturbance for Terrestrial Ecology: Construction activities will involve disturbance of a roosting area for Waterbirds and limited impact on inter-tidal habitat. Mitigation measures will be adopted as outlined in Section 7.2 of Chapter 7.
- Aquatic Ecology: Pollution control measures as outlined in Section 7.3 of Chapter 7.
- Construction Noise and Vibration: Controls on noise and vibrations from heavy earthmoving equipment and rock excavation as outlined in Section 7.4 of Chapter 7.
- Earthworks and Waste: Measures to reduce the amount of construction waste generated and the potential impact of contaminated materials on the project is dealt with in Chapter 7.6.
- Air Quality: Dust Minimisation Plan as outlined in Section 7.5 of Chapter 7.
- Disturbance of Existing Drainage Culverts: Temporary drainage will be provided until such time as the permanent drainage facilities are in place.
- Cultural Heritage: Mitigation measures as outlined in Chapter 10.

The contractor will be required to prepare a Waste Management Plan and an Environmental Operating Plan prior to construction commencing. In addition the appointed contractor will be required to prevent, as far as is possible dirt being released onto public roads. In the event that site traffic leaves dirt on the road the Contractor will be required to clean the road.

All of the above mitigation measures will be tied into all contract documents and it will be a requirement of the Main Contractor to adhere to all of these mitigation measures and any further measures required as part of the planning conditions.

Chapter 12

Interrelationships

Chapter 12 Interrelationships

In both Northern Ireland and the Republic of Ireland an Environmental Statement is required, by the relevant Environmental Impact Assessment Regulations, to include:

"A description of the aspects of the environment likely to be significantly affected by the development, including, in particular, population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and ***the inter-relationship between the above factors****.'*

Inter-relationships relates to the reactions between impacts within a project and the inter-relationship between impacts identified under one topic with impacts identified under another topic. For example inter-relationships exist between archaeology and landscape; human beings/communities and noise; or visual impact and a requirement for noise barriers.

The "aspects of the environment likely to be significantly affected by the development" are covered in Chapters 5 to 11 of this EIS/ES inclusive. In some cases there are inter-relationships between these factors and these are described in this chapter. The potential inter-relationships are highlighted in Table 12.1 and significant interactions are discussed below.

Table 12.1 Matrix to Summarise Inter-relation of Environmental Topics and Issues

Receptor / **Activity**	**Traffic**	**Human Beings**	**Terrestrial Ecology**	**Aquatic Ecology**	**Noise and Vibration**	**Air Quality**	**Landscape and Visual**	**Material Assets**	**Cultural Heritage**	**Construction Phase**
Traffic		●			●	●		●		
Human Beings										
Terrestrial Ecology										
Aquatic Ecology							●			
Noise and Vibration		●	●	●						
Air Quality										
Landscape and Visual		●		●				●	●	
Material Assets										
Cultural Heritage							●			
Construction Phase	●	●	●	●	●	●			●	

● Key interactions/interrelationships effects highlighted.

The various interactions identified in this chapter have been discussed in each of the previous chapters in terms of the manner in which they affect one another. Table 12.1 clearly shows that the key interactions occur as a result of the traffic, noise, landscape and visual and construction phase impacts.

Aquatic Ecology

Early consultations with the Loughs Agency and Warrenpoint Harbour Authority highlighted the importance of minimising the release of sediment during both the construction and operation of the bridge. The presence of commercially licensed aquaculture beds (mussels and oysters) within Carlingford Lough directed the Loughs Agency to advise of the requirement to ensure that these commercial interests were not impacted by the release of either sediment or contaminants into the water body. Warrenpoint Harbour Authority also made it clear that any release of sediment could impact their dredging contract which is required to maintain the deep water channel and turning circle serving the harbour. Along with other considerations these concerns lead to the development of long span designs which were supported from above deck rather than on numerous bridge piers within the river channel. It is considered that the presence of above deck structures have the potential to negatively impact on the landscape of the receiving environment.

Cultural Heritage

The proposed bridge lies within an area of high archaeological sensitivity. A number of listed monuments, including Narrow Water Keep and a motte, located just to the north of the A2 roundabout, occur in the immediate vicinity and the area possesses significant cultural history. It was considered crucial that the development did not physically impact or visually detract from these monuments. In addition, the archaeological studies indicate that the possibility of archaeological remains being discovered along the selected route and particularly along and beneath the river bed is relatively high. Again along with other considerations the preferred solution was to minimise the amount of disturbance of the river bad and therefore minimise the number and size of the piers. Therefore a above deck solution was the preferred option which again considered that the presence of above deck structures have the potential to negatively impact on the landscape of the receiving environment

Traffic

Traffic volume directly influences and is linked to air quality and noise and vibration. Through these issues it is also linked to the impacts and benefits felt by the local population. The increased traffic as a consequence of bridge construction has a minor negative interaction with air quality and noise and vibration for the immediate local environment; whereas the predicted reduction in congestion and reduced travel times between Omeath and Warrenpoint produces positive interactions with population, air quality and material assets.

Noise and Vibration

Noise and vibration during the construction phase, especially during any necessary piling operations, has the potential for a temporary negative impact on human beings and material assets in the immediate vicinity. Construction noise and vibration will also impact bird usage of the area for both feeding and roosting and has the potential to impact fish movements. All of these issues have been identified and successfully mitigated.

Landscape and visual impacts

The visual impact of the completed bridge is closely related to cultural heritage, human beings and material assets and aquatic ecology. The bridge design choice was strongly influenced by the need to minimise the impact on the aquatic ecology and the need to avoid impacting undiscovered in-river archaeological remains. Equally it is felt that the dramatic nature of the bridge and unique opening mechanism will in itself have an impact on the economy of the area, and thus on Human Beings.

Construction Phase

Table 12.1 clearly shows that the Construction Phase has inter-relationships with the majority of environmental factors. Chapters 5 to 11 have identified that any negative environmental impacts occur during the construction phase can all be effectively mitigated. The completed scheme has been assessed as having primarily positive social, economic and environmental impacts.

Chapter 13

Mitigation Measures

Chapter 13 Mitigation Measures

13.1 General

Mitigation measures are the measures proposed in order to avoid, reduce or where possible remedy the significant adverse environmental effects of the proposed development. From the outset mitigation measures have been incorporated into the design of the proposed road and bridge. For example, Chapter 4 'Alternatives Considered' highlights that one significant reason for the choice of bridge design was the lack of interference it will have on the sensitive environment of the Newry River estuary and associated foreshore.

This section of the Environmental Impact Statement/Environmental Statement provides a summary of the mitigation measures/environmental commitments proposed. These measures cover both the construction and operational phases and will ensure that project does not have any significant negative environmental impact.

13.2 Traffic and Transport

The Narrow Water Bridge will not adversely affect the existing road network on the southside. The bridge is expected to beneficial to the R173 Omeath Road as the proposed Cornamucklagh Roundabout will act to calm traffic in the vicinity of the crossing. However, it is anticipated that, without management, traffic queuing on the north side when the bridge is open could extend onto the A2 roundabout. In order to remedy this situation and ensure the maintenance of a free flowing roundabout and A2 carriageway traffic management measures have been agreed with the Roads Service (Northern Ireland). These measures include road markings, signs and VMS signage (refer to Chapter 5).

The existing lay-by on the northbound carriageway of the A2 dual-carriageway is capable of accommodating any additional parking demand arising from the provision of the bridge, however, due to the difficulty in accurately assessing the parking demand associated with the scheme, it is recommended that the parking should be monitored by local authorities following completion of the bridge.

The proposed development will not result in any significant adverse impacts on traffic and transport during the construction or operational phases. Traffic management measures will be required at certain locations to mitigate against any construction impacts. The site entrances will be managed such that vehicles can access the site safely. Furthermore, temporary diversions will be required for the construction of the new roundabout on the R173 and the diversion of the existing culverts under the roundabout on the A2.

Bridge construction adjacent or over the navigational channel of the Newry River will need to be highlighted to marine vessels in accordance with the requirements of Warrenpoint Harbour Authority. In addition, the navigational channel will need to be closed while the opening span is being installed. It is intended to minimise this period of closure by assembling the rolling bascule section off site and transporting it directly to the site through Carlingford Lough. This minimises the time period to install the opening span over the navigational the channel and therefore, the period that the channel will be closed.

13.3 Human Beings

No specific socio-economic related mitigation measures are required for this project. Specific mitigation measures to protect the residential amenity of adjacent dwellings and sensitive receptors are proposed in other sections of the EIS/ES under all the various the chapters. Also at Detailed Design stage Louth County Council will continue to consult with the fishermen to ensure that opening times of the bridge are optimised to minimise disruption to their operations.

13.4 The Natural Environment

13.4.1 Terrestrial Ecology

The ecological impact assessment identified that the proposed road and bridge at Narrow Water is in an area of high nature conservation value. The area of foreshore is a candidate SAC in County Louth and an Area of Special Scientific Interest in County Down. Carlingford Lough SPA also occurs further up the lough.

The primary potential impacts highlighted by this study include minor loss of poor quality saltmarsh habitat on the Omeath foreshore, the temporary loss of a high tide waterbird roost site on the Omeath foreshore and the potential for avian collision against the bridge cables. There is no impact on the qualifying interest of the candidate SAC (refer Section 7.2).

The following comprehensive mitigation measures are proposed to minimise and avoid all such impacts:

Habitats

While the salt marsh at this site is of low quality and is not a qualifying habitat of Carlingford Shore cSAC, salt marsh is an Annex I habitat and therefore care is required to minimise loss and disturbance.

At the commencement of construction, the area required for the works will be identified and marked (by fencing) so that incursions by machinery or storage of materials on adjoining areas does not happen.

If entry to the site is required over adjoining intact salt marsh, the salt marsh will be covered with appropriate matting to minimise damage to the surface vegetation.

In general, salt marsh habitats are sensitive to erosion, which can result in slippage and release of sediments to the estuarine waters. Monitoring is required during and after construction in order to establish that no negative impacts in this regard have occurred. If this is the case then some remedial measures would be needed, possibly in the form of bunding or vegetation re-establishment. The salt marsh beneath the footprint of the bridge foundations on the Louth side will be cut out in sods, stored, and later used, as necessary, to repair the disturbed edges of the remaining salt marsh habitat and to encourage salt marsh regeneration. Storage of the sods should be at a nearby location (at an appropriate tidal height) and with vegetation side up.

Hedgerows and Trees

It will be necessary to compensate for the loss of trees and hedgerows through the planting of substitutes. These will be of native shrubs and trees and preferably of those species which have been lost. The following species are recommended for replacement planting:-

- Shrubs: hawthorn, broom, wild cherry, blackthorn
- Trees: sessile oak, rowan (mountain ash), whitebeam, ash, grey willow

(refer Chapter 8 for Landscape Planting detail and **Figure 8.7** Landscape Planting)

Birds

Creation of New High Tide Roost

As the proposed scheme will affect regular roosting sites for wintering waterbirds in this part of the Carlingford system, it is best practice to provide an alternative high tide roost.

In order to encourage the speedy adoption by the waterbirds of the man-made alternative island, it is recommended that the "new" island has the following characteristics:-

- is located within sight of the existing roosts;
- is in relatively sheltered waters, to reduce wave erosion of the substrate and provide roosting birds with protection from strong winds;
- is approximately the same size as the combined existing island and spit;
- is cut off from the mainland shore at high tides (neaps and springs);
- is flat-topped with gently graded edges;
- is constructed with a base of stones and cobbles similar in size to those at the existing island, with a top layer of silt planted/seeded with similar saltmarsh vegetation.

Furthermore, the constructed island should not occupy intertidal substrates which are themselves of value as feeding areas for waterbirds or of ecological value from a habitats perspective.

Taking into account the above criteria, it is proposed to construct the new roost site on the shore immediately to the south-west of the small beacon and at the landward side of the beacon. This intertidal area is stony, with a partial covering of fucoid seaweed, and was found in the 2008 and 2009 surveys to support few feeding waterbirds. Also, this part of the Newry River estuary is relatively sheltered and is close to and within sight of the existing roost sites. This location is such that the constructed island will be cut off from the mainland at high neap and spring tides.

The elevation of the constructed island should vary between 0.5 and 1.0 m above mean high spring tides, so that the waterbirds are not forced to move elsewhere during very high tides. This is the situation present on the existing saltmarsh island.
To reduce wave and current erosion of the edges of the constructed island, it is recommended that larger stones/cobbles be placed around the perimeter, while smaller material can be used to fill the interior.

The new man-made island will be constructed before bridge works commence (ideally one full winter beforehand), so that it is available as an alternative high tide roosting site as and when birds are disturbed from the existing roosting sites.

Disturbance During Construction

It is inevitable that some disturbance will be caused to birds during the construction period. It is considered that the nesting Grey Herons are the most sensitive species – to minimise the risk of significant disturbance to the herons and indeed the other breeding birds in Cillin Wood any necessary pile-driving operations will be carried out outside the early breeding season of the Grey Herons (March - May).

In order to minimise the disturbance of the overwintering waterbirds the construction of the northern and southern abutments, which will require direct access on to the foreshore, shall be completed outside of the main overwintering period.

Removal of Vegetation

To comply with the Wildlife Acts 1976 & 2000 (and the Wildlife (NI) Order 1985), clearance of vegetation in fields and hedgerows which would disturb breeding birds and destroy nests, eggs and chicks, will be carried out outside of the nesting season (1st March to 31st August).

Landscaping

Suitable native trees and shrubs shall be planted close to the link road to provide compensatory nesting, feeding and sheltering habitat for birds displaced by vegetation clearance. This planting shall be co-ordinated with the bat and landscaping mitigation measures.

Minimisation of Collision Risk

To reduce the risk to waterbirds (and other species) from collision with the bridge itself, and the towers, suspension cables and other fittings associated with the bridge, the entire structure will be lit at night (refer Chapter 3, Section 3.5.5) so that all elements of the structure are clearly visible to nocturnal flying birds. This will be provided in the form of architectural up-lighting which will be focused on the bridge structure and away from the river and adjoining areas of vegetation.

To minimise the potential collision risk to flying birds posed by the suspension cables during daylight, the cables will be light in colour (off-white) so that they are visible to flying birds.

Provision should be made to alter the lighting arrangements and/or add cable markers, should casualties be reported due to collisions.

Mammals

Mammal underpasses

Badgers typically follow the same pathways between setts, feeding areas and latrines. In most cases these pathways occur along features such as hedgerows, treelines, woodland edges and watercourses. To avoid unnecessary badger road casualties mammal underpasses will be constructed adjacent to regular crossing points on the proposed link road (refer **Figure 7.3**). Underpasses will be constructed in accordance with the NRA *Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes (2006).*

Badger/mammal fencing

Mammal resistant fencing will be required to guide badgers and other mammals to passage facilities and to prevent animals crossing the new link road. The specification for mammal resistant fencing is given in the NRA *Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes (*2006*)*. The location of the mammal resistant fencing required is shown on **Figure 7.3** in

Volume 3. Fencing will be recessed and tied into culvert and mammal underpass locations to guide badgers and other mammals safely under the road and prevent them accessing the road carriageway.

Bats

The trees which are present within hedgerows along the route are primarily immature Ash and as such are unlikely to contain the required hollows or crevices which bat species utilise as roost sites. Despite this, all such trees shall be inspected and surveyed by a bat ecologist in the Spring of 2011 to ascertain usage by bats and, where required, any necessary derogation licence shall be requested from NPWS and the licence conditions adhered to.

Linear features such as hedgerows and tree lines serve as commuting corridors for bats and the severance of such features by a new road can prevent movement of these animals between roosts or between roosts and foraging areas. As the planned link road will present a barrier between any bats in the southeast and the large woodland in the northwest, which is an obvious foraging area, both road sides shall be planted with hedgerows/tree lines and woodland copses (refer Chapter 8 for Landscape Planting detail). One area of planting will be allowed to develop to a minimum height of 4m to act as a 'fly-over' to ensure that commuting bats can cross high over the road avoiding collisions with traffic (refer to **Figure 7.3** in Volume 3).

Monitoring

As the works will affect habitats and species that are within an area designated for nature conservation and/or are listed in the Habitats Directive, monitoring is required both during and after construction.

Construction Phase Monitoring

A project ecologist shall be appointed to oversee the works during construction. At the commencement of works, the ecologist shall walk the site with the Project Engineer to highlight the conservation issues and to discuss implementation of the mitigation measures contained within the EIS.

The ecologist will visit the site, as considered necessary, when works are in progress. The main purpose of this will be to ensure that adjoining habitats are not being affected by the works.

A site survey will be carried out by the ecologist when works are near completion. Attention will be given to adjoining salt marsh areas to check for disturbance etc. – if necessary, remedial measures will be undertaken at this stage.

A report should be prepared by the ecologist to record the state of the site after works are complete.

Operation Phase

Habitats

The project ecologist shall inspect the site twice a year for 3 years period to determine the success of the mitigation measures and direct additional planting and maintenance as required. This shall be included for in the construction contract. Particular attention shall be given to recovery of shoreline vegetation and establishment of new plantings (as required).

Birds

The success of the new roost site shall be monitored for 3 years following construction. This shall involve two high tide counts per year to coincide with the review of the success of planting measures. If necessary, adjustments will be made to the design/construction of the roost to ensure it is serving its purpose.

Any reports of bird strikes with the bridge structure should be followed up and if these are regular, then remedial measures will be necessary and will be directed by a qualified ornithologist.

Badgers

The success of the mitigation measures for badgers will be monitored for a period after construction, and measures taken to enhance use of underpasses where required. Quarterly monitoring will be carried out to determine the success of the measures employed. Monitoring shall be continued for two years after construction ceases, in accordance with the *NRA Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes*.

In order to ensure that the long term effectiveness of badger resistant fencing and underpasses, these will require periodic maintenance in accordance with the *NRA Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes.*

Liaison with Statutory Bodies

NPWS and NIEA will be notified when works are due to commence and shall be informed if any unexpected issues arise during the course of the works. An annual monitoring report will be issued to both bodies with respect to the success of the mitigation measures and any further actions taken.

13.4.2 Aquatic Ecology

The issues of concern in terms of aquatic ecology were identified as water quality / aquaculture and fish migration.

Water Quality and Aquaculture

Carlingford Lough is a designated shellfish production site and as such contains licenced shellfish beds. The quality of the water is thus protected by the EC (Quality of Shellfish Waters) Regulations 2006, the essence of which makes it imperative that the construction and operation of the bridge does not result in significant sediment release which could impair water quality.

The cable-stayed bridge requires only a single small in-river pier and as such has minimal impact water velocity and sediment transport. In addition the construction methodology allows the bridge to be built in sections from the southern shore. These issues combine to direct that there is no requirement for specific mitigation measures in this instance.

Fishery Migration

The issue in this instance is the requirement to avoid preventing salmonids, eels or lamprey species migrating upstream. The piling required for the construction of the central pier could prevent this migratory movement. These operations will only be undertaken during normal working hours and as such will allow fish movement during at least half of the 24 hour tidal cycle. However in order to minimise any impact on fish movements, the in-river piling shall be undertaken outside of the main migratory periods. With respect to this, the contractor shall be required to submit their methodology and timing to and receive the agreement of the Loughs Agency.

<u>Mitigation Measures</u>

The following mitigation measures are proposed to prevent the occurrence of any pollution incidents:

- Throughout all stages of the construction phase of the project the contractor shall ensure that good housekeeping is maintained at all times and that all site personnel are made aware of the importance of the associated aquatic environment and the requirement to avoid pollution of all types.
- The storage of oils, hydraulic fluids, etc will be undertaken in accordance with current best practice for oil storage.
- Oil interceptors will be provided in order to prevent runoff of pollutants to river.
- An emergency plan to deal with accidental spills will be drafted.
- Any land drains or pipes served along the route will be connected into new pipes or ditches.
- The pouring of concrete, sealing of joints, application of water-proofing paint or protective systems, curing agents, etc will be completed in the dry to avoid pollution of the freshwater environment.
- All machinery operating in-stream will be steam-cleaned in advance of works and routinely checked to ensure no leakage of oils or lubricants occurs. All fuelling of machinery will be undertaken within the site compound. Steam cleaning will also ensure no accidental spread of invasive species into the river system or Carlingford Lough.
- The timing of In-stream works (including cofferdam erection and dismantling) shall be agreed with the Loughs Agency and will arranged to avoid impacting on the main estuarine migratory movements of salmon and lamprey (main upstream movement through the estuary considered as being June through October).
- Dredged spoil will be removed off site and disposed of under appropriate licence or permissions to an authorised spoil depository location.

13.4.3 Noise and Vibration

The Noise and Vibration Impact assessment identified that two properties in County Louth and one property in County Down would suffer minor increases in noise levels as a result of traffic using the road and bridge.

The use of 'low noise road surface' will reduce the noise impact by between 3 and 5 decibels which in each case brings the noise levels to within the recommended limits.

There are a number of mitigation measures which are considered appropriate and of good working practice for all construction contracts. These measures are detailed in BS5228 (1997), *Noise and Vibration Control on Construction and Open Sites*, and are summarised below. These guidelines should form the basis of control and limiting of potential impact to noise sensitive locations.

Choice of Plant

The contractor should take note of the control measures for relevant plant listed in BS5228 and apply the appropriate measures where practicable. These measures should include:

- Positioning of static plant as far as possible from residential properties, and utilising available screening by temporary structures, stock piles, etc.

- Use of well maintained plant, and where possible new plant manufactured under more strict EC guidelines for manufacturers.
- Substitution of unsuitable plant.
- Maintenance of silencers and moving components.

Screening

Temporary screening using sandbags, 20mm plywood sheeting or similar dense boarding may be required to reduce impact of static machinery or extensive works close to noise sensitive locations. Such measures can be best assessed during the contract by monitoring.

Monitoring

It would be appropriate to conduct noise monitoring of construction during noisy or extensive works at locations close to residential properties. Where the permitted noise levels are exceeded the appropriate screening will be put in place. Measurements should be conducted using a Type 2 or better sound level meter to check on the continuing impact of the works.

With regard to vibration, vibration levels will be monitored at the beginning of the pile driving process to ensure that levels at the most proximate properties and structures does not cause damage.

Appointment of a Responsible Person

It is recommended that the contractor should appoint or delegate a ‘responsible person’ who will be present on site and who will be willing to answer and act upon queries from the local public.

Night Works

It is not anticipated that the contract will require any construction works to take place outside normal hours. However there may be items of plant (e.g. dewatering pumps and similar) in use during night-time hours. They should be chosen, sited and enclosed such that levels at the nearest properties do not exceed 45 dB L_{Aeq}. This level is based on the World Health Organisation criteria for undisturbed sleep, and assumes a resident may have a partially open window.

13.4.4 Air Quality and Climate

Construction Phase

Due to the size and nature of the construction activities exhaust emissions will have a negligible impact on local air quality and on climate.

A dust minimisation plan will be formulated for the construction phase to control and minimise potential dust emissions.

Operational Phase

In relation operational aspects of road schemes, emissions of pollutants from road traffic can be controlled most effectively by either diverting traffic away from heavily congested areas or ensuring free flowing traffic through good traffic management plans. No mitigation measures are thus required or recommended.

13.4.5 Soils, Geology and Hydrogeology

In general, the temporary and permanent impacts on soils, geology and hydrogeology are considered minimal and will be managed by a number of best practice control measures including:

- All suitable material excavated within the cut sections shall be used to the greatest possible degree as fill material on the development.
- All unsuitable material excavated shall be disposed of in accordance with legislative requirement with due regard for the impact on the disposal site. Where possible this material will be utilised in landscaping of the development.
- Embankment and cut slopes which are considered at risk from erosion are to be topsoiled and seeded as soon as possible to prevent the deterioration due to weathering effects.
- Potential pathways for surface pollution by road surface water runoff will be mitigated by means of a suitable drainage system, from approximately Chainage 250 to 300 in particular.
- It is likely that a clay liner or geosynthetic membrane could be utilised between Chainage 250 and 300 to reduce the potential for contamination of soils and groundwater by petrol or other contaminants.
- All topsoil and any pockets of organic material will be removed from the proposed route prior to construction. Where construction of earthworks on soft ground is required at the northern riverbank, excavation of soft soil materials will be required prior to placing any embankment fill materials.
- Topsoil will be removed from all temporary access roads in advance of construction and stored. For the permanent condition reinstatement the underlying soil will be scarified and the topsoil will be replaced and seeded following the removal of temporary works.
- Appropriate drainage will be provided to collect seepage water and slope angles provided suitable for materials in side slopes.
- Monitoring of groundwater installations to be undertaken at construction stage.
- A geotextile screen and boom with oil barrier will be required around marine works to prevent runoff, silt, oil or other deposits generated by construction activities such as boring in overburden or rock from polluting the river.
- A monitoring programme for sampling and testing of suspended solids and turbidity in the Newry River during any such construction activities.
- Replacement of soils in tidal ranges with general granular Class 1 or select granular Class 6A fill is proposed, with appropriate geotextile separation and rock armour shoulders to the embankment.
- Avoidance of excavation and removal of potentially contaminated soils where alternative engineering solutions can be used in the proposed development to ensure the existing ground is capable of providing adequate formation to access roads over potentially contaminated ground.
- Where soft cohesive alluvium, gravels and boulders are present, proof-rolling may be used to confirm whether the soils need to be removed or if they may remain in place subject to detailed design.

13.5 Landscape and Visual Impact

Bridge Design

Given the nature of the project, consideration of mitigation has been a significant aspect of the project design and as such the proposal incorporates a number of design elements to minimise the landscape and visual impact of the project. These elements include:

- An alignment that is near perpendicular to the river centerline, which is thereby shorter and a more visually natural bridging
- A tie-in to an existing roundabout on the A2 on the northern side of the river, thereby reducing impact on shore and surrounding area;
- Siting the bridge adjacent to and avoiding impact on the wooded promontory of Ferry Hill. In this way the wooded hill provides a visual foreground/background anchor for the main tower on the southern side of the bridge. This effect is clearly illustrated in the Photomontages;
- Minimising and down-sizing the number of piers and apparent mass of the structural components, thereby decreasing adverse visual impacts on views along the river/lough; and
- Incorporation of a signature bridge design with inclined towers and a unique opening mechanism.

As such cognisance was taken of the significance of the landscape setting and it was considered that the landmark bridge best:

- acknowledges and reflects the recognised scenic and visual qualities of its wider setting;
- provides an iconic structure that will assist in the development and realisation of co-ordinated and focused amenity, landscape and recreation objectives and policies for the significant landscape resource of the Cooley Peninsula and the South Down landscapes;
- marks a location of a clear transition between inland river valley and open coastal inlet;
- defines a boundary to westward extension of visually detracting port, port-related and mixed-use development along the shore towards Narrow Water Castle at Warrenpoint;

The visual profile of the bridge is fundamental to how the bridge will be perceived within the landscape. At a basic level the bridge comprises two towers with a thin cable-stay supported deck. Undoubtedly, the most significant physical elements of the proposal are the towers, which have been designed to reflect the nature of the adjoining landscape. The main tower located on the south shore is a tall structure inclined back towards the higher uplands of Anglesey Mountain. By contrast the northern tower is low and more in-keeping with the rolling hills of the northern shore. Between them the towers frame an open vista east 'to the sea' and west to the 'incised river valley'. This open vista is enhanced by the thin cable-stay supported deck, which requires only a single thin pier within the river channel.

The proposed location was selected for a variety of reasons, including its proximity to the wooded promontory of Ferry Hill, which provides a visual anchor for foreground and background views, (views east and west respectively) of the base of the main tower.

Treatment of Bridge Embankments

The bridge embankments on the northern side of the crossing are open in views from the A2 and Narrow Water Castle. The areas shall be sensitively contoured into tie-ins with the retained shoreline and seeded to a coastal and locally appropriate grass seed. Locally appropriate planting shall also be use to soften the engineered aspects of the embankment and to provide for added diversity.
On the southern embankments it is proposed to plant groups of scrub/shrub within a locally appropriate grassland mix on the slope. This will help to anchor the end of the bridge and low scrub is already a characteristic of the shores of Carlingford Lough.

Treatment of Approach Road

While the bridge ties-in directly to the existing roundabout on the A2 on the northern shore, a section of approach road is required to be constructed across pasture lands on the southern side. The southern approach road is located to the east of the wooded Ferry Hill and passes close to existing residential property. The full extent of cut and fill slopes along the road will be planted as a ribbon copse of low-canopy woodlands interlinked with locally appropriate thorn hedgerows. A more mature planting is to be provided as a bat 'flyover' where the scheme severs a hedgerow on the southern side of the lough.

Planting specification

The proposed planting will generally be established with 'bare root transplants', 'whips' and 'feathered trees' which adapt readily to disturbed ground conditions. The low-canopy woodland shall comprise 60% tree and 40% shrub species. The tree mix shall be 50% transplants, 50 and 75cm high; 30% whips, 100 to 120cm high; and 20% feathered trees of between 175 and 200cm high. All tree species shall be planted at 120cm centres. The shrub mix shall use locally appropriate thorn, willow etc. of between 40 and 60cm high. All shrub species shall be planted at 90cm centres.

Tree species utilised will be selected from a list, which will include alder, birches, ash, oak, scot's pine and willows and other plants found naturalised in the locality. Shrub planting species utilised will be selected from a list, which will include blackthorn, hawthorn, hazel, willows, gorse and other plants found naturalised in the locality.

Hedge planting will be primarily of blackthorn and hawthorn at 90 – 120cm high planted at 50cm centres within two staggered rows The hedge shall be planted with ash trees of 'standard size' to be randomly-spaced but averaging 1 tree / linear metre.

Shrub planting areas on the bridge embankments shall be of locally appropriate species, 50-75cm high, planted at 90cm centres, planted so as to cover a minimum of 50% of the slope.

General grass seeding areas to be topsoiled and seeded with a low maintenance mix. Otherwise locally appropriate seed mixes shall be used.

13.6 Material Assets

Agricultural

Four agricultural holdings will be affected by the proposed Narrow Water Bridge Project. However on none of these the agricultural impact will be severe or major.

Measures to compensate farmers due to land acquisition, drainage works and loss of facilities will be agreed by the valuer following planning approval.

Commercial

Leading Lights

The link road and bridge abutment in County Louth has the potential to have an impact on the operation of this leading light navigation system by interrupting views of one of a pair of stone navigation beacons (see **Figure 3.2** in Volume 3). To mitigate this impact Carlingford Lough Commission and Warrenpoint Harbour Authority have been consulted with respect to the acceptability of relocating this light and to the proposed location and design of any new required structure. Louth County Council therefore proposes to construct a new leading light to the south of the bridge and to the satisfaction of WHA and CLC prior to the construction of the southern tower. See **Figure 3.2** in Volume 3.

Carneyhaugh Properties Ltd.

Carneyhaugh Properties Ltd control the land shown in Plate 9.1 below and in 2010 received outline planning permission for a mixed use development. The proposed development as described within the outline application includes for provision of a hotel and restaurant, residential units and office and retail units. The property group have stated their full support of the project and have cooperated in the design of the Control Building and access as the proposed scheme will enhance their development. *(It should be noted that leave has been sought by Warrenpoint Harbour Authority for a judicial review of the decision to grant outline permission).*

The location and construction of the control building and access (refer to **Figure 3.2** in Volume 3) will result in a minor loss of lands over which outline planning permission has been granted for the proposed mixed-use development. The design and location of the Control Building and the access has been agreed with Carneyhaugh Properties Ltd. Finishes will be as per **Figure 3.16 to 3.19** in Volume 3 and will be sympathetic to the proposed development.

Foreshore

Two small areas of foreshore are required for construction of the two main bridge embankments. In both instances the foreshore is not occupied for any financial purpose and as such the impact is not considered significant.

In County Louth these land are deemed to be in the control of the state (Department of the Environment, Community and Local Government have been identified as owner or reputed owner in the Compulsory Purchase Order.).

Further works on the foreshore in County Louth is required for the construction of the new Leading Light and for the proposed new roost site.

In County Down the Foreshore is owned by The Crown Estates. In this instance the area of foreshore is under lease to Newry and Mourne District Council. This area of foreshore will be acquired under a Vesting Order issued by Roads Service NI, or by agreement where possible.

13.7 Cultural Heritage

Given the archaeological sensitivity of the environs of the line of the proposed bridge, non-invasive pre-development testing has been carried out in accordance with mitigation measures as stipulated by the Heritage authorities in NI and ROI. This pre-development testing took the form of geophysical, non-invasive surveys within the riverine line of the proposed route and within the terrestrial line of the project. These surveys have been carried out by appropriate specialists who have made recommendations for further work.

Marine Investigations

The marine geophysical survey carried out within the riverine line of the proposed route revealed several target features of interest. These include upstanding features and buried metallic objects. The nature of these target features is currently unknown and it is recommended that they are subject to archaeological diver inspection prior to construction work commencing (ADCO, 2010).

Additionally, the geophysical survey cannot claim to fully identify material of archaeological significance as the ability for different materials, both buried and exposed, to provide a suitable reflection for deployed geophysical devices does vary. Given this, it is recommended that archaeological diver inspection takes place within the section of river bed selected for development.

It should be noted that the marine geo-physical survey did not cover the mudflats and inter-tidal areas on either bankside. These areas will be impacted upon by the proposed development and, as such, it is recommended that these areas are subject to intertidal survey. Any features observed during the inter-tidal survey should be measured and described in detail with the archaeological record supported by photographic and metrically-accurate survey.

The construction of the embankment on the County Louth side of the proposed bridge has the potential to impact on part of the 19th century training wall within that location. It is, therefore, recommended that this section of the training wall is recorded by photography and metrically-accurate survey prior to disturbance.

The line of the proposed new bridge may interrupt views between the existing leading lights (LHS002-007 & LHS002-008). The leading lights are operational navigational beacons constructed during the 1880s which have since been included on the Record Protected Structures for County Louth. Neither leading light (LHS002-007 & LHS002-008) will be impacted upon by the proposed development though the leading light (LHS002-008) is located in close proximity to the north of the proposed bridge.

The siteworks associated with the construction of the bridge could potentially impact upon the leading light (LHS002-008). As such, it is recommended that appropriate mitigation measures are put in place to protect the leading light (LHS002-008). These mitigation measures should be agreed in advance with the appropriate statutory bodies but will include an exclusion zone being created around the leading light (LHS002-008). This exclusion zone would be defined by semi-permanent fencing which would physically prevent access to the immediate environs of the leading light (LHS002-008) thereby protecting the feature against accidental damage during siteworks.

Given the impact upon the line of sight between the navigational beacons, it is proposed that a new navigational beacon will be constructed to the south of the bridge to fufill the function currently carried out by leading light (LHS002-008). The construction of the new navigational beacon will involve groundworks within the intertidal zone that have the potential to impact upon any archaeological features or artefacts that may exist within the footprint of the beacon. Given this, it is recommended that groundworks associated with the new navigational beacon are carried out under the constant supervision of a suitably qualified archaeologist under licence to DoAHG.

Terrestrial Investigations

The terrestrial line of the project was also subject to geophysical survey which revealed a number of responses across the survey area (Leigh, 2010). The nature of these responses is uncertain and it is possible that they represent archaeological features.

Given this, it is recommended any potential features noted by geophysical survey should be resolved with archaeological testing prior to development work starting. This should include the broad area of magnetic disturbance associated with the former railway line as this modern disturbance could potentially mask the magnetic responses of archaeological features.

As with marine geophysical survey, terrestrial geophysical survey cannot claim to fully identify material of archaeological significance with the result that unidentified sub-surface archaeological features could potentially exist in situ. Given this, it is also recommended that the terrestrial line of the proposed link road and compound be top soil stripped under archaeological supervision before development work commences.

This top soil stripping should be carried out by a backacting excavator equipped with a toothless bucket which is under the constant supervision of a suitably qualified archaeologist under licence to DoAHG (formerly DoE: HLG).

Topsoil should be removed until either glacial subsoil or the top of archaeological features are encountered.

13.8 Construction Phase

The contract for the construction of the road scheme will include provisions to minimise any temporary nuisance that may occur and the management of the construction site. The undertaking of the works will be monitored to ensure compliance with the requirements of the contract. Such measures will include restricting site working hours and noise levels (refer to the mitigation measures outlined in Section 7.4 Noise and Vibration) and provision of engineered temporary traffic management schemes.

Temporary Traffic Management

In order to minimise inconvenience to road users, the contract will require the contractor to put in place measures to maintain all roads and accesses affected by the works, or their replacements, and to maintain traffic flows and existing accesses until such time as the permanent works have been completed. As the proposed road and bridge are primarily off line there should be minimal severance or disruption for the local community.

The most significant impacts to traffic flows will occur at the tie-ins at both ends of the scheme, where new road construction / roundabouts etc. could cause disruption to traffic. Temporary traffic management and careful planning of the works will be required to minimise this disruption. This will be agreed with the relevant authorities prior to commencement (Louth County Council; The Roads Service).

Temporary Community Severance

As stated the primary impact will occur during construction of the roundabouts at the tie-ins. It is envisaged that it will be possible to manage the construction process so as not to cause any temporary severance or separation of communities from existing facilities or services. Disruption due to traffic management will occur but this will be minimized as far as possible.

Temporary Land Severance

As outlined in Chapter 9, a number of farms will be affected by the scheme. However no severance, either permanent or temporary, will occur as a result of the land acquisition (refer **Figure 9.1** in Volume 3).

Site Security and Public Health

Both the site compound and the bridge construction site will be provided with permanent boundary treatment from the outset or where this is not possible with temporary secure fencing. This is essential to protect the public from the works which will, at stages, be highly dangerous elevated structures over the Newry River and inter-tidal area.

Impact of Construction on Public Utility Services

As highlighted above (11.3.5) some alterations and diversion works will be required to the existing utility services as a result of the scheme. This may cause a small interruption to some local services and in the case of the diversion of the drainage culverts, significant traffic management. These will be planned in advance and agreed with the authorities directly affected.

Impact on Navigation

Prior to the main tower construction works on the southern shore it is important that the new navigation beacon is constructed so that navigation into Warrenpoint Harbour and up the Newry River is not affected by the obstruction of the existing beacon. The new beacon has been designed to imitate the existing beacon whose function it will replace, however Warrenpoint Harbour Authority and Carlingford Loughs Commission will be consulted through the design and construction process to ensure their requirements are met.

Mitigation Measures for Construction Operations

The main mitigation measures to minimise impacts arising from construction will be:

- Disturbance for Terrestrial Ecology: Construction activities will involve disturbance of a roosting area for Waterbirds and limited impact on inter-tidal habitat. Mitigation measures will be adopted as outlined in Section 7.2 of Chapter 7.
- Aquatic Ecology: Pollution control measures as outlined in Section 7.3 of Chapter 7.

- Construction Noise and Vibration: Controls on noise and vibrations from heavy earthmoving equipment and rock excavation as outlined in Section 7.4 of Chapter 7.
- Earthworks and Waste: Measures to reduce the amount of construction waste generated and the potential impact of contaminated materials on the project is dealt with in Chapter 7.6.
- Air Quality: Dust Minimisation Plan as outlined in Section 7.5 of Chapter 7.
- Disturbance of Existing Drainage Culverts: Temporary drainage will be provided until such time as the permanent drainage facilities are in place.
- Cultural Heritage: Mitigation measures as outlined in Chapter 10.

The contractor will be required to prepare a Waste Management Plan and an Environmental Operating Plan prior to construction commencing. In addition the appointed contractor will be required to prevent, as far as is possible dirt being released onto public roads. In the event that site traffic leaves dirt on the road the Contractor will be required to clean the road.

All of the above mitigation measures will be tied into all contract documents and it will be a requirement of the Main Contractor to adhere to all of these mitigation measures and any further measures required as part of the planning conditions.