

PART III

ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES

8 AIR QUALITY

8.1 INTRODUCTION

This section of the EIS describes the baseline air quality and gives an assessment of the potential impacts of the proposal on air quality in the vicinity of the Ulster Canal from Upper Lough Erne to Clones.

8.2 LEGISLATION AND POLICY

The Air Quality Strategy for England, Scotland, Wales and Northern Ireland was first published in January 2000. This Strategy established a framework for achieving further improvements in ambient air quality in the UK to 2003 and beyond. The latest Air Quality Strategy for England, Scotland, Wales and Northern Ireland was published in July 2007. This Strategy sets out air quality standards and objectives, which have been set to measure the improvement of air quality. A summary of the current National Air Quality Strategy objectives is given in **Table 8.1**.

Table 8.1: National Air Quality Strategy Objectives (Air Quality NI, 2011)

Pollutant	Air Quality Objective		To be achieved by	Area
	Concentration	Measured as		
Benzene	16.25 µg m-3	Running annual mean	31-Dec-03	All authorities
	3.25 µg m-3	Running annual mean	31-Dec-10	Scotland and N. Ireland
1,3-Butadiene	2.25 µg m-3	Running annual mean	31-Dec-03	
Carbon Monoxide	10.0 mg m-3	Max daily running 8-hour mean	31-Dec-03	England, Wales and N. Ireland
Lead	0.5 mg m-3	Annual mean	31-Dec-04	
	0.25 mg m-3	Annual mean	31-Dec-08	
Nitrogen Dioxide	200 µg m-3 not to be exceeded more than 18 times a year	1-hour mean	31-Dec-05	
	40 µg m-3	Annual mean	31-Dec-05	
Particles (PM10) (gravimetric)	50 µg m-3, not to be exceeded more than 35 times a year	24-hour mean	31-Dec-04	All authorities

	40 µg m-3	Annual mean	31-Dec-04	
Particles (PM2.5) (gravimetric)	25 µg m-3 (target)	Annual mean	2020	All authorities
	15% cut in urban background exposure	Annual mean	2010 - 2020	
Sulphur dioxide	350 µg m-3, not to be exceeded more than 24 times a year	1-hour mean	31-Dec-04	
	125 µg m-3, not to be exceeded more than 3 times a year	24-hour mean	31-Dec-04	
	266 µg m-3, not to be exceeded more than 35 times a year	15-minute mean	31-Dec-05	
PAH	0.25 ng m-3	Annual mean	31-Dec-10	
Ozone	100 µg m-3 not to be exceeded more than 10 times a year	Daily maximum of running 8-hour mean	31-Dec-05	

These objectives have been most recently transposed into law through S.R. No. 188 of 2010, The Air Quality Standards Regulations 2010, which came into force on the 11th June 2010 (National Archives, 2010), revoking The Air Quality Standards Regulations 2007. This legislation enacts a different Calendar Year Limit Value for Benzene (5 µg m-3) than in the Air Quality Strategy.

Air quality legislation in Ireland is derived from The Clean Air For Europe (CAFE) Directive (2008/50/EC), which was published in May 2008, and is now entered into force and replaces the Air Quality Framework Directive and the first, second and third Daughter Directives. The fourth Daughter Directive (2004/107EC) will be included in CAFE at a later stage. **Table 8.2** gives the limit values of CAFE Directive 2008/50/EC (EPA, 2010). These limits for specific pollutants are defined in order to protect our health, vegetation and ecosystems. The CAFE Directive was transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011). It replaces the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), the Ozone in Ambient Air Regulations 2004 (S.I. No. 53 of 2004) and S.I. No. 33 of 1999.

Table 8.2: Limit values and Alert Thresholds of CAFE Directive 2008/50/EC

Pollutant	Limit Value Objective	Averaging Period	Limit Value ug/m ³	Limit Value ppb	Basis of Application of the Limit Value	Limit Value Attainment Date
SO ₂	Protection of human health	1 hour	350	132	Not to be exceeded more than 24 times in a calendar year	1 Jan 2005
SO ₂	Protection of human health	24 hours	125	47	Not to be exceeded more than 3 times in a calendar year	1 Jan 2005
SO ₂	Protection of vegetation	Calendar year	20	7.5	Annual mean	19 July 2001
SO ₂	Protection of vegetation	1 Oct to 31 Mar	20	7.5	Winter mean	19 July 2001
SO ₂	Alert Threshold	1 hour	500	-	Public to be informed if threshold exceeded for 3 consecutive hours	-
NO ₂	Protection of human health	1 hour	200	105	Not to be exceeded more than 18 times in a calendar year	1 Jan 2010
NO ₂	Protection of human health	Calendar year	40	21	Annual mean	1 Jan 2010
NO + NO ₂	Protection of ecosystems	Calendar year	30	16	Annual mean	19 July 2001
NO ₂	Alert Threshold	1 hour	400	-	Public to be informed if threshold exceeded for 3 consecutive hours	-
PM ₁₀	Protection of human health	24 hours	50	-	Not to be exceeded more than 35 times in a calendar year	1 Jan 2005
PM ₁₀	Protection of human health	Calendar year	40	-	Annual mean	1 Jan 2005
PM _{2.5} - Stage 1	Protection of human health	Calendar year	25	-	Annual mean	1 Jan 2015
PM _{2.5} - Stage 2	Protection of human health	Calendar year	20	-	Annual mean	1 Jan 2020
Lead	Protection of human health	Calendar year	0.5	-	Annual mean	1 Jan 2005
Carbon Monoxide	Protection of human health	8 hours	10000	8620	-	1 Jan 2005
Benzene	Protection of human health	Calendar year	5	1.5	-	1 Jan 2010

8.3 METHODOLOGY AND GUIDANCE

This air quality assessment is prepared using the advice in the “Guidelines on the information to be contained in Environmental Impact Statements” (EPA, 2002) and the “Advice Notes on Current Practice” Project Type 10– Inland Waterways and Ports (Infrastructure Project Type 10F) (EPA, 2003).

8.4 BASELINE CONDITIONS

The following sections summarise the local and regional climatic conditions and landscape, and the main environmental designations, sensitive receptors and background air pollution levels within the vicinity of the proposed navigation.

8.4.1 Climate

The climate of the island of Ireland can be defined as being a Temperate Oceanic or Temperate Maritime Climate, which is similar to that of most of north west Europe. The Ulster Canal from Upper Lough Erne to Clones is in the mid north of the island. The annual average temperature in Clones is 8.8°C, with monthly mean temperatures of 14.5°C and 14.2°C in July and August and 4.0°C and 4.2°C in January and February. The area receives on average 928.3mm of rainfall per annum, with 56% (517mm) of that rainfall occurring during the navigation season of April – October. Statistically at Clones (1961-1990) the driest month of the year is April, which averages only 55.9mm, and the wettest month is October which averages 97.3mm of rainfall. Annual mean wind speeds at Clones are 8 knots, with gusts up to 87 knots being recorded. The annual average evaporation rate at Clones (1971 - 2000) is 687.6mm, with the highest average evaporation of 108.3mm in June and the lowest average evaporation of 12.7 mm in December.

8.4.2 Landscape

The landscape in the close proximity of the proposed navigation from Upper Lough Erne to Clones is made up mainly of waterways and lowland drumlins. The proposed canal length between Gortnacarrow and Clones is generally the same at an elevation of about 49m OD, while drumlin tops in the area are generally around 70m elevation. Further afield the entire navigation length is surrounded on all sides by higher ground, to the west the Cuilcagh Mountains (666m), to the north Slieve Beagh (370m), to the east the higher ground at Cavanagarvan (200m), and to the south Slieve Glah (319m). The lowest lying area near to the canal is Upper and Lower Lough Erne to the north west of Gortnacarrow.

8.4.3 Sensitive Environments & Local Receptors

Within the proximity to the canal line between Gortnacarrow and Clones there are few sensitive receptors. The majority of the receptors present along most of the line are residents of single

dwelling and livestock in farm buildings, while at Clones there is a higher density of residential, social and commercial properties. In the vicinity of the River Finn navigation stretch there are once again few human receptors, however there are protected environmental designations (Upper Lough Erne SAC and SPA) that contain habitats or species that may be sensitive to air pollution.

8.4.4 Background Air Pollution

In close proximity to the canal, within Northern Ireland, there are no automatic air quality monitoring stations, with the nearest two being at Lough Navar and at Armagh. The Northern Ireland 2008 Background Air Quality Maps¹ give a predicted nitrogen dioxide and particulate matter (<10µm) concentration for every square kilometre in Northern Ireland. An average of all the values within one kilometre of the canal and river navigation sections is given in **Table 8.3**. This table shows the area to have very low background air pollution for the current year and the potential earliest year of opening (2014), with all values well within the guidelines of the Air Quality Strategy 2007 for England, Scotland, Wales and Northern Ireland, and the Limit and Threshold values of the CAFE Directive.

Table 8.3: Average Predicted Background Air Pollutant Concentrations

Location	Year	Nitrogen Dioxide µg m-3	Particles (PM ₁₀) µg m-3
Canal Section	2011	2.84	8.43
	2014	2.50	8.24
River Navigation	2011	2.72	8.37
	2014	2.42	8.19

For air quality monitoring in Ireland, Counties Cavan and Monaghan are grouped into Zone D by the EPA, which are all areas outside Dublin (Zone A), Cork (Zone B), and the 15 biggest towns in Ireland (Zone C). In 2010 the Air Quality in Ireland Report² found that for the key indicators of SO₂, NO₂, PM₁₀, Ozone, Lead, Benzene and Carbon Monoxide, Zone D was meeting target values.

The nearest real-time monitoring station in Ireland to the study area is at Kilcrist in County Monaghan, which is located in the Kilcrist water treatment works. This is a rural setting with little traffic or other influences on air quality. The results of the real-time monitoring station at Kilcrist feed into the Zone D air quality classification. **Table 8.4** shows the recorded annual average pollutant concentrations at Kilcrist Co. Monaghan.

¹ Northern Ireland Air, 2009. <http://www.airqualityni.co.uk/>

² EPA, 2010. *Air Quality in Ireland 2010, Key Indicators of Ambient Air Quality*.

Table 8.4: Kilkitt Air Pollution Concentrations 2010

Pollutant	Annual Mean Pollutant Concentration	Limit Value
SO ₂	2 µgm ⁻³	20 µgm ⁻³ (Protection of vegetation)
NO ₂	3 µgm ⁻³	40 µgm ⁻³ (Protection of human health)
NO _x	4 µgm ⁻³	30 µgm ⁻³ (Protection of vegetation)
PM ₁₀	10 µgm ⁻³	40 µgm ⁻³ (Protection of human health)
O ₃	59 µgm ⁻³ (with no 8-hr mean limit exceedances)	Max ozone daily 8-hr mean limit: No more than 25 days > 120 µgm ⁻³

The environs of the study would generally have good air quality, as there are few industrial operations, few busy roads and there is a low development density, therefore few anthropogenic pollution sources. As the land surrounding the Ulster Canal, from Upper Lough Erne to Clones is mainly of semi natural and improved grassland it will be acting as both a source and a sink for green house gas (GHG) emissions by potentially having methane emissions from livestock and wetlands, nitrous oxide emissions from agriculture, yet also having carbon dioxide sequestering from the vegetation.

Fermanagh District Council has not declared any Air Quality Management Areas (AQMA's), with the nearest AQMAs being at Church Street in Dungannon and Lonsdale Road in Armagh, which are approximately 26 miles east and 30 miles north east of Clones respectively. The development will therefore have no impact on any AQMA's.

Consultation with Fermanagh District Council and Monaghan County Council revealed that there were no known air quality issues in the area of the proposed navigation development.

8.5 DUST

Large fraction particulate matter (>10µm) may be classed as a nuisance and is principally caused by construction works, road traffic and natural processes. There are no Irish limit values for ambient dust deposition of nuisance dust, however internationally there are a number of guidelines used, such as the German TA Luft Guidelines (2002), which gives a mass deposition value of 350mg/m²/day (annual average) for *Possible Nuisance*, while in the UK there is a general “unofficial” guideline of *Nuisance Dust* of 200mg/m²/day (annual average) used, whereas levels above this should trigger an action by the operator to mitigate the dust source.

8.6 ROAD TRAFFIC

RPS carried out a Traffic Assessment (TA) to assess the impact on the local road network of the restoration of the Ulster Canal from Upper Lough Erne to Clones, which can be found in **section 16** of this document. Traffic has the potential to negatively impact upon air quality through exhaust emissions and the loads that it may be carrying. There is the potential for effects on air quality if the traffic composition changes, there are average road speed changes, there are alterations to road layouts, or most importantly if there are changes in traffic numbers.

8.6.1 Construction Road Traffic

It has been assumed that all construction road traffic will be accessing the site from the A3/N54 Cavan Road. It has been estimated within the TA that the planned construction will require an additional 80 HGV trips over a working day over a 3 year period for delivery of construction materials and for the removal of unsuitable spoil material from the site. It was assumed that HGVs arrive full and leave empty, or arrive empty and leave full, to provide a robust assessment. This equates to a total of 160 personal car unit trips per day. These vehicle trips were all calculated as going on and off the A3/N54 Cavan Road from the construction working strip via five access points.

For scoping of an air quality assessment due to traffic emissions the Design Manual for Roads and Bridges (DMRB, 2009) classifies affected local roads as being those that meet any of the following criteria:

- Road alignment will change by 5 m or more; or
- Daily traffic flows will change by 1,000 AADT or more; or
- Heavy Duty Vehicle (HDV) flows will change by 200 AADT or more; or
- Daily average speed will change by 10 km/hr or more; or
- Peak hour speed will change by 20 km/hr or more.

As this proposal is not anticipated to affect the local road network by any of the above criteria, the development would be considered to be neutral in terms of air quality and no further assessment on construction traffic would be required.

8.6.2 Operational Road Traffic

There is only anticipated to be a slight increase in annual road traffic to the canal once operational, which would mainly be during the navigation season of April to October. The TA in **section 16** estimates an additional 108 trips per day at the Gortnacarrow access and 144 trips per day at Clones Marina. As per the DMRB information within the above **section 8.6.1** this insignificant increase in

operational road traffic is unlikely to have any negative impacts on air quality within the area and therefore no detailed modelling assessment has been undertaken.

8.7 NAVIGATION ACTIVITIES

8.7.1 Construction Activities

Emissions from plant and other mechanical equipment on-site during construction should only have short term and very localised impacts on air quality. Provided the on-site plant and equipment is modern and maintained, there should be no significant negative impacts on air quality from their exhaust gases. Dust and emissions from construction activities can be avoided or managed through adherence to the dust mitigation measures presented later in this section, which should form part of a Dust Minimisation Plan that should be implemented throughout the construction phase of the project.

8.7.2 Operational Activities

With the introduction of the proposed navigation and marina there will be an obvious increase in vessel numbers in the area, as vessels have been unable to access this stretch of navigation for almost 100 years. The UK Guidance on Local Air Quality Management LAQM TG (09) (DEFRA, 2009) recommends that detailed assessment of air quality impacts from ports is required only for large ports with more than 5,000 shipping movements per year which have a relevant public exposure within 1km of berthing and manoeuvring areas. It was estimated in the 2006 socio-economic report for the canal (PWC, 2006) that there would be approximately 40 boats permanently on this stretch of navigation and another 600 visiting boat movements per year. In total there has been estimated to be 1,210 boat movements per year through the Gortnacarrow lock gates. The emissions from these slow travelling cruisers, narrow boats, and open boat types will not cause any significant increase in air pollution within the area and do not warrant any further detailed investigation.

8.8 SUMMARY OF IMPACTS

The potential air quality issues associated with the proposed development include:

- Nuisance dust and Particulate Matter (PM₁₀) from construction activities;
- Traffic-derived air pollution and dust from transport during construction.

The potential consequences of these issues are:

- Increased dust and traffic-derived pollutions can negatively impact on amenity, visual and health aspects of local receptors during the construction period.

Quantities of dust may be generated during construction of the canal and marina. Most nuisance dust generated will be deposited close to the source, however smaller dust particles may disperse further from the site. The distances where likely impacts are expected from construction sites are outlined in **Table 8.5**. The risk of dust impacts occurring during construction can be reduced quite simply with good site management practices. It will be important that any construction works at Gortnacarrow, in the vicinity of the River Finn, are well managed to ensure that excessive levels of dust are not deposited in the waterway.

Table 8.5: Assessment criteria for the impact of dust from construction, with standard mitigation in place, NRA 2006.

Source		Potential distance for significant effects (distance from source)		
Scale	Description	Soiling	PM10*	Vegetation effects
Major	Large construction sites, with high use of haul roads	100m	25m	25m
Moderate	Moderate sized construction sites, with moderate use of haul roads	50m	15m	15m
Minor	Minor construction sites, with limited use of haul roads	25m	10m	10m

*Significance based on the PM₁₀ Limit Values specified in S.I. 271 of 2002, which allows 35 daily exceedances/year of 50 µg/m³

The increase in construction traffic along the canal line during the proposed construction will only have a localised temporary effect on the A3/N54 Cavan Road and should have no affect on air quality within Clones Town, or other nearby settlements. During the construction period and during canal operation any increases in pollutant concentrations on the local and regional road network should be insignificant.

8.9 MITIGATION MEASURES

Quantities of nuisance dust may be generated during construction, with most of this being deposited close to the source. The smaller the dust particle the more likely it is to disperse further from the site. However the risk of nuisance dust impacts from construction of the proposed reclamation can be quite simply reduced with good site management practices. A Dust Minimisation Plan should be formulated for the Construction Phase of the project. This construction Dust Minimisation Plan should include the following general dust and emission mitigation measures:

- Site roads will be regularly cleaned and maintained as appropriate. Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic only;
- Any site roads with the potential to give rise to dust will be regularly watered, as appropriate, during dry and/or windy conditions (also applies to vehicles delivering material with dust potential);
- All vehicles exiting the site should make use of a wheel wash facility prior to entering onto public roads, to ensure mud and other wastes are not tracked onto public roads. Wheel washes will be self-contained systems that do not require discharge of wastewater to water bodies;
- The contractor will be required to ensure that all vehicles are suitably maintained to ensure that emissions of engine generated pollutants is kept to a minimum;
- Public roads outside the site will be regularly inspected for cleanliness, and cleaned as necessary;
- The site should be adequately screened with suitable barriers to reduce the potential for dust dispersion;
- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind and will be located as far from receptors as possible;
- Minimise drop-heights to control the fall of materials;
- The transport of topsoil, rock, aggregate, and any other fill materials should be undertaken in tarpaulin-covered vehicles;
- The number of material handling operations should be minimised to ensure that dusty material is not handled unnecessarily;
- Any material on made ground should be kept damp and not allowed to dry out;
- Hard surfacing of made ground will take place as soon as is operationally feasible.

On-going review of the Dust Minimisation Plan will be necessary throughout the construction phase of the project. Responsibility for dust management should be assigned to a specific member of the project team who will liaise with contractors, suppliers, local residents and the local authority. A complaints procedure should be designed and made available to stakeholders.

The UK Building Research Establishment (BRE), the Construction Industry Research and Information Association (CIRIA), the Office of the Deputy Prime Minister (ODPM, 2005) and the London Councils (2006) have produced best practice guidance documents for dust minimisation plans and dust minimisation from construction and demolition projects.

Although there is not anticipated to be any significant negative impacts from the air emissions from boat traffic on the proposed canal, it could still be beneficial to the local environment if a proportion of the boats that are to be permanently on the canal were electrically powered. Electric motors instead of internal combustion engines would mean significantly less local air emissions and noise.

8.10 RESIDUAL IMPACTS

Following the implementation of appropriate environmental management controls, only minor, localised and temporary adverse effects are anticipated from construction related dust during dry and breezy conditions. Appropriate mitigation measures will be implemented to minimize the generation of nuisance dust. Particular care will be taken during excavation and stockpiling works to ensure that dust generation is minimised. Any predicted increase in traffic-derived pollutant concentrations during construction would be expected to be insignificant and emissions should remain well within current air quality limit values.

8.11 CONCLUSIONS

The restoration of the Ulster Canal from Upper Lough Erne to Clones has the potential to have temporary impacts on air quality through increased traffic and plant emissions, and the creation of nuisance dust during the construction phase. Through adequate site management these potential negative impacts can be minimised or mitigated for completely.

The future volume of road and navigation traffic due to the canal is expected to be low in terms of impact on air quality. Once completed in 2014 it is estimated that there will be an additional 108 private vehicle trips per day to the Gortnacarrow jetty / lock gate car park, 144 private vehicle trips per day to Clones Marina and 1,210 annual boat passages through the Gortnacarrow lock gates. This small increase in road and water traffic in the area is not expected to cause any significant increase in air pollution within the area, and there should be no breaches of the relevant air quality standards and limits as a result of the navigation operations.

9 AQUATIC ECOLOGY

9.1 INTRODUCTION

This aquatic ecological impact assessment was undertaken for the proposed restoration of a section of the Ulster Canal between Clones and the River Finn at Gortnacarrow, with additional dredging required on the River Finn to extend the navigation corridor to Upper Lough Erne.

The old Ulster Canal was opened in 1841, linking the Erne system with the Lough Neagh basin. The route of the navigation is 93km long and is situated in counties Armagh, Monaghan and Fermanagh. The Ulster Canal from Upper Lough Erne to Clones within the study area passes through County Fermanagh in Northern Ireland and Counties Monaghan and Cavan in Ireland; a section of approximately 14km long. The lower portion of the proposed scheme will be within the Lough Oughter SAC, the Upper Lough Erne SAC and the Upper Lough Erne SPA. An overview of the study area, including the designated conservation sites is presented in **Figure 9.1**.

Previous studies which examined the potential for restoring and re-opening the Ulster Canal, and those with relevance to the aquatic fauna and fisheries interests within the study area were also reviewed. These included:

- Ulster Canal Feasibility Study – Updated. January 2006. ESB International & Fergus McIlveen
- Strategic Environmental Assessment: Ulster Canal (Upper Lough Erne to Clones) Restoration Plan – Scoping Document October 2009
- Strategic Environmental Assessment: Lough Oughter Navigation Plan – Scoping Document June 2009.
- Environmental Report: Strategic Environmental Assessment of the Ulster Canal (Upper Lough Erne to Clones) Restoration Plan. RPS Group (August 2010).
- Natura Impact Report (Plan Level): Ulster Canal (Upper Lough Erne to Clones) Restoration Plan. RPS Group (May 2010).

Fieldwork for this assessment was undertaken in 2009 and 2011. There were no seasonal constraints in undertaking this assessment.

9.1.1 Legislative context

The current assessment takes account of national and international legislation with regard to Environmental Impact Assessment and also for the conservation of biodiversity. The following legislation has been reviewed and incorporated:

- The Water Framework Directive 2000/60/EC
- The Habitats Directive 92/43/EC

- Environmental Liability Directive 2004/35/EC
- European Communities (Environmental Impact Assessment) Regulations, 1989 (S.I. No. 349 of 1989) and subsequent amendments
- Wildlife Act, 1976 and Wildlife (Amendment) Act, 2000
- EC Environmental Objectives (Surface Waters) Regulations, S.I. No. 272 of 2009
- The Fisheries (Consolidation) Act, 1959
- Local Government (Water Pollution) Act, 1977 (as amended by Sections 3 and 24 of the 1990 Act)
- Plant Protection Products Directive 91/414/EEC
- Water Supply (Water Quality) Regulations (Northern Ireland) 2007 (S.R. 2007/147)
- Urban Waste Water Treatment Regulations (Northern Ireland) 2007 (S.R. 2007/187)
- The Surface Waters (Fishlife) (Classification) (Northern Ireland) 1997 Regulations S.R. 1997/488
- Environmental Liability (Prevention & Remediation) Regulations (Northern Ireland) 1999

9.1.2 Consultation

Preparation of this section of the EIS included consultation, either directly or through publicly-available information, with:

- Northern Ireland Environment Agency (NIEA, Natural Heritage)
- National Parks and Wildlife Service
- Environmental Protection Agency
- Department of Environment, Heritage and Local Government
- Department of Arts, Heritage and the Gaeltacht
- Department of Communications, Energy and Natural Resources
- Office of Public Works
- Central Fisheries Board (now Inland Fisheries)
- Inland Waterways Association Ireland
- Waterways Ireland
- Department of Agriculture Fisheries and Food
- Northern Regional Fisheries Board Non-Statutory
- North Western International River Basin District – NIEA and NS Share
- Department of Agriculture and Rural Development – Rivers Agency

9.2 METHODOLOGY

9.2.1 Desktop Review

A desktop review was carried out to identify features of ecological and biodiversity importance within the study area and surrounding region. A review of areas designated (or being considered) for designation for nature conservation was carried out and included designated Special Areas of Conservation, Areas of Special Scientific Interest (ASSIs) and proposed Natural Heritage Areas (of national importance). Furthermore, a review of the published literature was undertaken in order to collate data on fisheries and aquatic species of conservation concern within the study area.

Available information on the ecology of the study area was obtained from sources such as the National Parks and Wildlife Service (NPWS), Environmental Protection Agency (EPA), Inland Fisheries Ireland, the Environment Agency Northern Ireland and the Loughs Agency Northern Ireland.

9.2.2 Field Assessment

A walkover habitat assessment of the study area was undertaken to include the existing route of the old canal and upstream and downstream sections of proposed tie-in locations, with additional survey by boat on the main channel of the Finn. During the survey, specific attention was given to searching for protected aquatic species within the river corridor; these included salmonid habitat (*Salmo* spp.), brook lamprey *Lampetra* spp., otter *Lutra lutra* and white-clawed crayfish *Austropotamobius pallipes*.

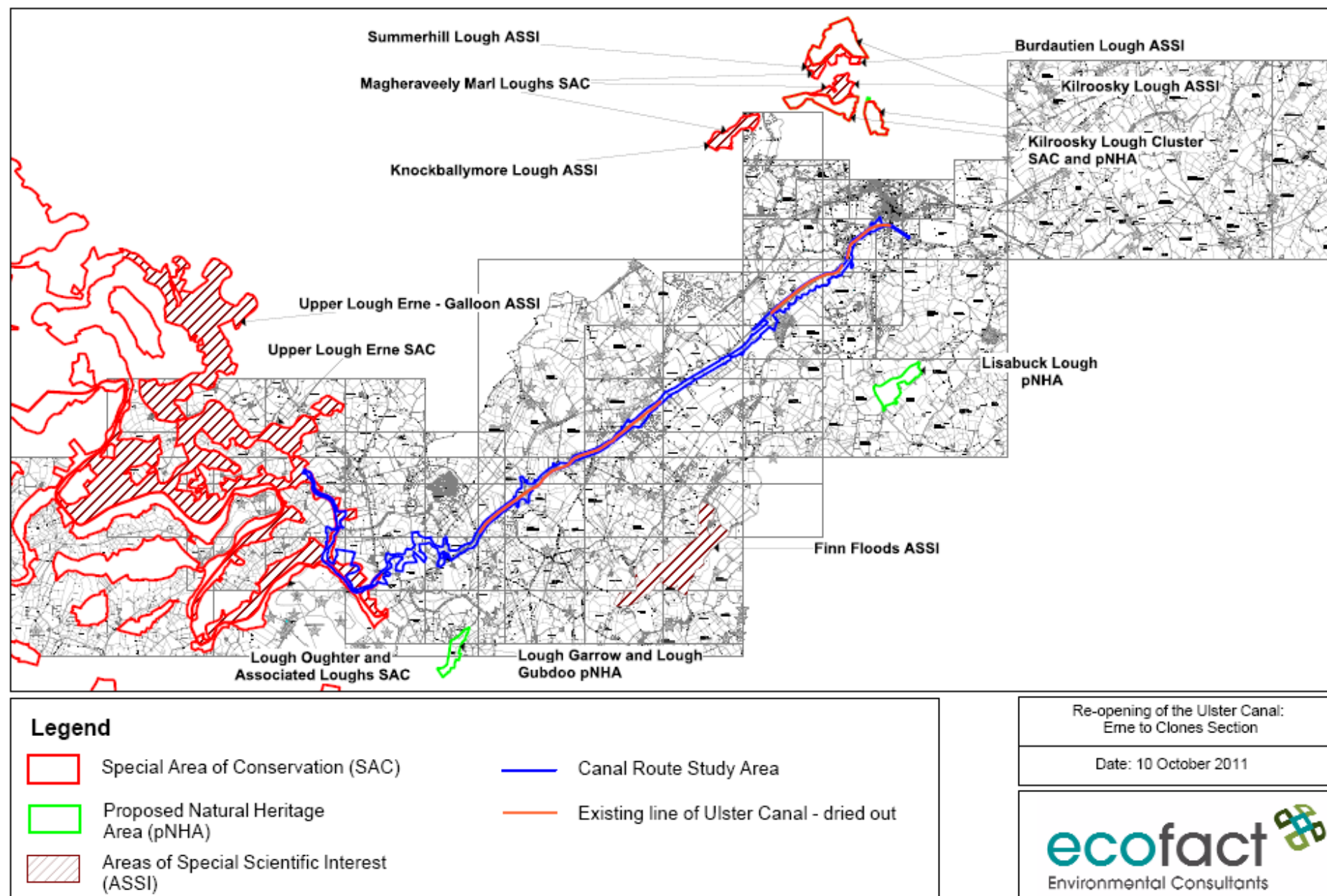
Based on the findings of the main Aquatic Ecological Study, feedback and further consultation with NIEA, Natural Heritage it was considered necessary to carry out a more detailed assessment of the aquatic ecological interests, including fisheries, present within the surface water catchments of the study area. It was found that the study area was in the known distribution range of white-clawed crayfish *Austropotamobius pallipes* in Ireland. Brook lamprey *Lampetra lampetra* has also been previously recorded from the study area. These aquatic species are listed on Annex II of the E.U. Habitat Directive. In addition, the aquatic beetle *Donacia bicolora* is listed as a UK priority species and has been recorded from Upper Lough Erne.

Surveys were carried out during July 2011 at selected representative locations identified as Sensitive Receptor Areas (SRAs) in EIS **Appendix C, Figures A9.3.1 – A9.3.9** to confirm the presence or absence of protected species. A total of 10 sites in the study area were surveyed during the current assessment. Water levels were low at the time of the survey and this was considered to be the ideal time to undertake such an assessment. These site locations are detailed in **Table 9.1**, the supplemental report (**Appendix C 9.5**) and illustrated in **Figure 9.2**.

A boat was used to access sites to survey lampreys, white-clawed crayfish and aquatic macroinvertebrates. All equipment used in the surveys (traps, waders, pole-nets, wet suits,

wellingtons, etc.) had been thoroughly washed, all organic debris removed and associated surfaces cleaned and then allowed to dry thoroughly. Once cleaned and dry, all equipment had been treated with bleach disinfectant. This procedure was repeated upon completion of the surveys.

Figure 9.1: Designated Sites in Proximity to Ulster Canal



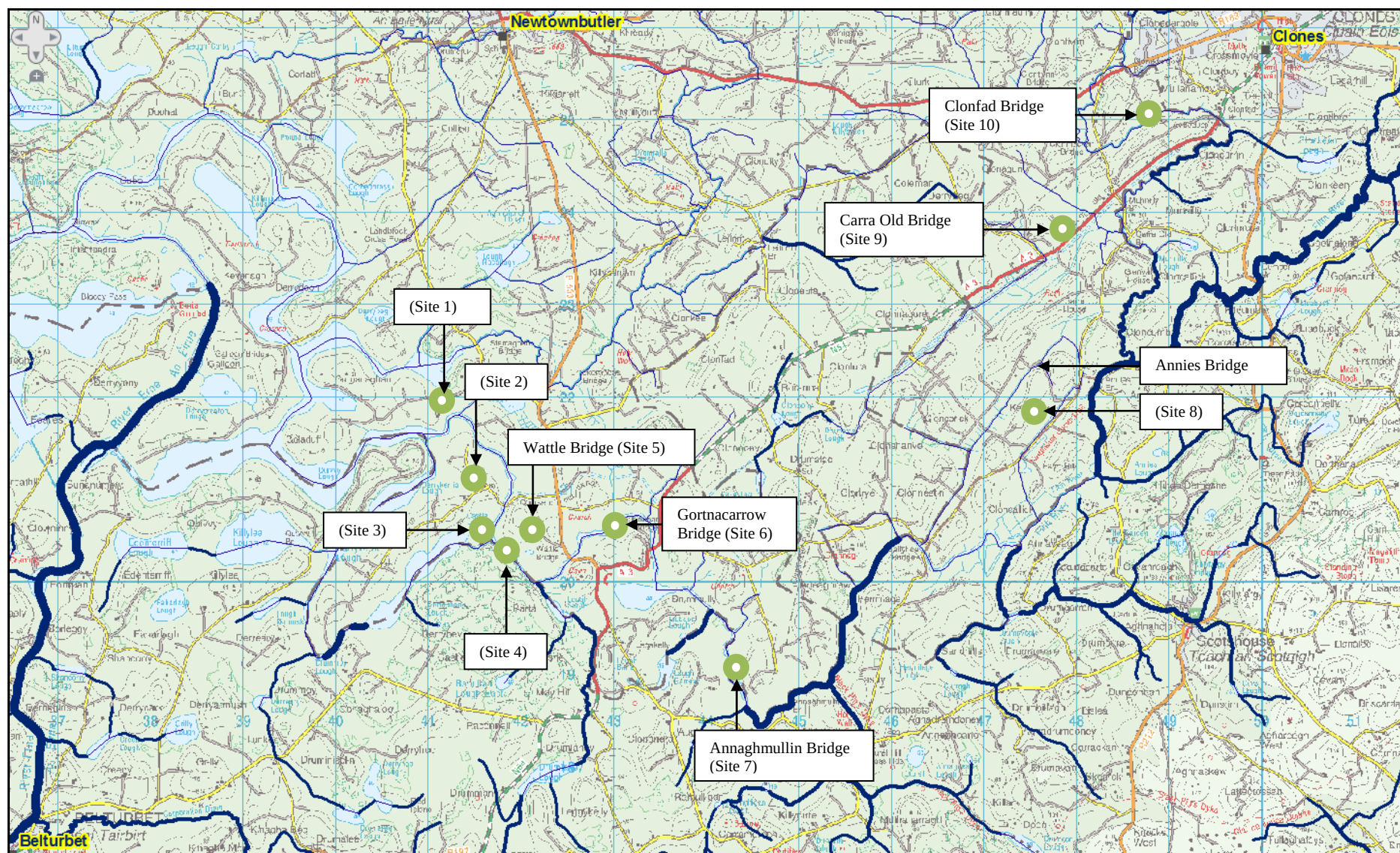


Figure 9.2: Map showing the study area on the River Finn and Upper Lough Erne between Clones, Co. Monaghan and Quivvy Lough, Co. Fermanagh. (Adapted from the EPA Hydrotol).

Table 9.1 Locations of the study sites examined as part of the Ulster Canal Regeneration Project in July 2011 and the surveys carried out at each location.

	Site location	NOS Grid Reference	Surveys carried out			
			Electric fishing	Biological / sweep sampling	Hand searching	Crayfish trapping
Site 1	River Finn approximately 300m upstream of the confluence with the Kilgarrow Lough outflow	M41443 21691	✓	✓	✓	
Site 2	Bridge downstream of Wattle Bridge	M41751 20829	✓	✓	✓	✓
Site 3	Approx. 500m downstream of Wattle Bridge (Lough Sarah outflow confluence with River Finn)	M41604 20457	✓	✓	✓	
Site 4	Approx. 800m downstream of Wattle Bridge	M41793 20278	✓	✓	✓	
Site 5	Wattle Bridge	M42460 20250	✓	✓	✓	✓
Site 6	Gortncarrow Bridge	M43363 20343	✓	✓	✓	✓
Site 7	Annaghmullin Bridge	M44767 18665	✓	✓		✓
Site 8	Approx. 600m downstream of Annies Bridge	M48234 21581	✓	✓		✓
Site 9	Carra Old Bridge	M48488 23689	✓	✓	✓	
Site 10	Clonfad Bridge	M49486 25033	✓	✓		

9.2.2.1 Lampreys

Each site was investigated for lampreys using electrical fishing. This is a well-established technique for sampling fish populations in freshwater. When an electric current is passed through water, a fish within the electrical field will turn and swim towards the anode (known as the anodic effect). This mechanism is referred to as electrotaxis and fish may be stunned (electronarcotisation) as it reaches the anode. A dip net is then used to retrieve the fish from the water.

The anode handle of the electrical fishing unit consists of fibreglass and is equipped with a safety switch. The electrode was fitted with a fine mesh net (1 mm) to facilitate lamprey collection. The cathode, consisting of wire, was allowed to trail behind the operator. The operators (2 persons) wore insulated chest waders. The machine was secured to one operator who also held the anode. The assistant (second operator) held an insulated dip net (mesh size 1mm; 40 cm x 40 cm frame, handle length 182 cm) for collecting lampreys that failed to be captured by the operator.

The sampling approach permitted the recording of presence/absence data, as well as facilitating collection of population structure and minimum density data. Sampling areas at each site were fished in a zigzag manner. The area fished at each site varied depending on the extent of fine-grained bed material and suitable water depth available. A fishing operation started with the gear constantly 'on' followed by a regular on/off sequence. While the gear is 'on' the anode was slowly pulled backwards in the water to cause lampreys to emerge from burrows as a result of electro-taxis. This procedure was

repeated throughout the operation. By keeping the anode 1-15 cm above the sediment and pulling the anode backwards, the number of lampreys stunned within the substrate was reduced.

Captured lampreys (and other fish) were removed quickly using the anode net or dip net and placed into a container of river water. Surveys were completed after 20 minutes continuous fishing (or earlier if large quantities of lampreys were encountered or if there was a paucity of suitable and accessible habitat at the site). After each survey was completed, all captured fish were anaesthetised using a solution of Phenoxyethanol. Bycatch species captured at each site were counted. Lampreys were measured to the nearest millimeter (standard length), weighted to the nearest 0.1g and identified using the keys given in Gardiner (2003). The following equipment was utilised in the assessment:

- Portable bench and chair
- Soft fine-meshed net
- Bendy stainless steel tweezers
- Measuring board
- Smooth white Formica board
- Headband magnifier and hand lenses

9.2.2.2 White-clawed crayfish

Hand searching was undertaken using a bathyscope in water depths to ca. 50cm and also by snorkelling. Deeper areas were searched using the snorkelling gear. Hand searching involved slowly overturning rocks, cobbles and other immersed objects and checking for the presence of white-clawed crayfish underneath.

The sweep sampling technique involved using a hand-held pond net, and sweeping and re-sweeping a 1m² area. Each standard 1m² sweep of the net was recorded as a sampling unit. 'Trapy' plastic mesh traps, as were used to traps white-clawed crayfish. These were set out along lines across the river; eight traps per line, evenly spaced. The traps were baited with a mix of tinned cat-food and liver, which was contained within the traps in small plastic mesh boxes. One of these was modified by the application of 10mm mesh on the outside of the trap. The traps were set out in the evening, retrieved the following morning and examined for the presence of crayfish.

9.2.2.3 Aquatic Macroinvertebrates

Biological sampling for macroinvertebrates followed EPA freshwater macroinvertebrate sampling methodology given in Toner *et al.* (2005). This procedure involved the use of a 'D' shaped hand net (mesh size 0.5 mm; 350 mm diameter) which was submerged on the river bed with its mouth directed upstream. The substrate upstream of the net was then kicked in order to dislodge invertebrates, which were subsequently caught in the net. In addition, macroinvertebrates found during searches for white-clawed crayfish were pooled with other macroinvertebrates recorded during the above technique. Where flows within the River Finn were too slow, too deep, or substrates too soft for kick sampling a

series of sweep net samples were undertaken from the water's edge to include marginal riparian vegetation and accessible substrates.

9.2.2.4 Habitat assessment

Habitat assessment was carried out at the rivers/streams on the site using the methodology given in the Environment Agency's '*River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003*' (EA, 2003) and the Irish Heritage Council's '*A Guide to Habitats in Ireland*' (Fossitt, 2000). Aquatic macrophyte species nomenclature follows Stace's '*New Flora of the British Isles*' (1997). Keys used in the identification of flora included Rose (1989), Webb (1996) and Rose (2006). No seasonal limitations were encountered during the field survey. All the affected watercourses were assessed in terms of:

- Watercourse width and depth and other physical characteristics;
- Substrate type, listing substrate fractions in order of dominance, i.e. large rocks, cobble, gravel, sand, mud etc;
- Flow type, listing percentage of riffle, glide and pool in the sampling area;
- Instream vegetation, listing plant species occurring and their percentage coverage of the stream bottom at the sampling site (as applicable);
- Dominant bankside vegetation;
- Estimated cover by bankside vegetation, giving percentage shade of the sampling site.

The results of the physical habitat study were used to assess habitat class (spawning, nursery, rearing, and foraging/adult holding) for salmonids, lampreys, and other fish. The habitat classes used are defined as follows: -

- Spawning habitat is used by fish for the specific act of spawning;
- Nursery habitat is used by developing embryos and young-of-the-year (YOY);
- Rearing habitat is used by sub-adult fish other than YOY for foraging and refuge from predators;
- Foraging habitat is used by adult fish [for feeding or] periods between feeding events/ Adult holding is used by adult fish, which do not feed in freshwater, before spawning events (i.e. lampreys and salmon).

Habitat has a key influence on the macroinvertebrate communities, which occur in rivers and streams. Also, individual macroinvertebrate species such as the Annex II listed white-clawed crayfish and pearl mussel have specific habitat requirements. The habitats of aquatic areas within the study the area were assessed in relation to macroinvertebrates and rated as being suitable or unsuitable for individual protected aquatic macroinvertebrates. General habitat quality for macroinvertebrate communities was rated as being Optimal, Suboptimal, Marginal or Poor with reference to a scheme developed by Barbour & Stribling (1991). This scheme is presented in **Table 9.2**.

Table 9.2 Physical habitat assessment of streams for their suitability for macroinvertebrate production (adapted from Barbour and Stribling, 1991).

Score	Optimal	Suboptimal	Marginal	Poor
	20	15	10	5
<i>Bottom substrate</i>	More than 60% of bottom is gravel, cobble, and boulders. Even mix of substratum size classes.	30-60% of bottom is cobble or boulder substrata. Substrate may be dominated by one size class.	10-30% of substrata consists of large materials. Silt or sand accounts for 70-90% of bottom.	Substrate dominated by silt and sand. Gravel, cobble and larger substrate sizes <10%.
<i>Habitat complexity</i>	A variety of types and sizes of material form a diverse habitat.	Structural types or sizes of material are less than optimum but adequate cover still provided.	Habitat dominated by only one or two structural components. Amount of cover is limited.	Monotonous habitat with little diversity. Silt and sand dominate and reduce habitat diversity and complexity.
<i>Pool quality</i>	25% of the pools are as wide or wider than the mean stream width and area >1m deep.	<5% of the pools are >1m deep and wider than the mean stream width.	<1% of the pools are >1m deep and wider than the mean stream width. Pools present may be very deep or very shallow. Variety of pools or quality is fair.	Majority of pools are small and shallow. Pools may be absent.
<i>Bank stability</i>	Little evidence of past bank failure and little potential for future mass wasting into channel.	Infrequent or very small slides. Low future potential of slides.	Mass wasting moderate in frequency and size. Raw spots eroded during high floods.	Frequent or large slides. Banks unstable and contributing sediment to the stream.
<i>Bank protection</i>	Over 80% of streambank surfaces are covered by vegetation, boulders, bedrock, or other stable materials.	50-80% of the streambanks covered with vegetation, cobble, or larger material.	25-50% of the streambank is covered by vegetation.	<25% of the streambank is covered by vegetation or stable materials.
<i>Canopy</i>	Vegetation of various heights provides a mix of shade and filtering light to water surface.	Discontinuous vegetation provides areas of shade alternating with areas of full exposure. Or filtering shade occurs <6h/day.	Shading is complete and dense. Or filtering shade occurs <3h/day.	Water surface is exposed to full sun nearly all day long.

9.2.3 Evaluation

The results of the ecological survey were evaluated to determine the significance of identified features located in the study area on an importance scale ranging from international-national-county-local. The criteria used are shown in **Table 9.3**. The scheme used for assessing the significance of impacts is given in **Appendix C 9.1**.

Table 9.3 Criteria used in assessing the importance of ecological features.

Importance	Criteria
International	An internationally designated site or candidate site (SPA, pSPA, SAC, cSAC, Ramsar Site, Biogenetic Reserve).
National	A nationally designated site or candidate site (NHA or ASSI) Sites which hold Red Data or Priority species
County	Sites which hold nationally scarce plant species (recorded from less than 65 10 km squares), unless they are locally abundant. Sites which hold semi-natural habitats likely to be of rare occurrence within the county. Sites which hold the best examples of a semi-natural habitat type within the county.
High Local Importance	Sites which hold semi-natural habitats and/or species likely to be of rare occurrence within the local area. Sites which hold the best examples of a high quality semi-natural habitat type within the local area.
Local Importance	Sites which hold high quality semi-natural habitats
Local Value	Any semi-natural habitat

9.3 RECEIVING ENVIRONMENT

9.3.1 Catchment Descriptions

9.3.1.1 River Finn

The River Finn rises to the north of Clones in the foothills of Garrane Mountain, south of Slieve Beagh and flows for approximately 65 river kilometres before reaching the centre point of the study area at Gortnagower Bridge. The course of the river is often broken and interrupted by drainage works on the main channel and interconnecting small loughs. The river forms the boundary between Northern Ireland and Ireland for much of its course as it meanders in a south westerly direction across the lowland plain between these hills and Clones town. The River Finn is joined by a number of first order streams and arterially drained channels before reaching Rosslea, where it flows through Drumbarrow Lough and continues south east to cross under the N54 at Mullanacloy. The Finn is met east of the N54 by a significant, unnamed tributary, which drains a low lying catchment to the south of the Monaghan Blackwater catchment. This tributary flows south through Smithborough to meet the Finn at Derryleggan.

South of Derryleggan the Finn flows parallel to the course of the old Ulster canal in a south westerly direction, passing to the south of Clones before being joined by the River Lackey which flows to the west of Clones and meets the Finn at Cloncumber. The River Lackey flows in a generally southerly direction, originating to the north of Clones and is approximately 20 river kilometres long.

The River Finn continues in a south westerly direction from Cloncumber, meandering widely at Annaghmullin Bridge to form Drumully Lough, west of Gortnacarrow Bridge. The Finn flows due northwest from Gortnacarrow, through Quivvy Lough to meet the Upper Erne.

The River Finn is designated Salmonid Water under the EC Freshwater Fish Directive, as is its tributary the River Lackey. The River Finn is also designated within the Upper Lough Erne SPA and the Upper Lough Erne SAC, while it is also designated within the Lough Oughter SAC from Castle Saunderson Estate.

In relation to the Finn (Monaghan) it was in a generally unsatisfactory ecological condition when sampled in 2007. The nearest EPA water quality monitoring station downstream of upper Lough Erne is at Cumber Bridge (EPA code 0500) which flows under the R212 approximately 2.5km south of Clones. This site achieved a biological water quality rating of Q3-4 slightly polluted, Class B in 2007 and again in 2010. This does not reach 'good ecological status'.

The salmonid fisheries of both the River Finn and the River Lackey have been significantly affected in the past two decades by arterial drainage and more recently by chronic pollution events, with ongoing impacts arising from point source pollution. According to O'Reilly (2004) the River Finn was once one of the finest brown trout rivers in Ulster, this being decimated by significant pollution events. The lower reaches of the River Finn, south of Clones, particularly from Drumully Lough to Quivvy Lough are recognised as being important coarse angling fisheries.

9.3.1.2 The Erne system

River Erne

The River Erne rises in Beaghy Lough, two miles south of Stradone in Co. Cavan and flows north and then west for 64 miles through Lough Gowna, Lough Oughter and Upper and Lower Lough Erne before entering the sea at Ballyshannon, Co. Donegal (O'Reilly, 2002). The Erne is in Hydrometric Area 36 and incorporates thirteen major river sub-catchments containing several major lochs including Upper and Lower Erne, Upper and Lower MacNean, Gowna and Oughter as well as several hundred smaller loughs (Mathers *et al.*, 2001). The Erne is a cross border river that flows through the Ireland/Northern Ireland border at Belturbet and again between Beleek and Ballyshannon. The main tributary of the River Erne is the Annalee River, which joins the Erne northwest of Butlersbridge.

The Woodford River flows into upper Lough Erne from the south west and has been developed as a navigable canal joining the Shannon and the Erne systems which is known as the Shannon – Erne Waterway. This waterway flows north east to the western shore of Upper Lough Erne.

According to the EPA the Erne River system was in unsatisfactory ecological condition when sampled in 2007 and in 2010 - Q3-4 was recorded across all sampling stations bar one.

Lough Erne

Lough Erne consists of two major lakes, the Upper (area 34.5km²) and Lower (area 109.5km²) Lough Erne and inflowing rivers are expanded to sizeable lakes of a variety of different types. There are

numerous other smaller lakes in the catchment connected directly or indirectly with the Upper Lough. In counties Cavan and Monaghan, there are more than 44 lakes in the river system and in County Fermanagh where both the upper and lower Lough Erne are situated there is a total of 357 lakes. Upper Lough Erne is the focal point of this study. This is a very large natural eutrophic lake situated in a drumlin landscape that creates a complex freshwater system and has a predominantly limestone catchment with an intricate shoreline and numerous small islands dotted across the basin. The bulk of the catchment drains into the upper Lough Erne and cross-border flow passes through a narrow passage of water at Derryvore just downstream of the confluence of the Finn, Erne and Woodford rivers. The Colebrooke and the Swanlinbar also enter the upper lake whilst the Silles and Arney enter the riverine channel called the River Erne which connects the two lakes. The upper lake is less than 10m deep over most of its area and water deeper than 20m is of limited extent. **Table 9.4** summarises this system.

Table 9.4 Physical characteristics of the upper Lough Erne system.

Physical characteristics	Upper Lough
Position	54° 14' N 7° 32' W
Elevation	46m
Catchment area*	2944 km ²
Lake area**	34.5 km ²
Mean depth	2.3m
Max depth	21m
Lake volume	0.08 x 10 ⁹ m ³
Inflow volume	2.18 x 10 ⁹ m ³ year ⁻¹
Turnover time (year)	0.04

9.3.2 Designated areas

Special Areas of Conservation (SAC's) are sites of international importance because of the presence of habitats or species that are of European importance, listed in the EU '*Habitats Directive*'. Special Protection Areas (SPAs) for birds are designated based on the presence of internationally significant populations of bird species listed on Annex I of the EU '*Birds Directive*'. Sites that have the above designations are known as NATURA 2000 sites as they contain protected habitats for flora and fauna of European importance. Sites of national importance in Ireland are termed proposed Natural Heritage Areas (pNHA's).

Natura 2000 sites identified within the study area of the current proposal include; the Lough Oughter SAC (Site Code 000007); Lough Oughter SPA; Upper Lough Erne SAC (Site Code UK0016614); Upper Lough Erne SPA (Site Code 9020071); Magheraveely Marl Loughs SAC (UK0016621); and Kilroosky Lough Cluster SAC (Site Code IE001786). It is noted that the Lough Oughter SPA lies over 9km from the proposed scheme and the conservation interests of this site are indirectly related to aquatic ecological interests which are considered in greater detail in relation to the Lough Oughter

SAC which is within the study area, the conservation objectives of the Lough Oughter SAC are presented in **Table 9.5**.

Table 9.5 Summary of the conservation objectives for Lough Oughter SAC.

Objective	Description
1	Maintain the Annex I habitats for which the SAC has been selected at favourable conservation status: Natural eutrophic lakes with <i>Magnopotamion</i> or <i>Hydrocharition</i> -type vegetation; Bog woodland.
2	Maintain the Annex II species for which the SAC has been selected at favourable conservation status: <i>Lutra lutra</i> .
3	Maintain the extent, species richness and biodiversity of the entire site.
4	To establish effective liaison and co-operation with landowners, legal users and relevant authorities.

Upper Lough Erne has a number of designations that provide protection to water dependent features and species under a variety of directives. The SPA, RAMSAR and SAC boundaries are coincident with the boundary of the ASSI. Areas of Special Scientific Interest (ASSIs) are areas of land that have been identified by scientific survey as being of the highest degree of conservation value. They have a well defined boundary and by and large remain in private ownership. The law relating to ASSIs is contained in the Environment (Northern Ireland) Order 2002. The Upper Lough Erne is also surrounded by Natural Heritage Areas (NHA) and proposed Natural Heritage Areas (pNHA) which are legally protected under the Wildlife Amendment Act (2000). ASSIs in the study area include the Kilroosky Lough ASSI (078), Knockballymore Lough ASSI (014), Upper Lough Erne-Galloon ASSI (090) and the Finn Floods ASSI (110).

The waters to the south of Derrykerrib bridge, being Lough Sarah and the River Finn at the Castle Saunderson Estate are designated under the Upper Lough Erne SPA (UK9020071 – Internationally important numbers of wintering Whooper Swans and regionally important numbers of Greenland white-fronted goose), Upper Lough Erne SAC (UK0016614 and SAC1184 - Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation, Old sessile oak woods with *Ilex* and *Blechnum*, Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*, and Otters *Lutra lutra*) and Upper Lough Erne Ramsar site (UK12024 – Eutrophic lake, swamp, fen and wet grassland, and an assemblage of rare, vulnerable and endangered species of plants and animals). The conservation interests of the Upper Lough Erne SAC are presented in **Table 9.6**.

Table 9.6 Summary of the conservation objectives for Upper Lough Erne SAC

Feature	Objectives
Naturally eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation (3150)	Maintain and enhance water quality Maintain a natural hydrological regime Maintain the extent of existing characteristic aquatic and emergent community types Maintain and enhance species diversity within each community including populations of rare and endangered species Maintain purity of the natural and characteristic species composition Minimal sediment load Substrate should be natural & characteristic of lake type Minimal environmental disturbance i.e. minimal negative impact from recreation and artificial structures and no fish farming Instigate cross border monitoring mechanism between the relevant authorities to monitor water quality
Old Sessile Oak Woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles (9A10)	Maintain and expand the extent of existing oak woodland but not at the expense of other SAC features. (There are areas of degraded heath, wetland and damp grassland which have the potential to develop into oak woodland) Maintain and enhance Oak woodland species diversity including the presence of notable or rare species Maintain and enhance Oak woodland structure Maintain the diversity and quality of habitats associated with the Oak woodland, e.g. fen meadow, grasslands, wet heath, wet woodland and scrub, especially where these exhibit natural transition to Oak woodland Seek nature conservation management over adjacent forested areas outside the SAC where there may be potential for woodland rehabilitation Seek nature conservation management over suitable areas immediately outside the SAC where there may be potential for woodland expansion
Alluvial Forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, Alnion incanae, Salicion alvae)	Maintain and expand the extent of existing alluvial forests but not at the expense of other SAC (ABC) features. (There are areas of wetland and damp grassland which have the potential to develop into oak woodland) Maintain and enhance Oak woodland species diversity including the presence of notable or rare species Maintain and enhance Alluvial forests structure Maintain the diversity and quality of habitats associated with the Alluvial forests, e.g. fen meadow, grasslands, wet heath, wet woodland and scrub, especially where these exhibit natural transition to Alluvial forests Seek nature conservation management over adjacent forested areas outside the SAC where there may be potential for woodland rehabilitation Seek nature conservation management over suitable areas immediately outside the SAC where there may be potential for woodland expansion
Otter <i>Lutra lutra</i>	Population numbers and distribution to be maintained and if possible, expanded Maintain the extent and quality of suitable Otter habitat, in particular the chemical and biological quality of the water, and all associated wetland habitats

This SPA and Ramsar designation not only covers the whole of Upper Lough Erne, but also land approximately 2km to the south east of the old Ulster Canal from Clonncallick to Lisnadurk. As well as being designated as an SPA, SAC and Ramsar site, Upper Lough Erne is also a Protected Salmonid Water.

Kilroosky Lough Cluster SAC/pNHA (IE001786) is located 1.2km north of the eastern portion of the scheme area, due north of Clones. The site covers an area of 57.61ha. The site is designated primarily for its feature hard oligo-mesotrophic waters, calcareous and alkaline fens listed on Annex I of the Habitats Directive and also for the presence of White-clawed crayfish listed on Annex II of the Habitats Directive. To the south west of the old canal dog-leg at Gortnacarrow there are further SAC designations for the Lough Oughter SAC and proposed NHA Designations (000007, Lough Oughter and Associated Loughs - Natural eutrophic lakes, Bog woodland and Otters), while to the south east of

Gortnacarrow there are proposed NHAs at Annagheane Lough (001836) and Drumcor Lough (001841).

Site synopses for the designated conservation sites within the study area are provided in Appendix C 9.2 of this report. The relationship between designated sites and the aquatic environment within the study area is limited to those sites that lie within the riparian corridor, or which contain species that are considered part of the aquatic environment.

9.3.3 Description of the Aquatic Ecological Interests within the Study Area

The aquatic ecological interests identified within the study area are presented in Aquatic Ecology Feature Maps in **Appendix C 9.3** of the current report. Within the study area, sites of particular importance in terms of aquatic ecology or areas potentially affected by the proposed scheme were identified as Sensitive Receptor Areas (SRAs). Any culverting or diversion of watercourses which may be required along the line of the Ulster canal has been highlighted as a Sensitive Receptor Area, taking account of the potential for downstream impacts. These have been indicated on the mapping provided. All watercourses and waterbodies within the study area are presented in **Tables 9.7 and 9.8** respectively, where the relative importance of these features in relation to aquatic ecology are discussed. All photographic plates referred to are found at EIS **Appendix C 9.4**.

9.3.3.1 Existing Ulster Canal

Clones to Clonfad Bridge

The proposed redevelopment of the canal will commence due south of Clones town between the N84 and the R212. It is proposed to access the canal from the N84, south of Clones and to create a marina close to the existing Canal Stores. No open standing water or aquatic habitats were recorded at the existing canal line at this location. The canal is completely overgrown with vegetation indicative of damp conditions, dominated by bulrush (*Typha* sp.) and wet grassland flora. The canal remains overgrown and dried out along this section, with semi-aquatic reed swamp and marsh habitat. A small area of standing water was recorded from the vicinity of Teehill House, however the macroinvertebrate community present was found to be depauperate, of local ecological significance.

At Clonfad Bridge the River Lackey, a tributary of the upper River Finn crosses below the road and the old canal bridge, flowing in a south-easterly direction, before turning due south west, downstream of Clonfad. The hydromorphology of this watercourse has been modified in the past, with evidence of water quality stress visible on the day of the survey. Siltation was high, as was instream vegetation growth in the channel upstream of the road bridge. Downstream of the road bridge the existing siphon comprises a check in flows at this location.

The River Lackey at this location was found to contain limited habitat suitable for salmonids, with water quality pressures adding to the hydrological constraints. This watercourse is to be culverted beneath the proposed canal during the redevelopment works. The aquatic macroinvertebrate

community at this location was found to be depleted, dominated by pollution tolerant species including *Asellus aquaticus*, *Chironomus* sp. and *Gammarus*.

Clonfad Bridge to Munilly Bridge

Downstream of Clonfad Bridge the old Canal follows the line of the road (A3), and was found to have been reclaimed in places for agricultural grazing land. The canal line for the most part remains damp and marshy with no open water or aquatic habitats recorded.

The River Lackey flows to the south east of the proposed canal line within this section. Realignment works are required on the River Lackey at Cloncurrin, where a sharp meander brings the watercourse to within the proposed land take of the Canal. This watercourse has previously been realigned at a second location along the line of the canal directly upstream of Munilly Bridge and additional works may be required at this location. Water quality in the Lackey was found to be 'moderate status' overall, according to the NIEA monitoring data (2008). Fish habitat at this location was found to be greater than at the Clonfad Bridge site with potential salmonid habitat and also extensive suitable habitat for brook lamprey. Otter are considered likely to occur and there is further potential for white-clawed crayfish at this location.

Munilly Bridge to Roranna

An unnamed minor tributary of the River Lackey flows from the west, downstream of this crossing point to meet the Lackey upstream of Carra Old Bridge. This minor stream will require realignment along the southern boundary of the Canal, as the canal will be re-routed from the old course to accommodate residential property. Drainage channels in the area of Clongowna will also require culverting beneath the proposed Canal realignment.

The Canal between Clongowna, Derrynure and Clonlura contains sections of standing water which was found to be stagnant with obvious nutrient enrichment. It is considered that these small sections of standing water are of no significant ecological value in terms of fisheries habitats; however, there is the potential for these habitats to be used by amphibians (common frog and smooth newt) for spawning. Neither of these species was recorded during the field survey. The macroinvertebrate populations within the old Canal at these locations were typical of enriched, standing water with low oxygen levels.

It is considered that the proposed redevelopment of the Ulster Canal will not significantly affect the aquatic ecological communities present within these areas; more likely resulting in an increase in aquatic diversity at these locations.

Roranna to Gortnacarrow

The old canal between Roranna and Clonooney was found to be significantly overgrown and dried out. However, sections such as at Roranna were found to contain a very small flow through of water,

sufficient to maintain a botanical community of wetland and marsh flora. There was no open, standing water of any importance for aquatic communities recorded at this section.

Due north east of Gortnacarrow Bridge at Clonoony the canal was found to be completely dried out with no aquatic or semi-aquatic habitats present, this situation was maintained to the old canal store at Gortnacarrow.

The proposed tie-in to the River Finn downstream of Gortnacarrow Bridge will cross existing treelines and open agricultural grassland to meet with the right bank of the River Finn. The watercourse at this location is constricted by a narrow channel, which has been excavated during a previous drainage scheme. The narrow confines of the channel at this location infer added ecological significance with respect to disturbance and water quality impacts (**Plate 15**).

The River Finn was fished at Cumber Bridge, upstream of Gortnacarrow Bridge by the Northern Regional Fisheries Board (now Inland Fisheries Ireland) during 2009. A total of nine fish species were recorded including Gudgeon (167), roach (101), brown trout (55), perch (9), pike (6), lamprey (2), eel (1), stone loach (1) and 3-spined stickleback (1). It is considered that the species diversity of the River Finn within the study area at Gortnacarrow remains the same, with extensive suitable habitat for coarse fish species identified directly downstream of the bridge; while the shallower section of the channel at Gortnacarrow Bridge may provide some suitable habitat for mature brown trout. No salmon were recorded during the electrical fishing exercise.

The River Finn provides extensive habitat for juvenile brook lamprey (*Lampetra planerii*), with silt deposits along both banks present throughout the watercourse within the study area. No suitable spawning habitat for this species was recorded from the study area during the current assessment and it is considered that adults will spawn in the upper reaches of the Finn, with juveniles drifting downstream to settle in silt deposits within the current study area.

9.3.3.2 Lower River Finn

The River Finn and Upper Erne are predominantly coarse fisheries, with a mosaic of interconnected lakes, slow flowing channels and river systems within a drumlin influenced landscape. The eutrophic status of the lake reflects unsuitable habitat for salmon and brown trout, while species including pike, minnow, stone loach, gudgeon, three-spined stickleback, perch, rudd, roach, bream, tench and hybrids occur.

The River Finn has been found to support a population of brook lamprey (*Lampetra planeri*), following a study of lamprey within the Erne catchment (King & Green, 2008). Lamprey were recorded from a station on the River Lackey at Clonfad Bridge. This species is listed on Annex II of the EU Habitats Directive and is afforded protection both in the UK and in Ireland. The River Finn, in particular the lower Finn within the study area contains extensive, optimum habitat for this species.

The River Finn and the River Lackey are both designated as Salmonid Waters under the Freshwater Fish Directive. However, the importance of these watercourses for salmonids has been affected by ongoing and occasional significant pollution events. The River Finn between Clones and Gortnacarrow Bridge is recognised as having a number of suitable fishing access points at the bridge crossings along this length of the watercourse.

River Finn is designated as being 'moderate status' according to the NIEA (2008), although macroinvertebrate and macrophyte diversity was evaluated as being 'good'.

Aquatic ecological interests within this study area include a coarse fishery, with some brown trout. Brook lamprey, listed on Annex II of the EU Habitats Directive also occurs throughout the study area, where extensive silt beds are present along the river margins. Annex II listed otter and white-clawed crayfish also occur. Red listed species include common frog, with smooth newt also likely to occur within back channels and quieter water of the Finn, such as at the old Ulster Canal tie-in and within the connecting channels between other loughs (e.g. Lough Sarah). Additional Red listed aquatic flora and invertebrates occur throughout.

The Upper Erne was surveyed by Inland Fisheries Ireland during 2010 as part of Water Framework Directive Monitoring. Coarse species dominated the results with the following species recorded in order of abundance: Perch (1031), Roach (308), European eel (31), Roach x Bream hybrids (30), Bream (4), Pike (4) and Brown trout (3). The low number of trout, combined with the high numbers of coarse fish stocks is considered indicative of the fisheries potential of the Lower River Finn which meets Upper Lough Erne at Quivvy Lough and shares the same depositing characteristics throughout the study area downstream of Gortnacarrow Bridge.

The River Finn has been found to support a population of lamprey (most likely Brook lamprey *Lampetra planeri*), following a study of lamprey within the Erne catchment (King & Green, 2008). Lamprey were recorded from a station on the River Lackey at Clonfad Bridge. This species is listed on Annex II of the EU Habitats Directive and is afforded protection both in the UK and in Ireland.

Pollan *Coregonus autumnalis* is an indigenous, freshwater fish species, confined to freshwater lakes and is unique to Ireland in a European context. The pollan is currently found in lakes situated on three river catchments in Ireland: Lough Neagh (where it used to be fished commercially); Lower Lough Erne; Lough Derg; and Lough Ree; although it was once found in large numbers on the Shannon lakes. Although the species was previously found in Upper Lough Erne, it is now thought to be on the verge of extinction there (Purcell 1996) with no records in recent times.

The aquatic habitats within the study area, dominated by lacustrine open water; slow flowing depositing rivers and standing water within reed swamp and marsh habitat (in the old Ulster Canal) provides for a diversity of aquatic invertebrate fauna. A number of species of particular conservation concern have been recorded from the study area or are expected to occur.

The beetle *Donacia bicolora* is a UK priority species, recorded from Upper Lough Erne. It is found on *Sparganium* ssp. near water, habitat recorded from much of the study area. Adults overwinter during the winter months and larvae develop attached to roots under the water. There is a UK Species Action Plan for this species which was published in 1999. The main threats to this species are loss of marginal habitat, which may arise from channelisation works and loss of riparian habitat. Protection of this species is in line with the implementation of the Northern Ireland habitat action plans for Fens, Mesotrophic Lakes and Eutrophic Standing Waters.

The white-clawed crayfish *Austropotamobius pallipes* is a priority species in Northern Ireland and is listed on Annex II of the EU Habitats Directive.

Gortnacarrow to Wattle Bridge

Downstream of Gortnacarrow Bridge the River Finn widens immediately and the aquatic habitats present were characteristic of a large, low-lying, depositing watercourse (**Plate 16**).

The watercourse narrows again approximately half-way between both bridges, where a section of shallow water, walled and channelized connects the wider, more sluggish sections of the river (**Plate 17**). Although flows at the narrows were faster, there was no evidence of suitable spawning habitat for salmonids.

Below this section the River Finn widens again (**Plate 18**) with reed-bed fringed river banks and a wide feature-less channel (**Plate 18**).

Wattle Bridge to Lower River Finn (end of scheme)

The River Finn was found to be significantly overgrown in the vicinity of Wattle Bridge with a narrow channel downstream (**Plate 19**). Works are required at this bridge location for navigation. The channel widens considerably directly downstream of the bridge, with uniform low-lying banks and tall reed vegetation (**Plate 20**).

In terms of aquatic habitats the corridor of the Finn remains similar in character, with the entrance to Lough Sarah being of note. This channel appears to have been modified in the past (**Plate 21**); however, Lough Sarah was found to be relatively undisturbed, with suitable habitat for coarse fisheries and a diversity of lacustrine invertebrates.

The new concrete bridge constructed over the River Finn, in the townland of Edergool will require some modifications during the construction phase of the proposed works (**Plate 22**) to allow for navigation. Directly downstream of this bridge the original terminal end of the Ulster Canal meets the Finn corridor (**Plate 23**). There was no flow through of water evident at this location and from an investigation of the old canal line at Edergool it was clear that the only aquatic habitats within the old

Canal in this area was limited to small pools of stagnant standing water, with dumping and agricultural inputs evident.

Further downstream the River Finn is also wide and featureless (**Plate 24**), similar to the habitats recorded further upstream. This sluggish character continues to the confluence with the Erne at Quivvy (**Plate 25**). **Table 9.7** summarises rivers and streams investigated as part of the Ulster Canal restoration scheme, whilst **Table 9.8** summarises those lakes investigated.

Table 9.7 Summary of rivers and streams investigated as part of the Ulster Canal restoration scheme.

Survey Reference	Waterbody ID / Hydrometric area	Watercourse	Tributary	Sub-tributary	Location	WFD risk status	WFD Status	Intersection with the Ulster Canal	Fisheries value	Protected Species present
R_L 1	UKGBNI1 NW363602103 HA36/36_2469 Erne & Melvin	River Lackey - KillyLackey River lower				2b 'strongly expected to achieve good status'	Moderate	1km SW Clones, at start of A3	Limited salmonid habitat. Freshwater Fish Directive monitoring status (08/09) 'Pass'	Likely to contain brook lamprey, with potential for otter and white-clawed crayfish. Kingfish also recorded.
R_L 1/1	UKGBNI1 NW363602103 HA36/36_2469 Erne & Melvin	River Lackey - KillyLackey River lower	Clonkeen 1 st order stream,		Immediately upstream of Cloncurrin approx.1.2km S Clones	2b 'strongly expected to achieve good status'	Moderate	Not affected by the proposed scheme	Low fisheries value	Minor watercourse, brook lamprey may occur.
R_L1/2	UKGBNI1 NW363602103 HA36/36_2469 Erne & Melvin	River Lackey - KillyLackey River lower	Munnilly 1 st order stream		1.9km SW Clones	2b 'strongly expected to achieve good status'		N/A	Low fisheries value	Minor watercourse, brook lamprey may occur.
R_L1 / 3	UKGBNI1 NW 363602103/ HA36/36_2469 Erne & Melvin	River Lackey - KillyLackey River lower	'Carra' Stream' 3 rd order	West of Carra House 1 st order	South west Of Carra Old Bridge	2b 'strongly expected to achieve good status'		To be culverted by the proposed Canal	Low fisheries value - drained	Minor watercourse, brook lamprey may occur.
R_L1 / 4	UKGBNI1 NW363602103/ HA36/36_2469 Erne & Melvin	River Lackey - KillyLackey River lower	Clonagun 1 st order stream			2b 'strongly expected to achieve good status'		2.8 km SW Clones, flows into canal from the west	Low fisheries value	Minor watercourse, brook lamprey may occur.
C1	HA36 Erne & Melvin	Clonkeelan 2 nd order stream			Northwest of the N54 at Clonnagore	1a 'at risk of not achieving good status'	Moderate	3.1km SW Clones, flows in to Canal from west	Low fisheries value	Minor watercourse, brook lamprey may occur.
R_F1/ 1	UKGBNI1 NW363602097 HA 36/36/F/01 Erne & Melvin	Finn River Lower	Gortnacarrow stream		0.5km SW Clonoony, directly d/s of Gortnacarrow	1a 'at risk of not achieving good status'	Moderate	Will be adjacent to the proposed marina at Gortnacarrow	Limited salmonid habitat. Freshwater Fish Directive monitoring status (08/09) 'Pass'	Likely to contain brook lamprey, with potential for otter and white-clawed crayfish.
R_F1	UKGBNI1 NW363602097 HA 36/36/F/01 Erne & Melvin	River Finn Lower				1a 'at risk of not achieving good status'	Moderate	Within the route of the proposed Ulster Canal	Limited salmonid habitat. Freshwater Fish Directive monitoring status (08/09) 'Fail'	Contains brook lamprey, otter and white-clawed crayfish. Of further importance for salmonids, coarse fish, floating river vegetation and tall reed/herb fringe.

Table 9.8 Summary of lakes investigated as part of the Ulster Canal restoration scheme.

Survey reference	Waterbody ID/ Hydrometric Area/	Lake	Tributary	Intersection with the Ulster Canal	WFD risk status	WFD Status	Fisheries value	Protected species present
L_E	UKGBNI PA2_50001/ 36HA/ Erne/NWIRBD	Upper Lough Erne	36/E/01_Erne River 36/F/01_River Finn Lower UKGBNIPA2_30397 Woodford River	Downstream of the proposed Ulster Canal channel	1a 'at risk of not achieving Good Status'	Good	An important coarse fisheries, supporting low numbers of salmonids (brown trout). Hydroelectric schemes within the lower catchment affect migration of anadromous salmonids.	Otter, White-clawed crayfish Lamprey. A diversity of Red listed aquatic flora and invertebrates
L_C	36_362/HA 36/IE36_02 Erne/NWIRBD	Clonkeen Lough	36_2287-Altartate Stream N of Clonkeen Lough 36_833 –Clonkeen stream W of Clonkeen Lough	1.6km east of the old canal line	1a 'at risk of not achieving Good Status'	Bad	Coarse fishery	Unknown, but not affected by the proposed scheme
L_C_1	HA36/36_411 Erne/NWIRBD	Clonlura Lough		On the old canal line	1a 'at risk of not achieving Good Status'	Moderate	No significant fisheries value	Otter potential no other species likely.
L_D	HA36/36_494 Erne/NWIRBD	Drumsloe Lough	36_1829 , 1st order stream	0.5km east Of the old Canal	1a 'at risk Of not achieving Good Status'	Moderate	No significant fisheries value	Otter potential no other species likely.
L_C_2	HA36/36_216 Erne/NWIRBD	Clonoony Lough	36_2092, 1 st order stream flowing in from the north	0.2km west Of the old Canal	1a 'at risk of not achieving Good Status'	Moderate	No significant fisheries value	Otter potential no other species likely.
L_L	HA36/ Erne/NWIRBD	Lakeview Lough	36_1759, 1 st order stream	0.4km south of the old Canal	1a 'at risk of not achieving Good Status'	Moderate	No significant fisheries value	Otter likely, potential for white-clawed crayfish
L_C_3	HA36 Erne/NWIRBD	Clonshan na-gh Lough		0.2km north of the old Canal	1a 'at risk of not achieving Good Status'	Moderate	No significant fisheries value	Otter potential no other species likely.
L_D_1	HA36/ Erne/NWIRBD	Drummully Lough	Lower River Finn main channel (36/F/01), flowing in from the South	0.5km south Of the old Canal	1a 'at risk of not achieving Good Status'	Moderate	An important coarse fishery supporting some brown trout within the Finn catchment	Otter, White-clawed crayfish, Lamprey. A diversity of Red listed aquatic flora and invertebrates
L_S_1	HA36 Erne/NWIRBD	Lough Sarah		Connected to the River Finn within the study area	1a 'at risk of not achieving Good Status'	Moderate	Coarse fish only. Likely important for spawning. No fisheries development at present	Likely to support otter, with potential for white-clawed crayfish.

L_C	HA 36 Erne/NWIRBD	Castle Lough	Lower River Finn main channel (36/F/01), flowing in from the East	On the old Canal	2a 'Probably Not at risk'	Moderate	An important coarse fishery. Limited brown trout within the Finn catchment	Otter, White-clawed crayfish, Lamprey. A diversity of Red listed aquatic flora and invertebrates
L_D_2	HA36 Erne/NWIRBD	Lough Derrykerri b	Lower River Finn main channel (36/F/01), flowing in from the East	1.6km W of the scheme	2a 'probably Not at risk'	Moderate	An important coarse fishery supporting some brown trout within the Finn catchment	Otter, White-clawed crayfish, Lamprey. A diversity of Red listed aquatic flora and invertebrates
L_Q_1	HA36 Erne/NWIRBD	Lough Quivvy	Lower River Finn main channel (36/F/01), flowing in from the East	Approx. 1km d/s of the study area on Upper Lough Erne	2a 'probably not at risk'	Moderate	An important coarse fishery supporting some brown trout within the Finn catchment	Otter, White-clawed crayfish, Lamprey. A diversity of Red listed aquatic flora and invertebrates

9.3.4 Results of Lamprey, Crayfish and Macroinvertebrate Survey

9.3.4.1 Overview of results

With the exception of the River Lackey it is considered that the study area is unsuitable for salmonid and lamprey spawning, no salmonids were recorded during the current electrical fishing exercise. Despite the presence of suitable juvenile habitat throughout the study area lamprey populations within the study area are restricted to the Lackey sub-catchment. The results of the electrical fishing surveys detailing the records for fish (including lamprey) are presented in **Table 9.9**.

Lampreys have similar spawning requirements as salmonids i.e. well aerated fast flowing waters over silt free gravel beds. The only fast flowing/riffled habitat recorded during the current assessment was on the River Lackey at Carra Old Bridge; however, this location comprised sub-optimal salmonid or lamprey spawning habitat due to extensive siltation. During the current survey lampreys (*Lampetra* spp.) were only recorded at the Carra Old Bridge and due to their presence inland and within this minor watercourse are considered to be brook lamprey (*Lampetra planeri*). Suitable habitat for the juvenile stage of lampreys was abundant along the River Finn and River Lackey, with ample deposits of silt at various locations along these rivers for lampreys to burrow; however, no lampreys were recorded. It is considered that the sluggish nature of the River Finn in the study area to Quivvy Lough does not meet the requirements for spawning lampreys.

White-clawed crayfish were not recorded during the current survey work despite the presence of suitable habitat at all locations surveyed. It is concluded that the white-clawed crayfish population in the Finn and River Lackeys within the study area, if any is insignificant. This conclusion has been reached given that no crayfish were recorded despite significant sampling effort. Sweep sampling was undertaken at each location. Reynolds *et al.* (2010) noted that juvenile crayfish are often recorded by sweeping through emergent vegetation. In addition, no crayfish were found in the baited traps at five locations distributed across the study area. Baited traps can attract crayfish from an unknown area, probably in a radius of several metres from the traps (Reynolds, 2010). Each train of traps comprised 8 individual traps, totalling 40 units of effort. It is considered that crayfish would have been detected also by the electrical fishing.

White-clawed crayfish are not usually found inhabiting substrates covered in mud or silt, although they may cross such areas while foraging. Holdich (2000) notes that an adverse effects can take place on a crayfish population as a result of sediment and excrement entering the water. Zebra mussel *Dreissena polymorpha* which occurs in the River Finn within the study area is thought to contribute to siltation and may also reduce the availability of habitat for white-clawed crayfish.

Water quality in the study area was deemed moderate, corresponding with 2010 water quality results for the River Finn at Cumber Bridge (EPA code 0500) which flows under the R212 approximately 2.5km south of Clones. The substrate at all locations was considerably silted and algal growth was

evident at all sampling locations. Pollution sensitive macroinvertebrate taxa were scarcely recorded in the study area; larvae of Group A mayflies being found only at two locations (Site 7 and Site 9). **Table 9.10** gives selected water quality results at the sampling sites investigated.

The macroinvertebrates recorded during the current study were mostly pollution tolerant species that are accustomed to living in slow flowing heavily vegetated channels. Some pollution sensitive mayfly larvae (*Ecdyonurus* sp., *Ephemera danica*) and less sensitive species (*Agrion splendens*, *Ischnura elegans*, *Limnephilus* sp.) were also recorded. The bivalves *Anodonta anatina* (duck mussel) and non native invasive zebra mussel *Dreissena polymorpha* are the most notable finds of the biological sampling. The RBD status of *Anodonta anatina* is 'Vulnerable' (Byrne *et al.* 2008) and it has been suggested by Moorkens (2006) that zebra mussel has been the cause of a serious recent decline in *Anodonta* sp. in Ireland. The zebra mussel and duck mussel were found to occur in the River Finn in the lower section of the study area. **Table 9.11** gives a full list of the macroinvertebrates recorded during the biological surveys undertaken.

Donacia bicolora is an aquatic leaf beetle in family Chrysomelidae. This metallic green or bronze beetle can be found on bur-reeds (*Sparganium erectum*) in summer when the adult is grazing on leaves. It is listed as a UK Priority Species. *D. bicolora* is known from many lakes in Fermanagh, mainly in the Upper Lough Erne system. Sweep net searches were carried out for this species in stands of *Sparganium erectum* along the River Lackey at Carra Old Bridge and Clonfad Bridge and within the River Finn where this plant was common. *D. bicolora* was not recorded during the current field survey work. It is noted that the plant food of the adult beetle (*Sparganium erectum*) was abundant within the River Lackey corridor. This beetle creates a cocoon on common club rush *Schoenoplectus lacustris* and the roots of this plant may be used by overwintering *D. bicolora*. Common club rush occurs throughout the study area on the River Finn corridor. No records of this species were recorded from the current survey and it is considered unlikely that this species would be significantly affected by the proposed works. Indeed, the reopened Canal section would lead to the availability of increased *Sparganium* habitat suitable for this species.

Table 9.9 Results of the electrical fishing surveys undertaken at 10 sites for the Ulster Canal Redevelopment Scheme, July 2011.

	Site	Species	Scientific name	Length (cm)	Weight (g)	Notes
Site 1	River Finn u/s Kilgarrow Lough outflow (8m ² fished)					
Site 2	Bridge downstream of Wattle Bridge (6m ² fished)					
Site 3	Approx. 800m downstream of Wattle Bridge (7m ² fished)					
Site 4	Lough Sarah outflow confluence with River Finn, d/s Wattle Br. (8m ² fished)	Roach	<i>Rutilus rutilus</i>			20+

Site 5	Wattle Bridge (12m ² fished)	Roach	<i>Rutilus rutilus</i>			
Site 5	Wattle Bridge	Pike	<i>Esox lucius</i>			
Site 5	Wattle Bridge	Perch	<i>Perca fluviatilis</i>			
Site 6	Gortnacarrow (16m ² fished)	Roach	<i>Rutilus rutilus</i>			100+
Site 7	Annaghmullin Bridge (10m ² fished)	Roach	<i>Rutilus rutilus</i>			20+
Site 7	Annaghmullin Bridge	Pike	<i>Esox lucius</i>			
Site 7	Annaghmullin Bridge	Three-spined stickleback	<i>Gasterosteus aculeatus</i>			
Site 8	Downstream of Annies Bridge (5m ² fished)	Roach	<i>Rutilus rutilus</i>			20+
Site 9	Carra Old Bridge (20m ² fished)	Brook lamprey	<i>Lampetra planeri</i>	14.7	5.5	
Site 9	Carra Old Bridge	Brook lamprey	<i>Lampetra planeri</i>	15.2	5.6	
Site 9	Carra Old Bridge	Brook lamprey	<i>Lampetra planeri</i>	14.4	6	
Site 9	Carra Old Bridge	Brook lamprey	<i>Lampetra planeri</i>	15.6	6.5	
Site 9	Carra Old Bridge	Gudgeon	<i>Gobio gobio</i>	7.8	5.3	
Site 9	Carra Old Bridge	Perch	<i>Perca fluviatilis</i>	4.3	0.7	
Site 9	Carra Old Bridge	Pike	<i>Esox lucius</i>			
Site 10	Clonfad Bridge (15m ² fished)	Stone loach	<i>Barbatula barbatula</i>	5.9	1.9	
Site 10	Clonfad Bridge	Stone loach	<i>Barbatula barbatula</i>	4.9	1.2	
Site 10	Clonfad Bridge	Stone loach	<i>Barbatula barbatula</i>	5.2	1.1	

*All brook lampreys recorded from an area of 1m².

Table 9.10 Selected water quality results at the sampling sites investigated as part of the Ulster Canal Regeneration Project in July 2011.

	Temperature (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (mgO ₂ l ⁻¹)	Conductivity (µS cm ⁻¹)
Site 1	18.5	81.8	7.7	473
Site 2	18.7	81.2	7.6	481
Site 3	18.9	83	7.7	482
Site 4	18.9	80.3	7.5	480
Site 5	18.6	79	7.4	483
Site 6	18.7	106.5	9.91	478
Site 7	18.4	92.8	8.7	521
Site 8	18.2	91.0	8.6	525
Site 9	17.8	72.3	6.89	556
Site 10	17.2	72	6.92	553

Table 9.11 Macroinvertebrates recorded during the biological surveys undertaken on Ulster Canal (Upper Lough Erne to Clones) during August 2011.

Group/Organism	Pollution sensitivity group	Functional group	Relative abundance									
			Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10
MAYFLIES (Uniramia, Ephemeroptera)												
Family Heptagenidae												
Autumn dun <i>Ecdyonurus</i> sp.	A	Scraper & gathering collector									*	
Yellow may dun <i>Heptagenia sulphurea</i>	A	Scraper & gathering Collector									*	
Hexes and big drakes (Ephemeridae)												
The green/grey drake mayfly <i>Ephemera danica</i>	A	Filtering collector							*			
Spiny crawler mayflies (Ephemerellidae)												
Blue-winged olive <i>Ephemerella ignita</i>	C	Gathering collector						*	*			
Baetidae												
Large dark olive <i>Baetis rhodani</i>	C	Scraper & gathering collector						*			*	*
CASED CADDIS FLIES (Tricoptera)												
Northern caddisflies (Limnephilidae)												
<i>Micropterna</i> sp.	B	Shredder									*	
<i>Halesus radiatus</i>	B	Shredder						*				*
<i>Anabolia nervosa</i>	B	Shredder	*	*	*			*				
<i>Limnephilus flavicornis</i>	B	Shredder			*							
Cinnamon sedge <i>Limnephilus lunatus</i>	B	Shredder	*			*		*	*			*
<i>Limnephilus binotatus</i>	B	Shredder		*								
Long horned caddisflies (Leptoceridae)												
<i>Athripsodes cinereus</i>	B						*	*				*
Phryganeidae												
<i>Agrypnia</i> sp.	B	Shredder						*				

Group/Organism	Pollution sensitivity group	Functional group	Relative abundance									
			Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10
Glossosomatidae												
<i>Agapetus fuscipes</i>	B	Scraper										*
CASELESS CADDIS FLIES (Trichoptera)												
Grey flags (Hydropsychidae)												
<i>Hydropsyche angustipennis</i>	C	Filtering Collector						*			*	
Green sedges (Rhyacophilidae)												
The sandfly <i>Rhyacophila dorsalis</i>	C	Predator										*
Trumpet-net caddisflies (Polycentropodidae)												
<i>Polycentropus kingi</i>	C	Filtering collector									*	
<i>Neuriclepsis bimaculata</i>	C	Filtering collector						*				
Gallery building caddisflies (Psychomyiidae)												
<i>Tinodes waeneri</i>	C	Filtering collector		*								
DAMSELFLIES (Odonata, Zygoptera)												
Jewelwings (Agriidae)												
Banded jewelwing <i>Agrion splendens</i>	B	Predator						*	*	*		*
Red and blue damselflies (Coenagriidae)												
Common bluetip <i>Ischnura elegans</i>	B	Predator					*	*	*			
DRAGONFLIES (Odonata, Anisoptera)												
Hawker dragonflies (Aeshnidae)	B	Predator										
<i>Aeshna</i> sp.	B	Predator				*	*					
TRUE FLIES (Diptera)												
Blackfly (Simuliidae)	C	Filtering collector						*				
Family Chironomidae												
Green chironomid	C	Filtering collector	*	*	*		*			*	*	*
BEETLES (Coleoptera)												
Whirligig beetles (Gyrinidae)												
<i>Gyrinus</i> sp.	C	Predator					*			*	*	
Diving beetles (Dytiscidae)												
Indeterminate larvae	C	Predator			*	*						*
Sub family Colymbetinae												
<i>Rhantus grappi</i>	C	Predator/scraper							*			
<i>Ilybius fuliginosa</i>	C	Predator	*									

Group/Organism	Pollution sensitivity group	Functional group	Relative abundance									
			Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10
<i>Ilybius quadriguttatus</i>	C	Predator			*							
Sub family Dytiscinae												
<i>Dytiscus marginalis</i>	C	Predator								*		
Crawling water beetles (Haliplidae)												
<i>Halipus confinis</i>	C	Predator		*			*					
Riffle Beetle larvae (Elmidae)												
<i>Elmis</i> sp.	C	Predator									*	*
<i>Limnius</i> sp.	C	Grazer						*				
Minute moss beetles (Hydraenidae)												
<i>Hydraena</i> sp.	C	Predator										*
Burrowing Water Beetles (Noteridae)												
<i>Noterus clavicornis</i>	C	Predator	*		*	*						
<i>Noterus crassicornis</i>	C	Predator	*									
Helophoridae												
<i>Helophorus</i> sp.	C	Predator		*						*		
SNAILS (Mollusca, Gastropoda)												
Family Lymnaeidae												
Wandering snail <i>Lymnaea peregra</i>	D	Shredder	*		*	*	*					
Great pond snail <i>Lymnaea stagnalis</i>	C	Shredder	*	*	*	*	*					
Family Planorbiidae												
Keeled Ramshorn Snail <i>Planorbis carinatus</i>	C	Scraper	*	*	*	*	*	*				
Great Ramshorn <i>Planorbis corneus</i>	C	Scraper				*						
<i>Planorbis contortus</i>	C	Scraper			*	*	*			*		
Family Hydrobiidae												
Common Bithynia <i>Bithynia tentaculata</i>	C	Shredder	*	*	*	*	*	*		*		
Family Physidae												
Bladder Snail <i>Physa fontinalis</i>	D	Shredder		*	*	*	*	*				
MSSELS (Mollusca, Lamellibranchiata)												
Orb/Pea Mussels (Sphaeriidae)												
<i>Pisidium</i> sp.	D	Filtering Collector		*		*	*	*	*		*	
Zebra Mussel (Dreissenidae)												
<i>Dreissena polymorpha</i>	N/A	Filtering collector	*	*			*	*				
Unionidae												
<i>Anodonta anatina</i>		Filtering collector	*	*			*		*			

Group/Organism	Pollution sensitivity group	Functional group	Relative abundance									
			Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10
CRUSTACEANS (Crustacea)												
Amphipods (Amphipoda, Gammaridae)												
Freshwater shrimp <i>Gammarus</i> sp.	C	Shredder	*	*	*	*	*		*	*	*	*
Isopods, Asellidae												
<i>Asellus aquaticus</i>	D	Shredder	*	*	*	*	*	*	*	*	*	*
LEECHES (Hirudinae)												
Erpobdellidae												
<i>Erpobdella octoculata</i>	D	Predator						*	*			
<i>Helobdella stagnalis</i>	D	Predator					*					
Piscicolidae												
<i>Piscicola geometra</i>	C	Predator				*						
Glossiphoniidae												
<i>Glossiphonia complanata</i>	D	Predator			*		*					
<i>Hemiclepsis marginata</i>	D	Predator	*	*				*	*		*	
<i>Glossiphonia heteroclita</i>	D	Predator		*				*				
BUGS (Hemiptera)												
Water crickets/Broad-Shouldered Water Striders (Veliidae)												
<i>Velia</i> sp.	C	Predator								*		*
Water scorpion (Nepidae)	C	Predator	*		*							
Greater water boatman (Notonectidae)												
<i>Notonecta glauca</i>	C	Predator	*	*	*	*	*	*		*		*
Lesser water boatman (Corixidae)												
<i>Callicorixa praeusta</i>	C	Grazer/Predator		*	*			*	*	*		*
Gerridae												
<i>Gerris</i> sp.				*		*	*		*	*		
ALDERFLIES (Megaloptera)												
Alderfly larvae (Sialidae)												
<i>Sialis</i> sp.	D	Predator		*	*	*	*	*	*			
SPIDERS (Crustacea, Arachnida)												
Water mite (Order Hydracarina)	C	Predator	*	*	*	*	*	*	*	*	*	*
SEGMENTED WORMS (Annelida, Clitellata)												
Aquatic earthworm (Lumbriculidae)	D	Collector							*			
FLATWORMS (Platyhelminthes)	D	Collector	*		*		*	*				
No. of different families			16	20	17	16	20	23	12	14	13	16

*Present, **Scarce/Few, ***Small Numbers, ****Fair Numbers, *****Common, ****Numerous, *****Dominant, *****Excessive.

9.3.4.2 Findings at the individual sites

Site 1

This site was located on the River Finn upstream of the confluence with the Kilgarrow Lough outflow. Sampling was carried out from the right bank of the river next to a small wooden marina.

The substrate in this part of the river was mostly silt which was deposited on angular cobbles and gravel. The depth of silt ranged from 15cm to 40cm within ca. 5 meters from the bank. An area of 8m² was surveyed for lampreys within the silt habitat but none were recorded. The habitat surveyed was deemed suitable for juvenile lampreys. No other fish species were recorded while electrical fishing for lampreys at this location.

The river could be waded near the bank and allowed hand searching for white-clawed crayfish to be easily carried out. The insides of tyres along the bank of the river were searched extensively but no crayfish were found inside these potential refuges. Similarly, no white-clawed crayfish were recorded in 10 sweep netting units carried out along the vegetated margins of the river.

A macroinvertebrate family diversity of 16 was recorded at this location. Most notable was the presence of the mussels *Anodonta anatina* (native) and *Dreissena polymorpha* (non-native, invasive). This species was recorded at a density of approximately 4/m² along the bank. The shells of this species were covered with a coat of silt. The best represented group at this site were molluscs with snails in three families occurring; *Bithynia tentaculata*, *Planorbis carinatus*, *Lymnaea stagnalis* and *Lymnaea peregra*. The burrowing water beetles *Noterus crassicornis* and *Noterus clavicornis* and the diving beetle *Ilybius fuliginosa* were also recorded. Cased-caddisfly larvae of Limnephilidae (*Anabolia nervosa* and *Limnephilus lunatus*) were also found at this location.

Site 2

This site was located on the River Finn at the bridge downstream of Wattle Bridge. The substrate along the bank comprised a significant proportion of rock, with silt embedded between rocks.

Sampling for lampreys and macroinvertebrates was carried out in the vicinity of the bridge at the left side of the river. An area of 5m² was surveyed for lampreys in a part of the river free of plants where the average depth was approximately 40cm. The habitat surveyed was deemed optimal for juvenile lampreys. Electrical fishing was carried out over an area of approximately 1m² along the vegetated margin of the bank upstream of the bridge, again in habitat considered suitable for juvenile lampreys. No lampreys were recorded in these areas however.

Crayfish surveying was carried out using sweep sampling (30 sampling units), hand searching (30 potential refuges) and trapping. The traps were set across the River upstream of the bridge. White-clawed crayfish were not captured in the traps following overnight exposure or by the other methods used.

A rich macroinvertebrate community was recorded at this location with a family diversity of 20. Pollution tolerant flatworms were common underneath rocks. These rocks were also inhabited by *Bithynia tentaculata*, *Dreissena polymorpha* and *Planorbis carinatus*. The snails *Lymnaea stagnalis* and *Physa fontinalis* were also recorded, the latter while sweep sampling through emergent vegetation. It is noted that *P. fontinalis* is not a truly aquatic species. The crustaceans *Asellus aquaticus* and *Gammarus* sp. and the leeches *Hemiclepsis marginata* and *Glossiphonia heteroclita* were also found at this location. The bugs *Notonecta glauca*, *Callicorixa praeusta* and *Gerris* sp., the beetle *Haliphus confinis* and the caseless caddisfly larvae of *Tinodes waeneri* were also recorded.

The Sensitive Receptor Areas (SRAs) at SRA 9 (**Appendix C 9.3**) at the road bridge crossing the River Finn identified the potential for crayfish and lamprey at this location. The current survey confirmed that these species were not present.

Site 3

This site was located approximately 800m downstream of Wattle Bridge on the left side of the River Finn. The sampled area comprised the submerged aquatic vegetation in the main channel of the River Finn and a shallow sheltered backwater. The substrate comprised some large rocks but was mainly composed of cobble and gravel material. The mean depth of the surveyed area was ca. 35cm.

An area of approximately 7m² that was deemed suitable for lampreys was surveyed by electrical fishing and no lampreys were recorded. Included in this area was approximately 4m² along a narrow channel linked to the River Finn thought to be used to get access to the river by boat in the past.

A total of 20 potential crayfish refuges were examined, mostly by overturning rocks. 15 sweep sample units were carried out along submerged vegetation. White-clawed crayfish were not recorded during these exercises.

Larvae of the cased caddisflies *Anabolia nervosa* and *Limnephilus flavicornis* were the only Trichopteran representatives at this location where a macroinvertebrate family richness of 177 was recorded. The most diverse group were the molluscs with *P. fontinalis*, *B. tentaculata*, *Planorbis contortus*, *P. carinatus*, *L. stagnalis* and *L. peregra* all recorded. An indeterminate diving beetle larvae was recorded together with adult *Ilybius quadriguttatus* and *N. clavicornis*.

This site was identified as SRA 8 (**Appendix C 9.3**) and although the potential for protected species was identified, the current survey has determined that crayfish and lamprey do not occur.

Site 4

This site was located at the Lough Sarah outflow confluence with the River Finn, approximately 500m downstream of Wattle Bridge. The Lough Sarah confluence meets the left side of the River Finn.

Sampling was undertaken along the River Finn upstream and downstream of the Lough Sarah confluence and also along the Lough Sarah outflow channel.

This part of the river was greater than 2m deep and surveying was carried out in the safety of the boat. The banks of this part of the river were heavily vegetated by emergent aquatic plants. The substrate at the sides of the river was soft with accumulations of dead organic debris from fallen leaves of mainly aquatic vegetation.

Electrical fishing was carried out over an area of 8m². Due to the very loose nature of the substrate, the area surveyed was deemed suboptimal for lampreys. In addition, the visibility of the substrate was impaired by the extent of vegetation. No lampreys were recorded from the surveyed area - it is considered that they do not occur in this part of the river. Roach *Rutilus rutilus* were recorded from this area.

Macroinvertebrates in 16 different families were recorded at this location. The assemblage comprised water mites (Hydracarina), alderfly larvae *Sialis* sp., the bugs *Notonecta glauca* and *Gerris* sp. as well as the fish leech *Piscicola geometra*. Planorbiiidae snails were well represented with three species found; *P. carinatus*, *P. corneus* and *P. contortus*. Less pollution sensitive (Group B) dragonfly larvae of *Aeshna* sp. and cased caddisfly larvae of *Limnephilus lunatus* were also recorded at this site.

This site was not identified as a SRA in **Appendix C 9.3**.

Site 5

Site 5 was located on the River Finn at the downstream side of Wattle Bridge. Substrate at this location was a mix of large submerged rocks (mostly near the edge of the river) and gravel. The substrate at this site was covered with a coat of silt and filamentous algal growth was luxuriant. The mean depth of the channel at this site was approximately 75cm. The gradient downstream of the bridge was slightly greater than upstream and downstream areas proving some glide habitat, an unusual feature along the river.

An area of approximately 12m² was surveyed for lampreys by electrical fishing. This area had a mean depth of 40cm, where rock and silt comprised the substrate. Conditions for juvenile lamprey were considered good with some optimal patches. No lampreys were recorded however. Perch *Perca fluviatilis*, Pike *Esox lucius* and roach *Rutilus rutilus* were recorded at this site.

Crayfish traps were set out across the river where depth ranged from 40cm to 1.2m. The area covered had potential crayfish refuges in the form of rocks but no crayfish were recorded when the traps were retrieved the following morning. Similarly, crayfish were not recorded during hand searching which involved examining 100 potential refuges or during sweep sampling (30 units).

A macroinvertebrate diversity of 22 was recorded at this location. The only Trichopteran member was *Athripsodes cinereus*. Six species of snail were found; *P. contortus*, *P. carinatus*, *B. tentaculata*, *P. fontinalis*, *L. stagnalis* and *L. peregra*. Bivalve molluscs recorded at this site were *A. anatina*, *D. polymorpha* and *Pisidium* sp. The leeches *G. Complanata* and *H. stagnalis*, the crustaceans *A. aquaticus* and *Gammarus* sp. as well the bugs *Gerris* sp. and *N. glauca* were also recorded. Larvae of the damselfly *Ischnura elegans* and the dragonfly *Aeshna* sp. were also recorded at this site.

This site was identified as SRA 7 (**Appendix C 9.3**). Lamprey and crayfish habitat was identified at this site; however, the current survey has determined that these species do not occur.

Site 6

This site was located on the River Finn at Gortnacarrow Bridge. The River Finn at this point is relatively shallow with a mean depth of ca. 60cm. Flow was a combination of glide and pool. Downstream of the bridge, the bed of the river comprised mostly rock, with a smaller proportion of gravel and silt. Aquatic vegetation featured strongly upstream of the bridge where there gravel and silt were the primary materials on the river bed. A thick coat of silt covered the substrate in the vicinity of Gortnacarrow Bridge and filamentous algal growth was also evident on rocks.

Electrical fishing for lampreys was carried out upstream of the bridge over an area of 12m². The substrate examined was deemed suitable for juvenile lampreys, especially around the vegetated margins where silt had been deposited. No lampreys were recorded. The only fish species recorded at this site was roach with hundreds of juveniles seen.

All three techniques for surveyed for white-clawed crayfish were deployed at Gortnacarrow Bridge; sweep sampling (20 units) upstream of the bridge with hand searching (100 potential refuges) and trapping undertaken downstream of the bridge. White-clawed crayfish were not recorded during these surveys.

A broad spectrum of aquatic macroinvertebrates was recorded at this site with 23 families being recorded. The invasive *D. polymorpha* was numerous on rocks, especially downstream of the bridge where flow was greater. All available surfaces on some rocks were completely covered with this species. Pollution tolerant flatworms were seen to be common on the underside of rocks with leeches (*G. Heteroclita*, *H. marginata* and *E. octoculata*) also occupying this niche. Mayfly larvae recorded were *Baetis rhodani* and *Ephemerella ignita*. The most varied taxonomic group were the trichopterans with 7 species recorded. Cased caddisfly larvae recorded were *Halesus radiatus*, *Anabolia nervosa* and *L. lunatus* of Limnephilidae, *A. cinereus* of Leptoceridae and *Agrypnia* sp. of Phryganeidae. Caseless caddisfly larvae recorded at this site were *Neuriclepsis bimaculata* and *Hydropsyche angustipennis*. Larvae of the damselflies *Agrion splendens* and *Ischnura elegans* were also recorded at this location.

The Aquatic Assessment identified SRA 5 and SRA 6 (**Appendix C 9.3**) in the vicinity of this site. Although suitable habitat for lamprey and crayfish were identified, neither of these species were recorded during the current survey.

Site 7

The River Finn was also surveyed between Annaghmullin Bridge and the old railway bridge approximately 60m upstream. This stretch of the river was generally sluggish and deep (mean depth of ca. 1.3m). Vegetated areas including along the margins of the river were shallower. These areas were the focus of the aquatic surveys. The substrate along the centre of the channel was mostly coble and gravel with mostly silt and organic debris near the bank of the river.

A total area of 10m² was surveyed for lampreys by electrical fishing. By and large, the substrate investigated was deemed suitable for juveniles with an area of ca. 5m² under the railway bridge considered optimal habitat. No lampreys were found in these areas however. The only fish species recorded was 3-spined stickleback *Gasterosteus aculeatus*.

Sweep sampling (30 units) and trapping for white-clawed crayfish was carried out at this location but this species was not recorded during these surveys.

A total of 12 macroinvertebrate families were recorded at this location. Mayfly larvae of the pollution sensitive *Ephemera danica* and pollution tolerant *E. ignita* were both recorded. Damselfly larvae of *A. splendens* and *I. elegans* were also present at this site. The only Coelopteran found at this site was the diving beetle *Rhantus grappi*. Also recorded in the assemblage were Hydracarina, Lumbriculidae, *Sialis* sp. and *Anodonta anatina*.

This site is located upstream of the confluence of the Ulster Canal route with the River Finn and comprises a reference site on the Finn, no SRA in **Appendix C 9.3** was identified at this location.

Site 8

This site was located on the River Finn approximately 800m downstream of Annie's Bridge. This part of the river had a wetted width of 15-20m wide. The sides of the banks were generally steep and most of the river was in excess of 1.5 meters deep. Emergent aquatic vegetation was present along the river margins but this band of plants was thin.

In general, this part of the River Finn, a lowland depositing river did not contain silt beds that could be surveyed effectively by electrical fishing. Silt deposits are expected to occur at depths outside of the effective range for electrical fishing. One depositing area of approximately 5m² with a mean depth of approximately 35cm was appropriate for electrical fishing but no lampreys were recorded. Roach were recorded at this site.

Trapping and sweep netting was carried out at this site with regard to white-clawed crayfish. This species was not recorded however.

Macroinvertebrates in 14 families were recorded at this location. Hemiptera were the best represented group with the following bugs found; *Velia* sp., *N. glauca*, *C. praeusta* and *Gerris* sp. the beetles *Dytiscus marginalis*, *Gyrinus* sp. and *Helophorus* sp. were also recorded. The only less sensitive (group B) indicator recorded at this site was larval *A. splendens*.

This site is located upstream of the confluence of the Ulster Canal route with the River Finn and comprises a reference site on the Finn. No SRA in **Appendix C 9.3** was identified at this location.

Site 9

Site 9 was located on the River Lackey at Carra Old Bridge. Surveying was carried out downstream of the bridge where shallow riffled flow turned to glide and pool habitat to 1m deep further downstream. The substrate in fast flowing areas comprised mostly rock, cobble and gravel substrate with silt dominating in slow flowing parts of the river. From approximately 40m downstream of the bridge, a silt bed of at least 20cm deep occurred all along the channel. In general, the substrate at this site was heavily silted.

Potential lamprey habitat at this site was widespread and an area of 20m² was surveyed by electrical fishing. A total of four brook lampreys *Lampetra planeri* were recorded. It is noted that all of these lampreys were recorded in an area of approximately 1m² in silt substrate alongside riffled habitat just downstream of the bridge. No lampreys were recorded in the large depositing area in the glide pool habitat. Other fish recorded at this site were gudgeon *Gobio gobio*, perch *Perca fluviatilis* and pike *Esox lucius*.

Hand searching was carried out in 100 potential white-clawed crayfish refuges but this species was not found in these areas. Similarly, no crayfish were found during the biological kick sampling and sweep sampling (N=20) surveys.

Macroinvertebrates in 13 different families were recorded at this riffled location. Mayfly was a well represented group with three species occurring; pollution sensitive *Ecdyonurus* sp. and *Heptagenia sulphurea* along with pollution tolerant *Baetis rhodani*. Cased caddisfly larvae of *Micropterna* sp. were recorded along with caseless larval *Polycentropus kingi* and *Hydropsyche angustipennis*. Beetles recorded were *Elmis* sp. and *Gyrinus* sp. Other macroinvertebrates in the community were *Asellus aquaticus*, Green chironomids and *Pisidium* sp.

SRA 3 and 4 at Munnilly identified the potential for brook lamprey based on suitable silt deposit habitats; this was confirmed by positive records for this species at the Carra Old Bridge sampling station downstream. However, no crayfish or salmonids were recorded within the Lackey watercourse.

Site 10

This site was located on the River Lackey at Clonfad Bridge. This stretch of the River Lackey was trapezoidal in cross sectional shape, mainly sluggish and heavily vegetated by emergent vegetation. The mean depth was approximately 65cm deep with depths generally increasing towards the middle of the channel. The substrate was mostly fine deposited material though some rock/cobble/gravel occurred where glide featured.

An extensive area of deposited silt, habitat deemed suitable for juvenile lampreys, was surveyed by electrical fishing (15m²). Most of this area was between Clonfad Bridge and a collapsed bridge ca 10m downstream. No lampreys were recorded in this area however. The only fish species recorded was Stone loach *Barbatula barbatula*.

Surveying for white-clawed crayfish was carried out via kick sampling and sweep netting (N=20). This species was not recorded though ample habitat in the form of vegetation and rocks was present.

Macroinvertebrate family diversity at this location was 16. The assemblage comprised the bugs *Velia* sp., *N. glauca* and *C. praeusta*, the crustaceans *Gammarus* sp. and *A. aquaticus* as well as green chironomids. The beetles *Hydraena* sp., *Elmis* sp. and an indeterminate diving beetle larvae was also recorded. The most diverse group were Trichopterans with cased larvae of *Agapetus fuscipes*, *A. cinereus*, *L. lunatus* and *H. radiatus* and caseless larvae of *Rhyacophila dorsalis* recorded. *A. splendens* and *Baetis rhodani* were also recorded at this site.

This site is identified as SRA 1 and SRA 2 in **Appendix C 9.3**; however, lamprey, salmonids and crayfish were not recorded during the current survey, despite the potential for these species to occur as identified in the overall Aquatic Assessment.

9.4 POTENTIAL IMPACTS

9.4.1 Construction phase Impacts

9.4.1.1 Potential Impacts Arising during the Restoration of the Old Ulster Canal

Due to the current condition of the old Ulster Canal line it is considered that the proposed reopening of the line will have limited potential for impacts affecting aquatic ecology within the line of the canal itself. This is taking account of the dried out condition and agricultural reclamation that has occurred along the current route over time since the closure of the canal. It is important to note that any impacts arising as a result of the proposed works must not impede the affected watercourses from achieving 'good ecological status', furthermore the canal itself must be constructed and re-instated in such a way as to allow for the achievement of 'good ecological potential of this artificial waterbody.

No aquatic habitats of ecological significance were noted on the line of the old Ulster Canal, with respect to fisheries or internationally protected species. There is potential for local impacts affecting small sections of standing water which are evaluated as being locally important for invertebrate populations. These impacts will be limited to small areas of habitat loss with the potential for significant habitat recreation and expansion for the affected species, with the re-flooding and extension of the canal system. There will therefore be some short term habitat loss at these pockets of standing water, during the interim period while the canal margins re-vegetate and natural succession allows the colonisation of a diverse riparian margin, as evident along the River Finn.

The restoration of the Ulster Canal to Clones will not result in any impacts affecting fish migrations, species diversity or population changes within the River Finn / Upper Erne system. There are no fish populations or sub-species or non-native species concerns in relation to the existing aquatic habitats within the Ulster Canal which would be of concern with regard to the connection of this route with the River Finn.

The proposed route of the Ulster Canal will broadly follow the existing line of the old canal, with some minor diversions and the inclusion of some additional link roads. This will require the culverting and / or bridging of a number of watercourses within the study area; the most significant of which is the River Lackey. There is therefore the potential for impacts affecting these watercourses, with subsequent indirect impacts affecting the Upper River Finn, arising during the construction phase of the proposed scheme. These impacts may potentially include water quality impacts (suspended solids and/or pollution releases), alteration in hydraulic regime, impoundments or blockages to fish or wildlife passage, loss of riparian habitat and loss of riparian habitat continuity.

9.4.1.2 Potential Impacts Arising on the River Finn during Construction

Dredging

The construction of the proposed connection to the River Finn and the creation of a navigable channel within the River Finn corridor will require some significant construction works along the riparian

corridor of the river, with further dredging operations within the main channel between Gortnacarrow and the terminal end of the scheme, upstream of Quivvy Lough. There is therefore the potential for the alteration of the hydraulic regime within the River Finn, where current flow patterns and flooding regimes may be affected, both through the proposed dredging operations and mooring facilities at a local level and also in relation to the connection to the Ulster Canal line, where diversions of flows and abstractions may potentially affect the aquatic environment of the Finn. Aquatic ecological interests most likely to be affected would be the riparian botanical communities and invertebrate species along the water's edge, including reed / herbaceous fringe habitats and populations of protected flora and fauna. Any lowering of water-levels or alteration in erosion / deposition patterns within the River Finn channel may affect the availability or locations of coarse fish spawning sites.

The proposed dredging works give rise to the potential for disturbance of salmonids and potential pollution impacts associated with increased suspended solids. This would also include impacts affecting salmonid ova and fry; with similar impacts affecting the more pollution sensitive macroinvertebrate populations within the aquatic environment. Any significant suspended solids increases have the potential to cause a fish-kill and must be mitigated for, both in relation to the control of suspended solids and also the timing of the works.

Any dredging impacts affecting salmonids, other fish species or turbidity levels in the River Finn will have further impacts on otter populations, resulting in loss of prey or indirectly with regard to loss of visibility within the watercourse for hunting.

Dredging activities on the River Finn would be likely to cause further disturbance impacts to otter arising from noise and increased human activity on the river.

There is the potential for the spread of aquatic invasive species during the construction phase, where machinery will be entering the works site, both along the riparian corridor at the mooring facilities sites and also along the River Finn to undertake the dredging works. It is imperative that mitigation measures for the control of invasives are undertaken by the site contractor.

The opening of the new connection between the old line of the Ulster Canal at Gortnacarrow and the River Finn / Upper Lough Erne downstream of Gortnacarrow Bridge may potentially give rise to water quality impacts including increases in suspended solids and discharge of deleterious, polluting substances arising from the construction works. It is a requirement that the proposed works do not conflict with the objectives of this watercourse to meet 'good ecological status'. Impacts affecting water quality during the construction phase are of particular importance with respect to the Natura 2000 designation of the study area, including the associated waterbodies such as Lough Sarah, which is currently relatively undisturbed.

Mooring facilities, Access etc.

The proposed construction works within the riparian zone of the River Finn gives rise to the potential for impacts affecting the Salmonid River status of the River Finn, with further potential for the disturbance and / or habitat loss impacts to otter, a species listed on Annex II of the EU Habitats Directive. No otter holts were recorded during current field survey; however, otter are considered to be widespread within the study area. It is recommended that pre-construction surveys are undertaken at detailed design stage.

The construction of the mooring facilities and access will require the removal of riparian habitats within the footprint of the proposed works, with shoreline access of construction vehicles and equipment posing a further risk to water quality. There is therefore the potential for temporary pollution risks to aquatic interests including salmonids, coarse fish and aquatic macroinvertebrates.

Any works along the riparian corridor will result in the temporary disturbance to and degrading of Annex 1 Eutrophic lakes vegetation (3150) habitat. It has been estimated that this would amount to <0.2% of the total area of this habitat type within the SAC.

9.4.2 Operational Phase impacts**9.4.2.1 Operational Phase Impacts Affecting the Ulster Canal**

As there are no existing aquatic habitats of ecological significance within the Ulster Canal, it is considered that the proposal will not have any ongoing or operational impacts affecting aquatic ecology within the existing line of the old Canal.

The potential for downstream impacts on the River Finn during any maintenance dredging operations on the Canal during the operational phase are not considered to be significant given the availability of controls of flows between the canal and Finn during any required works.

Furthermore there is the increased risk of the spread of non-native fish, invertebrate and plant species between water systems arising from the proposed scheme, associated with an increase in recreational boat usage on the system.

During the operational phase of the scheme there will be a through-flow of water within the Canal which will give rise to a greater potential for diffuse nutrient inputs from surrounding agricultural land, with the potential for the transport of nutrients to the River Finn. Measures are proposed to buffer the aquatic habitats of the canal to reduce the potential for this artificial waterbody to act as a direct vector of pollution to the River Finn.

9.4.2.2 Operational Phase Impacts Affecting the River Finn

The operational phase of the proposed scheme gives rise to the significant potential for the spread of aquatic invasive species arising from recreational use of the River Finn, extending into the Ulster Canal line. Although there is a current risk of the spread of invasives due to angling, kayaking etc. it is considered that further tourism development would create a greater risk within the study area. It is also important to note that any operational dredging, bank clearance or maintenance works within the aquatic environment would give rise to the risk of importation or transfer of invasive species; both flora and fauna.

There is the potential for operational maintenance works to give rise to increased suspended solids and / or pollutant discharges arising from periodic dredging, dredge spoil removal, increased bankside erosion due to boat traffic and the transport of sediment from the canal upstream.

The proposed modification of the River Finn channel via dredging, the construction of mooring sites and the required abstraction to supply the canal may give rise to hydromorphological impacts, which may have indirect impacts on riparian habitats and aquatic fauna within the study area. There is further potential for habitat loss and disturbance due to ongoing dredging maintenance and also increased recreational boat traffic on the watercourse.

Disturbance impacts, other than water quality may potentially include impacts affecting wildlife within the study area arising from increased noise and human activity, boat wash and erosion, trampling and loss of naturalness along the River Finn corridor and its associated loughs, which are relatively undisturbed at present. The increase in boat wash, alteration of the flow regime and operational maintenance of a navigable channel are considered likely to result in long-term and periodic habitat loss and disturbance of the Eutrophic lakes vegetation communities along the riparian habitats of the Finn.

9.5 MITIGATION MEASURES

9.5.1 Mitigations during Construction Phase

9.5.1.1 Mitigations for Water Quality and Aquatic Fauna

It will be necessary to get written permission from Inland Fisheries Ireland, who have responsibility for implementation of the Fisheries (Consolidation) Act, 1959 and also from the Department of Culture, Arts and Leisure (DCAL) in Northern Ireland with responsibility for the implementation of the Fisheries Act (NI) 1966, in order to proceed with the works. It is considered that disturbance to the spawning and nursery areas of both salmonids and lampreys are unavoidable as a result of the scheduled works. Salmon, all lamprey species and their habitats are further protected in Ireland and Northern Ireland under the EU Habitats Directive (1992). All works affecting any watercourse both temporary and permanent will be agreed with the relevant drainage and fishery authorities. All discharges to a watercourse will be in accordance with Pollution Prevention Guidelines 6 (PPG6), while all any abstractions will be subject to the requirements of UK TAG.

Timing of works is of significant importance. This requires both the culverting of watercourses within the canal route and also any dredging operations to be undertaken outside the spawning and early life stages of salmonids i.e. October to May inclusive.

Section 171 of the Fisheries (Consolidation) Act 1959 creates the offence of throwing, emptying, permitting or causing to fall onto any waters deleterious matter. Deleterious matter is defined as not only as any substance that is liable to injure fish but is also liable to damage their spawning grounds or the food of any fish or to injure fish in their value as human food or to impair the usefulness of the bed and soil of any waters as spawning grounds or other capacity to produce the food of fish.

Under Section 40 of the 1976 Wildlife Act, as amended by Section 46 of the Wildlife Amendment Act (2000), it is forbidden to cut or remove trees or other semi-natural vegetation during the bird nesting season, from the 1st of March to the 31st of August. This includes riparian vegetation along the river channel (i.e. reeds and marginal vegetation) which could be used by water birds.

The removal of in-stream river vegetation should be avoided where possible and where necessary the extent of vegetation removal will be limited; especially in areas where floating river vegetation, reed beds or riparian woodland may be within, or in proximity to any instream works that may be required as part of this scheme.

It is recommended that fish salvage exercises be undertaken from any instream works sites along the riparian corridor of the River Finn, both within the navigable sections and also at proposed crossing points within the Ulster Canal line. In addition, the removal and translocation of lamprey juveniles from dredged silt spoil will be required for all dredging and instream works. This must be undertaken by a suitably qualified fisheries biologist with demonstrated experience in lamprey salvage and translocation.

Otter ledges are required for all culverts at watercourse crossings to allow continued passage of otters within the study area, commuting between lakes and watercourses within the Finn catchment.

It is recommended that shallow margins are retained on both sides of the River Finn, where dredging is required, both to retain riparian habitats and also to minimise disturbance to juvenile lamprey populations and otter within the river margins. However, detailed site specific mitigations are required at a micro-siting level for all works along the riparian corridor of the River Finn at detailed design stage.

Protection of water quality during construction

Water quality impacts during the construction phase will be minimised / avoided by following method statements in accordance with PPG6 as part of a Construction Management Plan agreed in advance with NPWS, NIEA, IFI and DCAL.

The dredging works will be carried out during low flow conditions and will cease during heavy rainfall and flood conditions. Spoil and removed vegetation material from the river is to be stored no less than 5m back from the river and vegetation within this 5m buffer zone is to be retained, in order to reduce the run-off of suspended solids back into the water course. Surface water run-off and siltation measures are required in a water management plan for the works phase.

Where applicable it is recommended that coarse aggregates (cobble and gravel) removed from the river channel should be stockpiled for replacement and rehabilitation in the reformed river bed. Such material will be stored at least 10m from the river bank to ensure that runoff from the material does not affect water quality in the river in the form of increased suspended solids.

In areas where the existing riverbed consists of fine material (i.e. silt and/or mud) this material should be removed from the site and disposed of appropriately. Excavated material will not be discharged into the river.

A silt fence (or equivalent barrier) would be used to surround the works area. This would be installed directly adjacent to the river bank or within the river in the case of instream works, prior to any works commencing on site. Material removed would be stockpiled within a bunded area / or within a geotextile barrier.

Refuelling of all machinery will take place away from the river within bunded areas which shall be located a minimum of 10m from the river bank. In the case of pile driving machinery which cannot be moved away from the river, refuelling will be undertaken on a trial basis using drip trays, under the supervision of the site ecologist. The contractor shall provide a spill kit and oil soakage packs on site at all times, which should be deployed immediately in the case of a pollution event.

All fuels/oils/lubricants will be stored away from the river in an appropriate bunded area.

Cement is an aggressive pollutant and all cement material and empty bags will be stored away from the water course. Cement mixing shall not be carried out along the river bank and where possible pre-cast, dried concrete shall be used. Mixer washings and excess concrete shall not be discharged into the river.

Where instream works may be required the river must be effectively sheet-piled and the water pumped out, all concrete works and installation shall be carried out in the dry. Concrete will be allowed to cure for a minimum of 48 hours before the area is reflooded. No excess river bed material or vegetation is to be removed during instream works other than what is necessary for the efficient construction of the proposed walls, i.e. material contained within the silt curtain installed within the river bed.

The removal of river vegetation should be avoided where possible and where necessary the extent of vegetation removal will be limited; especially in areas where floating river vegetation may be within, or in proximity to, the required sheet-piling or excavation site.

No machinery will be allowed to operate within the river flow without full consultation and approval of the methodology of the proposed works by the relevant statutory bodies including NPWS, IFI, NIEA and DCAL. In general machinery will work on the river bed only when sheet-piling has been completed and the area is pumped dry. Trampling or installation of scaffolding or works platforms within the aquatic habitats and water's edge constitutes instream works and appropriate method statements will be required to minimise the impacts to these habitats based on the works programme.

Apart from discrete areas that may need to be sheet-piled, all work will be undertaken from the bank and excavated bank material shall be removed to the landward side. Loose material and debris shall not be dumped back into the river.

9.5.1.2 Method statements

The appointed contractor will be required to provide a detailed method statement and design showing how water quality impacts and habitat loss during the works will be minimised. The methodology will be approved prior to any works taking place. The recommended mitigation measures outlined in the EIS, in combination with further requirements agreed with the NPWS and the NIEA will be formatted as an Environmental Commitments Checklist with the Construction Method Statement as part of the Construction Management Plan. This will then allow for efficient implementation of the measures proposed, reflecting the basis of the EIS process and also allow for transparent ecological monitoring.

A suitable environmental management system will be used to control sediments during the works; this will include the installation of properly designed silt curtains and a monitoring programme for suspended solids in the river, to be agreed with the NPWS, IFI, NIEA and DCAL.

Fisheries enhancement works will be required as mitigation to reshape the river corridor following the works. This will require consultation with the Inland Fisheries Ireland, DCAL Fisheries, the NIEA and NPWS in order to obtain a design that meets the requirements of all protected species within this stretch of the river.

Prior to any instream works required during the proposed works the affected area will be fenced by a silt curtain to allow lamprey and other fish species to be removed. This will be achieved by electrical fishing by a suitably qualified fisheries ecologist, with prior consultation with IFI and DCAL Inland Fisheries. Fish salvage, removal and translocation will be carried out within two days of the proposed piling works, to ensure the affected sections are not recolonised by juvenile lamprey or other salmonid fish species. Dewatered areas behind piled sections will be checked by a suitably qualified fisheries ecologist for the presence of fish and appropriate action taken if any fish are trapped. Should lamprey species be recorded during the fish salvage exercise, these will require removal under licence from the NPWS/NIEA and translocation to an appropriate site upstream.

The safe spawning of salmonids during this period is ensured under Section 173 of the Fisheries (Consolidation) Act (1959). Works will be carried out outside of the salmonid spawning season and the times that early life stages of salmonid fish will be present. Overall, no instream work will be undertaken during the period October to April, unless approval is obtained in writing from Inland Fisheries Ireland or DCAL Fisheries within the relevant jurisdictions.

Detailed, task specific method statements will be required for each section of works at final design stage; where specific mitigations relating to the ecological interests of that section will be provided by the appointed contractor for the works to be agreed with the NPWS, NIEA, IFI and DCAL, particularly in relation to the dredging operations and the control of suspended solids within the River Finn.

Floating pontoons avoids bank loss, where minor mooring points are required; however, detailed site specific mitigations are required at a micro-siting level for all works along the riparian corridor of the River Finn at detailed design stage.

Works on site will not be permitted during hours of darkness, in order to allow wildlife including otters, bats and fish species to commute through the works area without disturbance.

9.5.1.3 Invasive species

During the proposed construction, the contractor must ensure that any plant or equipment that may have worked in environments where invasive species are present (including but not restricted to zebra mussel *Dreissena polymorpha*, , Asian clam *Corbicula fluminea*, curly waterweed *Lagarosiphon major*, Japanese knotweed *Fallopia japonica*, Indian balsam *Impatiens glandulifera*, giant hogweed *Heracleum mantegazzianum*, rhododendron *Rhododendron ponticum*, New Zealand flatworm *Arthurdendyus triangulate*, Chinese mitten crab *Eriocheir sinensis*), shall be suitably cleaned by high pressure hose before being used on the site to prevent the spread of invasive species. Water used for

this process shall always be carried out at the machinery depot, intercepted, and prevented from draining back into local watercourses.

The source location for material imported into the works area for works along the canal line and the river corridor should be subject to a separate suitability assessment prior to any works taking place. In particular, the material must be uncontaminated and would be ideally soil/sub-soil sourced in the local region. Waste material from construction sites etc. would not be suitable for use within the affected internationally important designated area. It must also be shown that the proposed material to be imported would not be a vector for the introduction into or transfer within the site of invasive non-native species (particularly Japanese knotweed *Fallopia japonica*).

9.5.2 Mitigation Measures for the Operational Phase

The operational phase of the proposed scheme will be managed under an operational Environmental Management Plan by Waterways Ireland, which will include measures for the enhancement of ecological diversity and facilitation of protected species will require the maintenance of satisfactory water quality and 'good ecological potential' within the Canal waterbody.

In addition, invasive species are recognised as posing a significant impact during the operational phase and it is recommended that Invasive Species Awareness Information Boards are erected strategically within the Canal line to maintain awareness of this threat.

Speed limits for vessels are recommended in line with Waterways Ireland current practice to reduce bank wash. However, it is considered that lower limits may be required at constricted channels within the Finn (i.e. between Gortnacarrow and Wattle Bridge) where the riparian habitats may require additional protection. It is recommended that Waterways Ireland bye-laws for the control of speed limits are applied.

Ongoing maintenance of the river channel will require a further ecological survey to assess the presence and recovery of protected aquatic species which may have colonised the affected stretch of the River Finn and also within the Canal. This survey will be carried out by a suitably qualified aquatic ecologist with particular reference to the success of the mitigation measures and enhancement works carried out during the proposed canal works and with recommendations for the avoidance of further impacts to the aquatic ecological communities during the required maintenance works.

This can be achieved by surveys identified in the Operational Stage Environmental Management Plan to check for invasive species. The interval of maintenance on the channel will affect the potential for naturalisation of the channel and further mitigations may be required in order to reduce or remedy potential impacts to protected species during maintenance works in the future.

Consultation with the statutory bodies NPWS and NIEA is recommended in this regard, where these statutory bodies should be contacted in advance of works within the site and the presence of Annex II listed species identified prior to works taking place.

9.5.3 Monitoring

During the works phase of the project the site will be monitored by a suitably qualified aquatic / fisheries ecologist to ensure that the measures to protect water quality and aquatic areas are fully implemented by the appointed contractor. The extent of monitoring required will be agreed in advance with the NPWS and the NIEA, with regard to the Natura 2000 status of the site and details of the monitoring frequency will be specified in the method statement. The site should also be monitored post-works to establish the success of the agreed enhancement features and to describe the residual impacts of the scheme on Annex II listed species within the study area, with particular reference to 'good ecological status/potential' requirements within the Finn / Upper Erne and the Ulster Canal.

Further monitoring of fish populations within the Finn corridor is recommended during the operational phase of the works, to be further detailed in consultation with the IFI and DCAL.

9.5.4 Reinstatement and Enhancement Works

Reinstatement of the river corridor and riparian habitats at the proposed mooring sites and at sections of the river corridor affected directly by the proposed scheme would benefit from well designed landscaping and habitat reinstatement to shield any proposed mooring site from the river corridor, thus minimising disturbance to aquatic ecological interests arising from car parking, launching and other human activity. All works along the river corridor (except for slipways and other entry points) must ensure the maintenance of a riparian buffer from the water's edge, which will be planted and maintained for wildlife continuity.

The canal may also provide suitable habitat for the Annex II listed white clawed crayfish and suitable enhancement measures for this species within the canal system would include the provision of hard substrates as refuges within the canal to facilitate colonisation. This would include piling of large cobbles into artificial reefs and cavity blocks along the Canal line, with further riparian planting creating additional suitable habitat.

The extent of reinstatement works will depend on the area of riparian and instream habitat affected by the proposed scheme, as determined at a detailed design stage, based on both the location of proposed mooring facilities and the results of any alteration in the hydromorphology of the River Finn, which may require conservation measures for riparian habitats. It is recommended any loss in riparian habitat or cover along the watercourse be reinstated to facilitate the overall ecological improvement of this habitat for aquatic fauna. A development measure to restore and enhance salmonid habitats along the affected stretch of minor watercourses and the River Finn within the scheme will be drawn up and agreed in advance with the relevant statutory agencies. Coarse gravel and cobble materials may also

be used to re-instate potential salmon and lamprey spawning grounds in the same areas. The nature and location of these instream improvement works will be agreed in advance and undertaken under the supervision of the site ecologist.

9.6 RESIDUAL IMPACTS

It is predicted that the proposed scheme will result in slight to moderate impacts affecting water quality in the short term, with long term water quality impacts evaluated as being in line with current trends; where the ongoing, operational phase of the navigation channel would not significantly detract in any way from the achievement of 'good ecological status' within the River Finn. This conclusion is based on the current situation within the Upper Erne, where recreational navigation is ongoing.

Works along the River Finn riparian corridor associated with moorings, jetties and car parking; in conjunction with abstractions for the Ulster Canal and dredging of the Finn main channel are considered likely to result in localised significant impacts on the Finn corridor in the short term; however, with proper mitigation during construction these will be reduced to slight negative, with a slight negative impact remaining in the longer term. It is considered that the long term impacts of the scheme will not result in a significant impact on the aquatic ecology of the SAC site.

The proposed reopening of the Ulster Canal is predicted to result in significant long term impacts affecting otter habitat within the River Finn corridor, consistent with the level of ongoing impacts affecting this species within the Upper Erne as a whole. In this context otter continue to occur throughout, having adapted to increased human disturbance. Furthermore the opening of the Ulster Canal will result in the creation of new foraging and commuting habitat for this species within the Finn catchment.

There is significant scope for the creation of compensatory habitat and instream compensation for fish habitat, both within the River Finn, along its margins in particular and also within the affected tributaries of the River Finn i.e. the Lackey catchment, where enhancement of salmonid habitat may be of considerable benefit.

10 TERRESTRIAL ECOLOGY

10.1 INTRODUCTION

10.1.1 Chapter Scope

This section of the EIS outlines the terrestrial ecology and nature conservation interests within the vicinity of the proposed Ulster Canal scheme. Following consultation with Northern Ireland Environment Agency, Natural Heritage (NIEA) and National Parks and Wildlife Service (NPWS), the following ecological surveys were undertaken within the study area:

- Extended Phase 1 Habitat Survey;
- Phase 2 Habitat Survey;
- Badger Survey;
- Bat Survey;
- Wintering Wildfowl Survey;
- Breeding Waterfowl and Wader Survey;
- Terrestrial Breeding Bird Survey;
- Terrestrial Invertebrate (Beetle) Survey;
- Smooth Newt Survey.

These surveys are described under Methodology in **section 10.1.2**. Due to the scale of the project this Terrestrial Ecology section is subdivided into four parts. **Section 10.2** covers designated nature conservation sites; **Section 10.3** covers Habitats and Flora; **Section 10.4** covers Avifauna and ornithology; and **Section 10.5** covers other fauna. All figures and plates for this Terrestrial Ecology section can be found in **Appendix D**.

10.1.2 Study Area Overview

Broadly speaking, the eastern portion of the scheme between Clones and Gortnacarrow passes through relatively flat farmland, and a thinly populated rural fringe, where the existing canal has mostly been in-filled (**Figure 10.1** Scheme layout – indicating terrestrial and aquatic survey areas). Some previous canal structures remain in parts including bridges and visible bank sides. This section is referred to as the terrestrial portion of the scheme. The western end of the scheme area passes through a system of freshwater waterbodies west of the endpoint of the original canal between Gortnacarrow and Upper Lough Erne. This section includes the River Finn and is referred to as the aquatic portion of the scheme.

10.1.3 Appropriate Assessment

Under Article 6(3) of The Habitats Directive (92/43/EEC), an assessment is required where a project may potentially give rise to significant effects upon a Natura 2000 site or sites. Natura 2000 is a European Network of protected sites which includes Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). The proposed restoration scheme impinges upon the Upper Lough

Erne SPA and SAC (Site Codes UK9020071 and UK0016614 respectively), and Lough Oughter and Associated Loughs SAC (Site Code IE000007). The scheme also passes within 1.2km of Kilroosky Lough Cluster SAC (Site Code IE0001786) and within 9km of the Lough Oughter SPA (Site Code IE0004049).

A Natura Impact Statement is defined in Irish law as being “a report comprising the scientific examination of a plan or project and the relevant European Site or European Sites, to identify and characterise any possible implications of the plan or project individually or in combination with other plans or projects in view of the conservation objectives of the site or sites, and any further information including, but not limited to, any plans, maps or drawings, scientific information or data required to enable the carrying out of an Appropriate Assessment” (Part 1 of S.I. 477/2011).

As this Ecological Impact Assessment Report is being submitted for planning simultaneously in Ireland and Northern Ireland, the legal term of a Natura Impact Statement is used for the Habitats Directive Article 6(3) Appropriate Assessment which has been prepared. It is appended to this EIS as **Appendix D**.

10.1.4 Methodology

Key Sources

An initial desktop review was carried out to identify features of ecological importance within the study area and surrounding region. The proposed scheme area and a surrounding buffer zone of 2km were included in the data trawl to collate relevant environmental data and anecdotal evidence to assist with the ecological assessment and evaluation of this proposal.

There are several previous reports which have examined and described the potential for restoring and re-opening the Ulster Canal, which have been referred to in the production of this section. These include:

- Restoration of the Ulster Canal (Upper Lough Erne to Clones) Feasibility Study;
- Restoration of the Ulster Canal (Upper Lough Erne to Clones) Strategic Environmental Assessment Report

Formal consultations were undertaken with the following organisations and personnel, which were felt to be of particular relevance to this chapter:

- Northern Ireland Environment Agency (NIEA);
- National Parks and Wildlife Service (NPWS);
- British Trust for Ornithology (BTO);
- BirdWatch Ireland (BWI);
- The Royal Society for the Protection of Birds Northern Ireland (RSPB, NI);
- Wildfowl & Wetlands Trust (WWT);
- Irish Whooper Swan Study Group (IWSSG);
- Heronries (John Lyons) Northern Ireland;

- Northern Ireland Bat Group (NIBG);
- Bat Conservation Ireland (BCI);
- Department of Environment, Heritage & Local Government (DEHLG).

In addition to the above, the following list of legislation and publications were consulted and/or are referred to in this document.

European

- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (The Habitats Directive);
- Directive 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds (codified version of Directive 79/409/EEC as amended) (The Birds Directive);
- Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy (The Water Framework Directive);
- Council Directive 2004/35/EC on environmental liability with regard to the prevention and remedying of environmental damage (The Environmental Liability Directive);
- Directive 2006/44/EC of the European Parliament and of the Council of 6 September 2006 on the quality of fresh waters needing protection or improvement in order to support fish life (The Fish Directive (consolidated)).

All-Ireland

- The status of birds in Ireland: an analysis of conservation concern 2008-2013. (Lynas, 2007) (Birds of Conservation Concern in Ireland (BoCCI));
- Ireland Red List No. 1: Water beetles (Foster *et al.*, 2009);
- Important Bird Areas in Europe: Priority sites for conservation. 2 vols. Cambridge UK: BirdLife International (Heath *et al.*, 2009).

Ireland

- The Wildlife Act 1976 as amended by the Wildlife (Amendment) Act 2000 Wildlife (Amendment) Act 2010 (The Wildlife Acts);
- European Communities (Conservation of Wild Birds) Regulations 1985 (S.I. 291/1985); and as amended by S.I. 31/1995,
- European Communities (Natural Habitats) Regulations, S.I. 94/1997 and as amended by S.I. 233/1998 & S.I. 378/2005; (The Habitats Regulations);
- European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477/2011);
- The Flora (Protection) Order, 1999 S.I. No. 94/1999;
- The Planning & Development Acts, 2000-2010
- National Biodiversity Plan, 2002;
- Monaghan County Development Plan 2007-2013;
- Cavan County Development Plan 2008-2014;
- *Draft* County Monaghan Local Biodiversity Plan 2008-2013;

- County Cavan Local Biodiversity Plan 2006-2011;
- Threat Response Plan: Otter 2009-2011 (DoEHLG, 2009);

Northern Ireland

- The Wildlife (Northern Ireland) Order 1985 (S.I. 1985/171 (N.I. 2)) as amended by The Wildlife (Amendment) (Northern Ireland) Order 1995 (S.I. 1995 No. 761 (N.I. 6)) and The Wildlife and Natural Environment (Northern Ireland) Act 2011;
- The Nature Conservation and Amenity Lands (Northern Ireland) Order 1985 (S.I. 1985/170) (The Nature Conservation and Amenity Lands Order);
- The Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (S.R. 1995 No. 380) as amended by the Conservation (Natural Habitats, etc.) (Amendment) Regulations (Northern Ireland) 2004 (S.R. 2004 No. 435), The Conservation (Natural Habitats, etc.) (Amendment) Regulations (Northern Ireland) 2007 (S.R. 2007 No. 345) and The Conservation (Natural Habitats, etc.) (Amendment) Regulations (Northern Ireland) 2009 (S.R. 2009 No. 8) (The Conservation Regulations);
- Northern Ireland Biodiversity Strategy (EHS, 2002);
- The Environment (Northern Ireland) Order 2002 (S.I. 2002/3153 (N.I. 7)) (The Environment Order);
- The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003 (S.R. 2003 No. 544);
- Fermanagh Area Plan 2007;
- The Wildlife and Natural Environment (Northern Ireland) Act 2011.

The following databases were consulted to retrieve ecological data:

- National Parks & Wildlife Service (NPWS) Maps & Data (<http://www.npws.ie/en/MapsData/>);
- Northern Ireland Environment Agency (NIEA) Maps ;
- National Biodiversity Data Centre (NBDC) Records & Mapping (<http://www.biodiversityireland.ie/>);
- National Biodiversity Network (NBN) database (<http://data.nbn.org.uk/>);
- Flora of Northern Ireland database (www.habitas.org.uk/flora/);
- British Trust for Ornithology (BTO) Wetland Bird Survey Data (WeBS);
- Wildfowl & Wetlands Trust (WWT) National Swan Census Data.

The following websites were also consulted:

- Wildfowl & Wetlands Trust (<http://www.wwt.org.uk/>);
- BirdWatch Ireland (<http://www.birdwatchireland.ie/>);
- BTO website (www.bto.org/);
- Botanical Society of the British Isles (BSBI) (<http://www.bsbi.org.uk/>);
- Joint Nature Conservancy Committee (JNCC) (<http://www.jncc.gov.uk/>);
- Butterfly Conservation (www.butterfly-conservation.org/);

- The Coleopterist (<http://www.coleopterist.org.uk/>);
- Invasive Species Northern Ireland (<http://www.habitas.org.uk/invasive/>);
- Invasive Species Ireland (<http://www.invasivespeciesireland.com/>);
- Institute of Ecology & Environmental Management (IEEM) (<http://www.ieem.net/>);
- IUCN Otter Specialist Group (<http://www.otterspecialistgroup.org/>).

Survey Methodologies

Extended Phase 1 Habitat Survey

Following an initial desktop ecological assessment, the proposed route of the Ulster Canal was visited over 11 days in July and August 2009, to undertake an Extended Phase 1 Habitat survey. The methodology used was a combined approach using the UK industry standard JNCC Phase 1 methodology (JNCC, 2003), and the Heritage Council's *Best Practice Guidance for Habitat Survey and Mapping* (Smith *et al.*, 2011), and the habitat assessment categories used in *A Guide to Habitats in Ireland* (Fossitt, 2000). Habitats were recorded and mapped and an intensive search was undertaken for protected, priority and invasive species. The aquatic portion of the scheme area was surveyed from a small work vessel.

The Extended Phase 1 Habitat Survey is a multipurpose survey that aims to identify any or a large number of ecological features including plant habitats, mammals, invasive species, invertebrates, amphibians, and reptiles. Habitats were surveyed and catalogued, noting dominant plant species and any protected, priority, and rare plant species.

Badger

During the Phase 1 and Phase 2 habitats surveys, a badger survey was undertaken in accordance with the guidance documents *Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes* (NRA, 2009), *Badger Survey – Specific Requirements* (NIEA, 2009) and with reference to *Badgers & Development* (EHS, 2004). Habitat features encountered during the habitat survey were searched for setts and field signs indicating badger activity in the locale of the proposal, particularly in areas of agricultural use with field boundaries and where land was more freely draining. Field signs are characteristic and sometimes quite obvious and include tufts of hair caught on barbed wire fences, conspicuous badger paths, footprints, small excavated pits or latrines in which droppings are deposited, scratch marks on trees, and snuffle holes, which are small scrapes where badgers have searched for insects and plant tubers (SNH, 2001). The habitat surrounding the sett, soil type, and signs of human activity are also noted.

Harris *et al.* (1989) note that setts are assessed for level of use and the number of entrance holes, and thus classified into four types: main, annexe, subsidiary and outlying. These types can be defined as follows:

- Main sett - These are large, well-established setts, normally in continuous use. Each group will use only one main sett and it will form the most likely location for the raising of cubs;

- Annexe sett - These setts are usually found in close association with the main sett, and will often be linked to it by a well-worn path. Where a second litter of cubs is born they will be raised in the annexe sett;
- Subsidiary sett - Subsidiary setts will usually have five or less holes, although not all of these will be in continuous use;
- Outlying sett - These setts are used on an occasional basis and will usually consist of only one to three holes. Spoil heaps will generally be smaller than those found associated with the other sett types, indicating a smaller underground structure.

The entrance holes to setts can provide an indication as to the level of use of the sett. Entrance holes can be classified as follows:

- Well used - These holes are in regular use and are therefore free of debris. They may have been recently excavated;
- Partially used - Debris, including leaves, twigs and other vegetation clutter the entrance to these holes, indicating they are not in regular use. The holes can be used after a minimum of clearance;
- Disused - A considerable amount of clearance is needed before these holes can be used. The holes may become so blocked that only a depression in the ground is visible where the hole used to be.

Otter

During the Phase 1 and Phase 2 habitats surveys, the terrestrial portion of the scheme between Clones and Gortnacarrow Bridge were comprehensively searched for otter field signs. Otter field signs were also searched for as part of the Aquatic Ecology Assessment (**section 9**), terrestrial breeding bird surveys and breeding waterfowl and wader surveys. Searches for otters and signs of otter activity were made in aquatic portion of the scheme area from both land and boat-based surveys during breeding and wintering bird surveys.

Guidance on otter survey was taken from the guidance documents *Otter Survey – Specific Requirements* (NIEA 2009) and *Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes* (NRA, 2009). The range of field signs indicative of otter presence (Scottish Natural Heritage, 1997) include:

- Spraints
- Food remains;
- Rolling places;
- Slides down river banks;
- Footprints or paths and;
- Shelters (either holts or couches).

Invasive Flora & Fauna Species

These species cause considerable risk to biodiversity via predation, competition, or interbreeding with native species, or are general pest species. Schedule 9 to Part 2 of the Wildlife Order lists non-native

plant species established in the wild in Northern Ireland and states “if any person releases or allows to escape into the wild any [listed plants]...he shall be guilty of an offence”. Other invasive and potentially economically damaging flora and fauna species not subject to legal penalties for release into the wild in Northern Ireland are listed on the Invasive Species Ireland Website.

Regulation 49(2) of the European Communities (Birds and Natural Habitats) Regulations 2011 states that it is an offence to plant, disperse, allow or cause to disperse, spread or otherwise cause to grow those species listed in the Third Schedule to the Regulations.

Detailed species profiles of invasive species on the island of Ireland are available on the cross-border initiative *Invasive Species Ireland website*, which is a cross-border web-based project. Observations for invasive species were made during Extended Phase 1 Habitat Surveys and Phase 2 Habitat Surveys.

Invertebrates

During Phase 1 and Phase 2 habitats surveys records of any butterflies, moths, dragonflies and damselflies were noted. The terrestrial portion of the scheme area between Clonfad, Munnilly Bridge and Clonnagore and between Clonoony House and Gortnacarrow Bridge River Erne was subject to a targeted terrestrial beetle survey. Nelson (2003) lists assemblage types with regard to invertebrate monitoring in N. Ireland. His list has been modified in the light of the broad structures proposed in ISIS (Invertebrate Species – habitat Information System) for Natural England (Drake *et al.* 2007) to produce the following structure (Alexander, 2006). This list forms the basis for methodologies to be used in any recording work.

Sampling techniques employed at selected sample sites within the scheme area were chosen on the basis of habitats encountered and therefore anticipated assemblages.

Amphibians

Smooth Newt *Lissotriton vulgaris* is found in a diversity of habitats including uplands, farmland and urban areas, but are most likely to be found in small to medium sized ponds (Inns, 2009). The breeding habitat varies from large to small ponds to densely weeded ditches. Newts are however more likely to be found in ponds (non-linear) than in ditches (linear) (O'Neill *et al.*, 2004), and show a strong preference for fish-free water bodies (Inns, 2009). However a recent survey of newts in Northern Ireland (O'Neill *et al.*, 2004) concluded that it remains difficult to predict likelihood of newt presence based on habitat, and highlighted that there is a clear requirement for surveys of sites proposed for development. Potential smooth newt breeding habitat was therefore recorded during the Extended Phase 1 Habitat Survey to facilitate further species-specific surveys. Potential smooth newt breeding habitat and an adult smooth newt were recorded within the scheme area during Extended Phase 1 Habitat Surveys in June 2009. Following from this, a smooth newt survey was undertaken within the scheme area. Surveys followed guidance issued by the Northern Ireland Environment Agency *Newt Survey – Specific Requirements* (NIEA, 2011) and additional guidance was gathered from the following sources:

- Inns, H. 2009. Britain's Reptiles and Amphibians, Wildguides, Hampshire;
- O'Neill, K., Jennings, S., Forsyth, L., Carey, R., Portig, A., Preston, J., Langton, T. & McDonald, R. 2004. The distribution and status of smooth newts in Northern Ireland, Environment & Heritage Service, Belfast, Unpublished Quercus Report.

All suitable waterbodies within the scheme area were surveyed to determine their use by smooth newts. In addition all potential refuges within 200m of the each waterbody were surveyed. Appropriate wildlife licences from NIEA and NPWS were acquired for the purposes of these surveys. Due to the timing of appointment for these surveys, only one block of field survey work could be undertaken within the wildlife licence conditions. Survey covered waterbodies and refuge areas previously identified. The survey methodology employed consisted of two components (1) a terrestrial refuge search and (2) torchlight surveys. Bottle trapping is prohibited in Northern Ireland and was not used. All waterbodies were subject to torchlight surveys. Terrestrial refuge searches undertaken during daylight hours. Terrestrial refuge searches including lifting suitable smooth newt hiding places (wood planks, logs, plastic sheets) within 200m of waterbodies. Torchlight surveys were used to scan for newts within waterbodies and were undertaken by two competent surveyors using 1 million candle power torches during the hours of darkness.

Dip-netting was not undertaken during these surveys due to the inaccessibility of open water and due to health and safety considerations of working near to water of unknown depth and unstable banks. Many waterbodies were also significantly vegetated and the decision was taken not to incorporate dip-netting due to the high risk of habitat disturbance. Surveys were not carried out in ambient air temperatures below 5°C, or in persistent or heavy rain, which can influence water turbidity and newt activity.

For each waterbody surveyed the following information was recorded:

- Weather conditions at time of survey;
- Waterbody length and width;
- % Cover of aquatic vegetation;
- Water Turbidity (0 = clear, 1 = slightly cloudy, 2 =very cloudy. 3 = opaque);
- Presence of fish, frogs and carnivorous birds;
- Abundance of newts in each waterbody where present (sex recorded)

Common Frog

Common frog *Rana temporaria* is the only species of frog found in Ireland and is protected in both Ireland and Northern Ireland. Common frogs are widespread throughout the island of Ireland and can be found in a range of damp environments including woodland, damp grassland, hedgerows, marshes, moorland, parks and gardens up to 1,000m above sea level (Inns, 2009). Common frogs are opportunistic breeders and whilst they will typically breed in small shallow ponds or at the shallow margins of larger lakes they will also use ditches and often puddles (Inns, 2009). Such waterbodies are important for breeding during spring and summer months however, surrounding damp vegetation

is important for winter hibernation (Inns, 2009). Observations for common frog were made during Extended Phase 1 and Phase 2 habitat surveys and during newt survey.

Reptiles

Live sightings or signs of common lizard are rare outside of formal surveys. Effort was therefore made during Extended Phase 1 and Phase 2 Habitat Surveys to identify potentially suitable habitats for common lizard, within which species specific surveys could be undertaken. Suitable habitats are however somewhat varied, but can include a range of dry habitats including open woods, heaths and grassland. Suitable habitats were not identified within the scheme area and therefore no formal survey for common lizard was undertaken. Existing records were however consulted before excluding the possibility of the species being present within the scheme area.

Phase 2 Habitat Survey

The Extended Phase 1 Habitat Surveys were followed by Phase 2 Habitat Surveys in May and June 2011 to more precisely describe grassland habitats identified within the proposed scheme area. During Phase 2 Habitat Surveys accurate species lists were obtained for grasslands within the terrestrial portion of the scheme area. Survey effort focused on identifying any priority grassland habitats and the distribution of Priority/Red-listed plant species. The distribution of invasive flora species were also more fully described within the terrestrial scheme area here. Phase 2 Habitat Surveys were undertaken in May and June 2011.

Wintering Bird Desktop Study

The Upper Lough Erne SPA is located within the proposed scheme area. The site qualifies primarily for designation by regularly supporting internationally important wintering populations of Whooper Swan *Cygnus cygnus*. Several other nationally and regionally significant wintering populations of waterfowl are also known to frequent the area. The Upper Lough Erne – Galloon ASSI is also located within the proposed scheme area and is important for wintering populations of Mute Swan *Cygnus olor*, Teal *Anas crecca*, Wigeon *Anas penelope* and Goldeneye *Bucephala clangula* and breeding waders including Snipe *Gallinago gallinago*, Lapwing *Vanellus vanellus* and Curlew *Numenius arquata*.

A review of all existing ecological information on wintering bird species within and in the vicinity of the proposed scheme area was therefore undertaken. Existing data was gathered within a survey area expanding 2km outside of the proposed scheme area. The key elements of this desktop review were to:

- Identify all wintering bird species within the survey area including all protected species and populations of species recorded in internationally and nationally important numbers;
- Identify gaps in existing data sets that require additional survey.
- To obtain existing information consultations were undertaken with the following key organisations and personnel:
- The Royal Society for the Protection of Birds (RSPB);

- The British Trust for Ornithology (BTO);
- BirdWatch Ireland (BWI);
- The Centre for Environmental Data and Recording (CEDaR);
- Northern Ireland Environment Agency (NIEA);
- The Wildfowl & Wetlands Trust (WWT).

BTO Wetland Bird Survey (WeBS) datasets were a key source of existing information for the aquatic portion of the scheme area.

Wintering Wildfowl Survey

The above desktop study identified gaps in existing data sets, which required additional wintering bird surveys to address. A wintering wildfowl survey was completed to gather data for areas of waterways in the western portion of the scheme area, where BTO Wetland Bird Survey (WeBS) data sets did not extend. The wintering wildfowl survey area therefore consisted of a 3km stretch of the River Finn between Kilgarrow Lough and Goladuff and a 200m stretch to the west of Wattle Bridge. The survey area was visited three times during the 2009/10 overwintering period, during which peak counts of all waterfowl and wader species were recorded from a series of vantage points.

Breeding Bird Desktop Study

The Upper Lough Erne SPA is located within the proposed scheme area. Upper Lough Erne supports an important assemblage of breeding birds, which include Common Tern *Sterna hirundo*, Great Crested Grebe, Curlew, Snipe and Redshank. To obtain existing information consultations were undertaken with the following key organisations and personnel:

- The Royal Society for the Protection of Birds (RSPB);
- The British Trust for Ornithology (BTO);
- BirdWatch Ireland (BWI);
- Heronries (John Lyons) Northern Ireland.

Breeding Waterfowl and Wader Survey

The aquatic portion of the proposed scheme area between Gortnacarrow and Derrykerrib consists entirely of eutrophic waterways, and is difficult to access on foot in many parts. This is largely due to bankside reedbeds that screen views of the water from ground level, and/or swampy bankside ground conditions which do not permit access on foot. Breeding waterfowl are more likely than wintering birds to skulk in bankside reedbeds or down side channels should they perceive disturbance. For this reason, a multi-disciplinary survey approach was adopted.

A breeding waterfowl survey was undertaken by two boat-based surveyors in June 2010. A small motor boat was launched from Derrykerrib Bridge at 05h00 and proceeded south along the River Finn to Gortnacarrow. All waterfowl activity and any observed nest sites were mapped on to survey sheets and BTO categories of breeding evidence were used to assign possible, probable or confirmed breeding status. The number of breeding pairs was determined using the guidance in Gilbert *et al.* (1998) for breeding waterfowl.

For breeding wader survey, agricultural fields adjacent to the waterway were accessed by boat, and walked by foot. Unsuitable fields were excluded from the survey and included those which were recently cut or intensely grazed (sward height <10cm) and/or dry underfoot making them unsuitable for foraging wading birds. Each suitable field was walked by one surveyor, who passed within 50m of every point. Wading birds observed were assigned to the nearest suitable nesting habitat and mapped onto survey sheets. BTO categories of breeding evidence were used to decide if a pair was possible, probable or confirmed breeders.

Terrestrial Breeding Bird Survey

The terrestrial portion of the scheme area from Clones to Gortnacarrow Bridge is approximately 8.5km long and is relatively easily accessible on foot throughout. Surveys were completed by walking along the old canal banks and through agricultural land. The methodology employed broadly followed the British Trust for Ornithology's Common Birds Census (CBC) territory mapping technique. Elements of the Dabbling and Diving Duck method (Gilbert *et al.*, 1998) were incorporated where breeding waterfowl were encountered in suitable habitats. All birds seen or heard within the scheme area were recorded and breeding evidence noted where possible. Breeding bird activity was also recorded within 100m of the proposed scheme area. Due to the area of land to be covered the entire route was walked over two consecutive mornings. Surveys were commenced one hour after dawn and completed before noon in order to coincide with peak bird activity. Surveys were not completed during adverse weather conditions. Three terrestrial bird surveys were completed between April and June 2011. Summary breeding bird territory maps were completed by compiling results from all three surveys.

Bat Survey

The route of the proposed Ulster Canal including bridges was visually examined by an experienced bat surveyor in summer and autumn 2009. Nocturnal bat survey was undertaken during July and August 2011 to record all evidence of bats including the species of bat, presence of roost sites and the proximity to or location within the proposed scheme area. Bat roost sites and potential commuting corridors were considered to a distance of 200m either side of the proposed scheme area and other structures with high potential beyond this distance were also considered. Residents and land owners encounters during the assessment were questioned regarding knowledge of the occurrence of bats to incorporate observations over a timescale longer than the study period.

Night-time surveys and pre-dawn assessments were undertaken over several nights and mornings along the proposed scheme. Three bat detector systems (heterodyne, frequency division and time expansion) were employed to allow for corroboration of the interpretation of the ultrasonic signals emitted by the bats and to allow the signals from each bat encounter to be recorded and analysed on sound analysis software, if desired. Surveying involved walking along sections of the existing canal as well as areas of farmland typical of the realigned route as well as the actual land take itself. Effort was heightened around existing bridges within or close to the scheme area and land in between.

Unattended monitoring of bat activity was undertaken using an Anabat SD1 detector. The Anabat SD1 detector was attached to a tree within the proposed canal alignment in close proximity to a derelict house within the proposed scheme area on the Fermanagh – Monaghan border at Clonagore/Derrynure.

A tree assessment based primarily on a visual evaluation of identifiable features (obvious crevices or ivy, the architecture of the tree and surrounding vegetation etc.) with a consideration of bat activity within the vicinity of potential trees, was also completed. A tree assessment in its entirety would require a bat detector evaluation and/or close-up examination of all cavities, crevices and loose bark from a ladder, hoist, teleporter with basket attached or through rope access. A difficulty in determining the utilisation of any given tree lies also in access, the visibility or obscurity of roost sites and the seasonality or sporadic nature of tree occupancy.

Impact Assessment

In the assessment stage, impact assessment was undertaken in accordance with the Institute of Ecology and Environmental Management (IEEM) *Guidelines for Ecological Impact Assessment in the United Kingdom* (2011), and also using experience of 'best practice' in the ecological assessment of similar developments. Ecological features are firstly valued (**Table 10.1.1**). The magnitude of an impact is assessed using criteria set out in **Table 10.1.2**. The impact significance (**Table 10.1.3**) is a combined function of the ecological value of the affected feature and the magnitude of the impact. It is important to note that there is no universally recognised definition of what constitutes significance. A combination of data, experience and the precautionary principle were therefore employed to select the appropriate ecological value, and magnitude categories.

The ecological value of a feature is generally relatively easy to categorise. However, the magnitude of potential impact may be difficult (or in certain cases impossible) to categorise. The following parameters were therefore considered:

- Physical nature;
- Type (+ve/-ve, Direct/Indirect);
- Range of species & habitats affected;
- Population sizes of species & habitats affected;
- Geographic scale;
- Duration;
- Cumulative effects.

Once identified, and characterised for magnitude, each potential impact was assigned a likelihood of occurrence (after mitigation):

- Certain (100%);
- Near-certain (95-100%);
- Probable (50-95%);
- Unlikely (5-50%);
- Extremely Unlikely (0-5%).

Table 10.1.1: Ecological Value of Features

Value	Criteria	Examples
Very high	High importance and rarity, international scale and limited potential for substitution	Internationally designated sites
High	High importance and rarity, national scale, or regional scale with limited potential for substitution	Nationally designated sites. Regionally important sites with limited potential for substitution.
Medium	High or medium importance and rarity, local or regional scale, and limited potential for substitution	Regionally important sites with potential for substitution. Locally designated sites.
Low	Low or medium importance and rarity, local scale	Undesignated sites of some local biodiversity and earth heritage interest
Negligible	Very low importance and rarity, local scale	Other sites with little or no local biodiversity and earth heritage interest

Potential impacts described in later sections assume no specific mitigation measures. Specific mitigation measures are therefore proposed where required to neutralise impacts identified as likely.

Table 10.1.2: Criteria for Determining the Magnitude of Potential Ecological Impact

Magnitude	Criteria
Major negative	The proposal (either on its own or with other proposals) may adversely affect the integrity of the site, in terms of coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and / or the population levels of species of interest.
Intermediate negative	The site's integrity will not be adversely affected, but the effect on the site is likely to be significant in terms of its ecological objectives. If, in the light of full information, it cannot be clearly demonstrated that the proposal will not have an adverse effect on integrity, then the impact should be assessed as major negative.
Minor negative	Neither of the above applies, but some minor negative impact is evident. (In case of Natura 2000 sites a further appropriate assessment may be necessary if detailed plans are not yet available).
Neutral	No observable impact in either direction.
Positive	Impacts which provide a net gain for wildlife overall.

Table 10.1.3: Estimating the Overall Ecological Appraisal Category

Magnitude of Potential Impact	Ecological value of sites damaged or improved				
	Very high	High	Medium	Lower	Negligible
Major negative	Very large adverse	Very large adverse	Moderate adverse	Slight adverse	Neutral
Intermediate negative	Large adverse	Large adverse	Moderate adverse	Slight adverse	Neutral
Minor negative	Slight adverse	Slight adverse	Slight adverse	Slight adverse	Neutral
Neutral	Neutral	Neutral	Neutral	Neutral	Neutral
Positive	Large beneficial	Large beneficial	Moderate beneficial	Slight beneficial	Neutral

10.2 SITES DESIGNATED FOR NATURE CONSERVATION

10.2.1 Existing Environment

A number of sites designated for nature conservation are located within the proposed scheme area, with several more occurring within a 10km buffer zone, as shown in **Figure 10.2**. JNCC and NPWS Standard Natura 2000 Data Forms and Conservation Objectives for all these sites are provided as part of the Natura Impact Statement in Appendix D.

Special Areas of Conservation

The aquatic portion of the scheme passes directly through two SACs, namely Lough Oughter and Associated Loughs SAC (Site Code IE000007), and Upper Lough Erne SAC (Site Code UK0016614). Kilroosky Lough Cluster SAC (Site Code IE001786) is located 1.25km north of the proposed marina in Clones. Magheraveely Marl Loughs SAC (UK0016621) is located 1.8km north of the proposed marina, and is contiguous with Kilroosky Lough Cluster SAC in Co. Monaghan.

Lough Oughter and Associated Loughs SAC (Site Code IE000007)

The Lough Oughter and Associated Loughs SAC is located within the lowland drumlin belt of north and central Cavan, entirely within Ireland. The site covers an area of 1463.5ha and was classified on the 19/11/1995. The site qualifies for designation primarily due to its natural eutrophic lakes and bog woodland listed on Annex I of the Habitats Directive and also due to the presence of otter, a species listed on Annex II of the Habitats Directive.

Table 10.2.1 summarises the primary qualifying selection features for the Lough Oughter and Associated Loughs SAC. Bog woodland is listed as a priority habitat under The Habitats Directive. A sub-set of the Annex I habitat types are defined as being ‘priority’ because they are considered to be particularly vulnerable and are mainly, or exclusively, found within the European Union. The importance of these priority habitat types is emphasised at several places in The Habitats Directive (Articles 4 and 5 and Annex III), not only in terms of the selection of sites, but also in the measures required for site protection (Article 6) and surveillance (Article 11) (McLeod *et al.*, 2005).

Kilroosky Lough Cluster SAC (Site Code IE001786)

Kilroosky Lough Cluster is located 1.25km north of the proposed marina in Clones. The site covers an area of 57.61ha. The site is designated primarily for its feature hard oligo-mesotrophic waters, calcareous and alkaline fens listed on Annex I of The Habitats Directive and also for the presence of White-clawed Crayfish listed on Annex II of the Habitats Directive. **Table 10.2.1** details the primary qualifying selection features for Kilroosky Lough Cluster SAC.

Upper Lough Erne SAC (Site Code UK0016614)

The Upper Lough Erne SAC is also located directly within the scheme area (**Figure 10.2**). The site was classified as an SAC on 20/05/2005 and covers an area 5738.38ha. The site qualifies for designation primarily due to its natural eutrophic lakes old sessile oak woods and alluvial forests listed on Annex I of the Habitats Directive. The site further qualifies for designation due to the presence of

otter and Atlantic salmon *Salmo salar* listed on Annex II of the Habitats Directive. **Table 10.2.1** details the primary qualifying selection features for the Upper Lough Erne SAC.

Magheraveely Marl Loughs SAC (Site Code UK0016621)

Kilroosky Lough Cluster is located 1.85km north of the eastern portion of the scheme area. The site covers an area of 58.78ha. The site is designated primarily for its feature hard oligo-mesotrophic waters, calcareous and alkaline fens listed on Annex I of The Habitats Directive and also for the presence of White-clawed Crayfish listed on Annex II of the Habitats Directive. **Table 10.2.1** details the primary qualifying selection features for Magheraveely Marl Loughs SAC.

Table 10.2.1: Primary Qualifying Features for Special Areas of Conservation in the study area

EU Annex I Habitat ¹	Annex II Species	Priority Annex I Habitat	EU Protection	Global Status ²	Representivity ³	Conservation Status ⁴	Cover (%)
Lough Oughter and Associated Loughs SAC							
Naturally eutrophic lakes with vegetation (3150)	-	-	-	C	B	C	67
Bog Woodland (91D0)	-	√	-	B	C	B	6
	Otter <i>Lutra lutra</i> (1355)	-	HD Annex II	A	-	A	-
Upper Lough Erne SAC							
Naturally eutrophic lakes with vegetation (3150)	-	-	-	A	A	-	67
Old Sessile Oak Woods with <i>Ilex</i> and <i>Blechnum</i> (9A10)	-	-	-	B	A	-	4.79
Alluvial Forests (91E0)	-	√	-	B	A	-	2.27
-	Otter <i>Lutra lutra</i>	-	HD Annex II	B	-	A	-
-	Atlantic Salmon <i>Salmo salar</i>	-	HD Annex II	Unknown	-	Unknown	-
Kilroosky Lough Cluster SAC							
Hard olido-mesotrophic waters with benthic vegetation (3140)	-	-	-	B	B	-	13
Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> (7210)	-	-	-	C	B	-	6
Alkaline Fens (7230)	-	-	-	C	C	-	2
-	White-clawed crayfish <i>Austropotamobius pallipes</i>	-	HD Annex II	C	-	C	-
Magheraveely Marl Loughs SAC (UK0016621)							
Hard olido-mesotrophic waters with benthic vegetation (3140)	-	-	-	B	A	A	10.55
Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> (7210)	-	-	-	C	C	C	1.36
Alkaline Fens (7230)	-	-	-	B	B	B	11.57
-	White-clawed crayfish <i>Austropotamobius pallipes</i>	-	Habitats Directive Annex II	B	-	A	-
Key to Table 10.2.1 ¹ Numbers are site Codes of EU Habitats Directive Annex I Habitat Types. Detailed habitat descriptions are available online from JNCC. ² Global Status - Conservation value global context where A = excellent, B = good, C = significant. ³ Representivity - Typicity of habitat; categories as for Global Status. ⁴ Conservation status categories as for Global Status.							

Special Protection Areas

The scheme passes directly through one SPA, namely Upper Lough Erne SPA (Site Code UK9020071). The scheme also passes within 9km of the Lough Oughter SPA. There are no further SPAs within 10km of the proposed scheme area.

Upper Lough Erne SPA (Site Code UK9020071)

The Upper Lough Erne SPA is located directly within the proposed scheme area. The site was classified as a Site of Conservation Importance (SCI) on 19/03/1997 and covers an area of 5771.54ha. The site's boundary is entirely coincident with the boundaries of the following ASSIs:

Corraslough Point;	Upper Lough Erne – Crom;
Dernish Island;	Upper Lough Erne – Trannish;
Finn Floods;	Upper Lough Erne – Belleisle; and
Inishroosk;	Upper Lough Erne – Galloon.
Killymackan Lough;	

Upper Lough Erne SPA qualifies for designation under Article 4.1 of The Birds Directive by regularly supporting internationally important numbers of overwintering Whooper Swan. **Table 10.2.2** describes the primary qualifying selection features for the designation of the Upper Lough Erne SPA.

Table 10.2.2: Qualifying Features for Upper Lough Erne SPA

Common Name	Scientific Name	Feature	National Importance ¹	International Importance ²	BD Annex I Species
Whooper Swan	<i>Cygnus cygnus</i>	Primary	√	√	√
Great-crested Grebe	<i>Podiceps cristatus</i>	Additional	√	-	-
Cormorant	<i>Phalacrocorax carbo</i>	Additional	√	-	-
Mute Swan	<i>Cygnus olor</i>	Additional	√	-	-
Tufted Duck	<i>Aythya fuligula</i>	Additional	√	-	-
Wigeon	<i>Anas penelope</i>	Additional	√	-	-
Teal	<i>Anas crecca</i>	Additional	√	-	-
Goldeneye	<i>Bucephala clangula</i>	Additional	√	-	-
Coot	<i>Fulica atra</i>	Additional	√	-	-
Mallard	<i>Anas platyrhynchos</i>	Additional	√	-	-
Snipe	<i>Gallinago gallinago</i>	Additional	√	-	-
Curlew	<i>Numenius arquata</i>	Additional	√	-	-
Redshank	<i>Tringa totanus</i>	Additional	√	-	-
Key to Table 10.2.2 ¹ National importance = 1% of All-Ireland population ² International importance = 1% of Global population					

Lough Oughter SPA (Site Code IE0004049)

The Lough Oughter SPA is located approximately 9km to the south of the proposed scheme (Figure 10.2). The site covers an area of 4,757.9ha. The SPA is located entirely within Ireland and is designated under the Birds Directive by regularly supporting internationally important populations of Whooper Swan and nationally important populations of Great Crested Grebe *Podiceps cristatus* and

Wigeon. **Table 10.2.3** describes the primary qualifying selection features for the designation of Lough Oughter SPA.

Table 10.2.3: Qualifying Features for Designation of Lough Oughter SPA

Common Name	Scientific Name	Feature	National Importance ¹	International Importance ²	BD Annex I Species
Whooper Swan	<i>Cygnus cygnus</i>	Primary	√	√	√
Great Crested Grebe	<i>Podiceps cristatus</i>	Additional	√	-	-
Wigeon	<i>Anas penelope</i>	Additional	√	-	-
Goldeneye	<i>Bucephala clangula</i>	Additional	√	-	-
Wetland & Waterbirds	-	Additional	-	-	-

Key to Table 10.2.3 as per Table 102.2.

Ramsar Sites

Sites designated for their nature conservation value, which are not statutorily protected, derive from International Treaties and Regional Planning Policy. The Ramsar Convention [The Convention on Wetlands of International Importance, especially as Waterfowl Habitat] is an international treaty for the conservation and sustainable utilization of wetlands designed to stem the progressive encroachment on and loss of wetlands. The Convention was developed and adopted by participating nations at a meeting in Ramsar, Iran in 1971 and came into force in 1975. The UK and Ireland are both original signatory nations.

The proposed scheme passes through the Upper Lough Erne Ramsar Site (UK12024), whose boundary encompasses that of the Upper Lough Erne SAC, Upper Lough Erne SPA and associated ASSIs. Upper Lough Erne Ramsar qualifies under the following Criterion of the Ramsar Convention:

Criterion 1

- The site is a particularly good representative an example of a eutrophic lake and associated swamp, fen and wet grassland
- The site is a particularly representative example of a wetland which plays a substantial hydrological, biological and ecological role in the natural functioning of a major river basin located in a trans-border position within Ireland;

Criterion 2

- The site supports an appreciable assemblage of rare vulnerable or endangered species or subspecies of plant and animal (including species published in Irish Red Data Books and the Irish Vertebrate Red Data Book);

Criterion 3

- The site is of special value for maintaining the genetic and ecological diversity of Northern Ireland because of the quality and peculiarities of its flora and fauna.
- Furthermore, a large number of plant and animal species are confined or almost confined to this area within Northern Ireland including rare species listed in Criterion 2.
- The site regularly supports substantial numbers of individuals from particular groups of waterfowl which are indicative of wetland values, productivity and diversity.

Criterion 6

- The site regularly supports internationally important numbers of wintering Whooper Swans.

Areas of Special Scientific Interest

ASSIs in Northern Ireland are designated under the Nature Conservation and Amenity Lands (Northern Ireland) Order 1985 (S.I. 1985/170) and the Environment (Northern Ireland) Order 2002. They represent areas of land, which have been identified through scientific surveys as being of the highest degree of conservation value due to its respective flora, fauna or geological features. Seven ASSIs are located within 3km of the scheme.

The Upper Lough Erne-Galloon ASSI site is located directly within the scheme area in the southern part of Upper Lough Erne (**Figure 10.2**). The site qualifies for protection due to its naturally eutrophic lake, species-rich grassland, swamp, sedge-dominated fen, wet woodland habitats. Nationally rare Frogbit *Hydrocharis morsus-ranae* is known to occur within the site. The site is also important for wintering wildfowl including Mute Swan, Teal, Wigeon and Goldeneye *Bucephala clangula* and breeding waders including Snipe *Gallinago gallinago*, Lapwing *Vanellus vanellus* and Curlew.

The Finn Floods ASSI consists of the unmodified mature flood plain section of the River Finn system. It is a mature river, with a marginal alluvial flood plain and interconnecting eutrophic lough which supports a range of associated swamp, tall herb fen and inundated grassland vegetation communities. The site has a rich assortment of rare and notable plant species and is part of the internationally important site network regularly used by the Upper Lough Erne wintering whooper swan population. It is also a breeding wader site and an important site for invertebrates with a rich assemblage, particularly aquatic waterbeetles, including several rare species. This ASSI, being part of the Upper Lough Erne SPA, is located 2.1km south of the central portion of the scheme at its nearest point.

In addition there are a further five ASSIs located within 3km of the proposed scheme area:

- Upper Lough Erne – Crom ASSI is located 2.8km northwest of the western portion of the scheme area;
- Knockballymore Lough ASSI is located 2km north of the eastern portion of the scheme at its nearest point;
- Summerhill ASSI is located 2.3km north of the eastern portion of the scheme at its nearest point;
- Burdaution Lough ASSI is located 2.4km north of the eastern portion of the scheme at its nearest point;
- Kilroosky Lough ASSI is located 1.8km north of the eastern portion of the scheme at its nearest point.

Natural Heritage Areas

As the primary designation for wildlife and biodiversity on a national level in Ireland, the Natural Heritage Area (NHA) may be considered equivalent to the ASSI in Northern Ireland. This is an area considered important for the habitats present or which holds species of plants and animals whose habitat needs protection. Prior to statutory designation, NHAs are proposed NHAs (pNHAs), which are subject to limited protection by Statute, but protected in County Development Plans. Site synopses are currently not available for pNHAs. NHAs in Ireland are designated under the Wildlife (Amendment) Act, 2000.

There are no NHAs or pNHAs directly within the proposed scheme area. There are four pNHAs within 3km of the scheme.

- Lough Garrow and Gubdoo pNHA is located 0.7km south of the western end of the scheme at its nearest point.
- The Lough Oughter pNHA is located approximately 2km south of the scheme at its nearest point.
- The Lisabuck Lough pNHA is located 2km south of the eastern portion of the scheme at its nearest point.
- The Kilroosky Lough Cluster pNHA is located 1.4km north of the eastern end of the scheme at its nearest point.

Non-Designated for Nature Conservation

Sites of Local Nature Conservation Importance (SLNCIs)

SLNCIs in Northern Ireland are local designations within Northern Ireland, and derive from the Regional Development Strategy for Northern Ireland 2025 under SPG-Env 1.2. They are designated in council area plans and development plans, with the aim to manage suitable sites, particularly in urban and urban fringe situations, as Local Nature Reserves, where habitat creation and conservation is combined with public access and environmental education. The relevant Area Plan for this study area is the Fermanagh Area Plan 2007. There are no SLNCIs within 10km of the site.

The Monaghan and Cavan County Development Plans do not identify Local Biodiversity Areas or other equivalent locally designated sites in the current Plans.

Important Bird Areas (IBAs)

The Important Bird Area (IBA) program is an international effort to identify, conserve, and monitor a network of sites that provide essential habitat for bird populations. BirdLife International began the IBA program in Europe in 1985. Since that time, BirdLife partners in more than 100 countries have joined together to build the global IBA network. IBAs are particularly important for species that congregate in large numbers such as wintering and passage waterbirds and breeding seabirds (51% of IBAs in Europe are identified for these species).

The Upper Lough Erne IBA (UK287) is located within the proposed scheme area. The site qualifies for designation under the following IBA Criteria:

- A4i – The site is known or thought to hold, on a regular basis, $\geq 1\%$ of a biogeographic population of a congregatory waterbird species;
- B1i – The site is known or thought to hold $\geq 1\%$ of a flyway or other distinct population of a waterbird species;
- B3 - The site is one of the 'n' most important in the country for a species with a favourable conservation status in Europe but concentrated in Europe and for which the site-protection approach is thought to be appropriate;
- C2 – The site is known to regularly hold at least 1% flyway population or of the EU population of a species threatened as the EU level (listed on Annex I of The Birds Directive) and;
- C6 – The site is one of the five most important in the European region in question for a species of subspecies considered threatened in the European Union (listed on Annex 1 of The Birds Directive).

The site's IBA 'Trigger Species' is Whooper Swan. The site is also known to support nationally important breeding populations of Great Crested Grebe and nationally important overwintering populations of Mute Swan, Little Grebe *Tachybaptus ruficollis* and Great Crested Grebe.

10.2.2 Impact Assessment

This section should be read the Natura Impact Statement in **Appendix D**. There are five designated sites which fall within the scheme area. These include two SACs (Lough Oughter SAC and Upper Lough Erne SAC), one SPA (Upper Lough Erne SPA), one RAMSAR Site (Upper Lough Erne Ramsar Site) and one ASSI (Upper Lough Erne – Galloon ASSI).

The Magheraveely Marl Loughs SAC and Kilroosky Lough Cluster SAC are located 1.25km north of the proposed marina at Clones at their closest point. They drain into the Lackey River, being part of the Finn (and Erne) system, but they are upstream of the proposed scheme. A potential increased risk of spread of invasive species by fishing both the canal/marina and the loughs has been raised by NIEA. The loughs are currently fished, with fishing stands in some areas and a stocking programme managed by IFI. The risk of spread of invasive species to these hydrologically isolated loughs currently exists. The proposed scheme does not increase these risks.

Potential impacts to remaining designated sites for the scheme fall into the following specific categories:

Potential Habitat Loss Impacts

- Permanent loss of Annex I Habitats;
- Permanent loss of potential foraging and nesting habitat for BD Annex I species, overwintering and breeding bird populations.

Potential Pollution Impacts

- Direct pollution impacts to Annex I Habitats and listed under the Habitat Directive;
- Indirect pollution impacts to BD Annex I species, HD Annex II Species, wintering and breeding bird populations and;
- Indirect pollution impacts to wintering and breeding bird populations causing disturbance via food resource depletion.

Habitat Deterioration and Biodiversity Loss

- Spread and establishment of invasive species.

Potential Disturbance Impacts

- Noise and visual to BD Annex I and HD Annex II Species during construction activities and the operation phase of the scheme;
- Noise and visual disturbance to overwintering and breeding bird populations during construction activities and the operational phase of the scheme.

Special Areas of Conservation

There are two SACs located within the proposed scheme area: Lough Oughter and Associated Loughs SAC and Upper Lough Erne SAC. In addition Kilroosky Lough Cluster SAC is located 1.2km north of the proposed scheme area. Collectively, their designation as SAC is based upon 10 qualifying selection features:

- Naturally eutrophic lakes with vegetation (3150) – Lough Oughter SAC/Upper Lough Erne SAC;
- Bog Woodland (91D0) – Lough Oughter SAC
- Old Sessile Oak Woods with Ilex and Blechnum (9A10) – Upper Lough Erne SAC
- Alluvial Forests with Alnus glutinosa and Fraxinus excelsior (91E0) – Upper Lough Erne SAC
- Otter (Habitats Directive Annex II Species) – Lough Oughter SAC/Upper Lough Erne SAC;
- Atlantic Salmon (Habitats Directive Annex II Species) – Upper Lough Erne SAC
- Hard oligo-mesotrophic waters with benthic vegetation (3140) – Kilroosky SAC
- Calcareous fens with Cladium mariscus and species of the Caricion davallianae (7210) – Kilroosky SAC
- Alkaline Fens (7230) – Kilroosky SAC
- White-clawed crayfish Austropotamobius pallipes (1092) – Kilroosky SAC

A summary of potential impacts of the proposed scheme on the Lough Oughter and Associated Loughs, Upper Lough Erne and Kilroosky Lough Cluster SACs is presented in **Table 10.2.4**. The

impacts on selection features of aquatic interest including Atlantic salmon and White-clawed crayfish are described in **section 9.0**.

Construction Impacts

Potential Loss/disturbance to Annex I Habitat Naturally eutrophic lakes with vegetation through dredging activities

Dredging will be required during the construction phase to initially re-establish boat navigation within the aquatic portion of the scheme area. Dredging within the River Finn is estimated to take place at 15 separate locations. The estimated volume of material to be dredged from the aquatic portion of the scheme is 4,835m³ as shown in **Table 6.3**. It is predicted that this will equate to a temporary disturbance to a maximum area of <0.2% of this habitat type within SACs.

Annex I Habitat Bog Woodland (91D0), Old Sessile Oak Woods (9A10), Alluvial Forests (91E0), Hard oligo-mesotrophic waters with benthic vegetation (3140), Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* (7210) Alkaline Fens (7230) were not recorded within the scheme and therefore no direct impacts on these SAC selection features as a result of construction activities is not likely.

Potential pollution impacts to Annex I Habitat Naturally eutrophic lakes with vegetation

Potential pollution impacts exist during the construction phase as a result of pollution events within the aquatic portion of the scheme from plant machinery associated with dredging and aquatic weed removal. The leakage of fuels or hazardous materials from plant construction may result in inhibited aquatic plant growth. This potentially large adverse impact is unlikely.

Potential Noise and disturbance impacts to Otter during construction activities

No live sightings of otters or signs of otters were recorded within the survey area despite intensive searches by ecologists during multiple visits to the site. Otters are however known to frequent the Lough Oughter and Upper Lough Erne SACs and are considered to use the River Finn corridor, but to an unknown extent. Dredging activities and aquatic weed removal during the construction phase within the aquatic portion of the scheme area are unlikely to result in a significant disturbance impact to this Annex II species. No construction activities are scheduled for bank-side habitats and no loss of potential holt habitat is anticipated.

Potential Injury or death of otters from excavations

Under the scheme Construction Management Plan, fencing will be used to secure the site during the construction phase, preventing access to excavations and creating a risk of otter death or injury. This potentially large adverse impact is reduced to a non-significant level with this mitigation.

Potential pollution impacts to otter

Potential pollution impacts exist during the construction phase as a result of pollution events within the aquatic portion of the scheme from plant machinery associated with dredging and aquatic weed removal. The leakage of fuels or hazardous materials from plant construction may result in direct otter fatalities or indirect impacts as a result of a reduction in prey sources. This potentially large adverse impact is unlikely.

Operational Impacts

Periodic ongoing loss and disturbance of Annex I Habitat Naturally eutrophic lakes with vegetation

Dredging activities within the aquatic portion of the scheme will be required intermittently throughout the operational phase of the scheme, in order to maintain navigation within the channel. Quantifying this loss is dependent on the extent and frequency of maintenance dredging of a navigable channel. As a worst-case scenario, this would amount to <0.2% of the total area of this habitat type within the SAC.

Potential for long-term indirect deterioration of Annex I Habitats Naturally eutrophic lakes with vegetation, Bog woodland, Old sessile oak woods, Alluvial forests, Hard oligo-mesotrophic waters with benthic vegetation, Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*, and Alkaline Fens.

This is possible as a result of the spread of both terrestrial and aquatic invasive plants throughout SAC areas. These include several invasive species recorded including Water Soldier *Stratiotes aloides* which is noted on the Natura 2000 (N2K) standard data form for Lough Oughter SAC, and five other invasive plants listed in **Table 10.3.5**. Canals and inland waterways are a recognised pathway (vector) facilitating spread of non-native species by natural dispersal and via water crafts (Stokes *et al.*, 2004). Spread and colonisation via waterways from a source outside the Erne catchment is ruled out as both water supply options are closed loop systems, with water remaining within the Erne catchment at all times.

Potential pollution impacts to Annex I Habitat Naturally eutrophic lakes with vegetation

Potential pollution impacts exist during the operational phase as a result of pollution events within the aquatic portion of the scheme from plant machinery associated with maintenance dredging and aquatic weed removal. The leakage of fuels or hazardous materials from plant construction may result in inhibited aquatic plant growth. This potentially large adverse impact is unlikely.

Injury or death of Otters from road traffic collisions

The scenario has been considered whereby the operational canal may bring otters using the River Finn corridor closer to the A3/N54 more often, thereby potentially increasing the exposure of otters to national road traffic flows. With the exception of the A3 road bridge at Gortnacarrow, the risk of road traffic collision to the west of the Fermanagh border at Clonmagore is considered to be low. However, the canal and primary road start to converge at Clonmagore and from this point eastwards towards the

proposed marina at Clones, the risk of road traffic collisions is considered higher. Mitigation is therefore proposed for this section and for the A3 crossing at Gortnacarrow.

Potential disturbance impacts to Otter

Potential pollution impacts exist during the construction phase as a result of pollution events within the aquatic portion of the scheme from plant machinery associated with dredging and aquatic weed removal. The leakage of fuels or hazardous materials from plant construction may result in direct otter fatalities or indirect impacts as a result of a reduction in prey sources. This potentially large adverse impact is unlikely.

Potential pollution impacts to Otter

Potential pollution impacts exist during the construction phase as a result of pollution events within the aquatic portion of the scheme from plant machinery associated with dredging and aquatic weed removal. The leakage of fuels or hazardous materials from plant construction may result in direct otter fatalities or indirect impacts as a result of a reduction in prey sources. This potentially large adverse impact is unlikely.

Table 10.2.4: Summary of potential impacts on Special Areas of Conservation

Potential Impact	Nature	Magnitude	Ecological Value of Feature	Significance of Impact	Impact Type	Phase	Duration	Direct/ Indirect	Likelihood of Occurrence	Mitigation Proposed	Residual Impacts
Loss/disturbance to Naturally eutrophic lakes with vegetation through dredging activities	-ve	Minor	Very High	Slight Adverse	Habitat Loss/ Disturbance	Construction	Temporary	Direct	Certain	No	NS
Disturbance to Naturally Eutrophic Lake with vegetation through dredging	-ve	Minor	Very High	Slight Adverse	Habitat Loss/Disturbance	Operation	Temporary	Direct	Certain	No	NS
Potential pollution impacts to Naturally eutrophic lakes with vegetation	-ve	Intermediate	Very High	Large Adverse	Habitat deterioration	Construction	Temporary	Indirect	Unlikely	Yes	NS
Potential pollution impacts to Naturally eutrophic lakes with vegetation	-ve	Intermediate	Very High	Large Adverse	Habitat deterioration	Operation	Temporary	Indirect	Unlikely	Yes	NS
Potential for indirect habitat deterioration of Habitats: (3150); (91D0); (9A10); (91E0); (3140); (7210); (7230).		Major	Very High	Very Large Adverse	Habitat deterioration	Operation	Long-term	Indirect	Unlikely	Yes	NS
Noise and disturbance to Otter	-ve	Minor	Very High	Slight Adverse	Species disturbance	Construction	Temporary	Direct	Possible	Yes	NS
Noise and disturbance to Otter	-ve	Minor	Very High	Slight Adverse	Species Disturbance	Operation	Long-term	Direct	Possible	Yes	NS
Injury or death of otters from excavations	-ve	Moderate	Very High	Large Adverse	Species Loss	Construction	Temporary	Direct	Unlikely	No	NS
Deterioration of Annex I Habitats due to point-source pollution incidents	-ve	Intermediate	Very High	Large Adverse	Habitat loss/Deterioration	Construction	Temporary	Indirect	Unlikely	Yes	NS
Deterioration of Annex I Habitats due to point-source pollution incidents	-ve	Minor	Very High	Slight Adverse	Habitat loss/Deterioration	Operation	Long-term	Indirect	Unlikely	Yes	NS
Physical disturbance of otter	-ve	Minor	Very High	Slight Adverse		Construction	Temporary	Direct	Possible	No	NS
Potential pollution impacts to Otter	-ve	Minor	Very High	Slight Adverse		Construction	Temporary	Direct	Unlikely	No	NS

Potential Impact	Nature	Magnitude	Ecological Value of Feature	Significance of Impact	Impact Type	Phase	Duration	Direct/ Indirect	Likelihood of Occurrence	Mitigation Proposed	Residual Impacts
Potential pollution impacts to Annex II Species Otter	-ve	Minor	Very High	Slight Adverse		Operation	Temporary	Direct	Unlikely	No	NS

NS = Non Significant

Table 10.2.5: Summary of potential impacts on Special Protection Areas

Potential Impact	Nature	Magnitude	Ecological Value of Feature	Significance of Impact	Impact Type	Phase	Duration	Direct/ Indirect	Likelihood of Occurrence	Mitigation Proposed	Residual Impacts
Loss of Whooper Swan night-time roost sites	-ve	Major	Very High	Very Large Adverse	Habitat loss	Construction	Long-term	Direct	Unlikely	No	NS
Loss of Whooper Swan foraging habitat	-ve	Major	Very High	Very Large Adverse	Habitat loss	Construction/ Operation	Long-term	Direct	Unlikely	No	NS
Disturbance to feeding/roosting whooper swans	-ve	Major	Very High	Very Large Adverse	Bird Disturbance	Construction	Temporary	Direct	Unlikely	Yes	NS
Disturbance to secondary feature waterfowl populations	-ve	Major	Very High	Very Large Adverse	Bird Disturbance	Construction	Temporary	Direct	Likely	Yes	NS
Loss of potential breeding wader habitat	-ve				Habitat Loss	Construction/ Operation	Long-term	Direct	Unlikely	No	NS
Disturbance to wintering Whooper Swans	-ve	Major	Very High	Very Large Adverse	Bird Disturbance	Operation	Long-term	Direct	Unlikely	Yes	NS
Disturbance to secondary wintering waterfowl populations	-ve	Major	Very High	Very Large Adverse	Bird Disturbance	Operation	Long-term	Direct	Likely	Yes	NS
Deterioration of aquatic habitats	-ve	Major	Very High	Very Large Adverse	Habitat Loss/Deterioration	Construction/ Operation	Long-term	Indirect	Unlikely	Yes	NS
Increase in base flow of River Finn due to additional 40ls ⁻¹ (1.4%) through-flow.	neutral	neutral	Very High	neutral	Habitat availability	Operation	Long-term	Direct	certain	No	NS

NS = Non Significant

Table 10.2.6: Summary of potential impacts on Ramsar Sites

Potential Impact	Nature	Magnitude	Ecological Value of Feature	Significance of Impact	Impact Type	Phase	Duration	Direct/ Indirect	Likelihood of Occurrence	Mitigation Proposed	Residual Impacts
Loss of eutrophic lake habitat	-ve	Major	High	Very Large Adverse	Habitat Loss	Construction	Long-term	Direct	Likely	No	NS
Loss of swamp habitat	-ve	Major	High	Very Large Adverse	Habitat Loss	Construction	Long-term	Direct	Unlikely	No	NS
Loss of fen habitat	-ve	Major	High	Very Large Adverse	Habitat Loss	Construction	Long-term	Direct	Unlikely	No	NS
Loss of wet grassland habitat	-ve	Major	High	Very Large Adverse	Habitat Loss	Construction	Long-term	Direct	Unlikely	No	NS
Deterioration of aquatic and terrestrial habitats due to point -source pollution	-ve	Major	High	Very Large Adverse	Habitat Deterioration	Construction/ Operation	Temporary /Long-term	Indirect	Unlikely	Yes	NS
Deterioration of aquatic and terrestrial habitats due to the spread and establishment of invasive species within these habitats	-ve	Major	High	Very Large Adverse	Habitat Deterioration	Operation	Long-term	Indirect	Unlikely	Yes	NS
Loss/Disturbance of Irish Red Data Book Species	-ve	Major	High	Very Large Adverse	Species Loss / Disturbance	Construction/ Operation	Long-term	Direct	Unlikely	Yes	NS
Loss/Disturbance of Irish Vertebrate Red Data Book Species											
Loss/Disturbance of rare or vulnerable species											
Increase in base flow of River Finn due to additional 40ls ⁻¹ (1.4%) through-flow.	neutral	neutral	Very High	neutral	Habitat availability	Operation	Long-term	Direct	certain	No	NS

NS = Non Significant

Table 10.2.7: Summary of potential impacts on Areas of Special Scientific Interest

Potential Impact	Nature	Magnitude	Ecological Value of Feature	Significance of Impact	Impact Type	Phase	Duration	Direct/ Indirect	Likelihood of Occurrence	Mitigation Proposed	Residual Impacts
Loss of naturally eutrophic lake habitat,	-ve	Major	High	Very Large Adverse	Habitat Loss	Construction	Long-term	Direct	Likely	No	NS
Loss of naturally eutrophic lake habitat,	-ve	Major	High	Very Large Adverse	Habitat Loss	Operation	Long-term	Direct	Likely	No	NS
Loss of species-rich grassland habitat	-ve	Major	High	Very Large Adverse	Habitat Loss	Construction/ Operation	Long-term	Direct	Unlikely	No	NS
Loss of swamp, habitat	-ve	Major	High	Very Large Adverse	Habitat Loss	Construction	Long-term	Direct	Unlikely	No	NS
Loss of sedge-dominated fen habitat	-ve	Major	High	Very Large Adverse	Habitat Loss	Construction	Long-term	Direct	Unlikely	No	NS
Loss of wet woodland habitat	-ve	Major	High	Very Large Adverse	Habitat Loss	Construction	Long-term	Direct	Unlikely	No	NS
Loss of nationally rare flora species	-ve	Major	High	Very Large Adverse	Species Loss	Construction	Long-term	Direct	Unlikely	No	NS
Deterioration of all habitats due to spread and establishment of invasive flora	-ve	Major	High	Very Large Adverse	Habitat Deterioration	Operation	Long-term	Indirect	Unlikely	Yes	NS
Deterioration of all habitats due point-source pollution events	-ve	Major	High	Very Large Adverse	Habitat Deterioration	Construction/ Operation	Temporary / Long-term	Direct	Unlikely	Yes	NS
Disturbance to overwintering wildfowl	-ve	Major	High	Very Large Adverse	Bird Disturbance	Construction/ Operation	Temporary / Long-term	Direct	Likely	Yes	NS
Disturbance to breeding waders	-ve	Major	High	Very Large Adverse	Bird Disturbance	Construction/ Operation	Temporary / Long-term	Direct	Likely	Yes	NS
Loss of potential breeding wader habitat	-ve	Major	High	Very Large Adverse	Habitat Loss	Construction/ Operation	Long-term	Direct	Unlikely	No	NS
Point-source pollution events resulting in the death of wintering wildfowl or breeding waders	-ve	Major	High	Very Large Adverse	Bird Death	Construction/ Operation	Temporary / Long-term	Indirect	Unlikely	Yes	NS
Increase in base flow of River Finn due to additional 40ls ⁻¹ (1.4%) through-flow.	neutral	neutral	Very High	neutral	Habitat availability	Operation	Long-term	Direct	certain	No	NS

NS = Non Significant

Special Protection Areas

There is one SPA located directly within the aquatic portion of the scheme area, Upper Lough Erne SPA. In addition Lough Oughter SPA is located approximately 9km to south of the proposed scheme. Only impacts on primary selection features are discussed here.

The Upper Lough Erne SPA qualifies primarily for designation by regularly supporting:

- Internationally important populations of overwintering whooper swans.

The Lough Oughter SPA qualifies primarily for designation by regularly supporting:

- Internationally important populations of overwintering whooper swan;
- Nationally important populations of wintering and breeding great crested grebe;
- Nationally important populations of wintering wigeon.

A summary of the potential impacts of the proposed scheme on the SPA is detailed in **Table 10.2.5**.

Construction Impacts

Noise and disturbance impacts to overwintering whooper swan, great crested grebe and wigeon due to construction activities

Dredging activities and the construction of mooring facilities at Gortnacarrow areas have the potential to disturb overwintering whooper swans, great crested grebe and wigeon utilizing fields within the vicinity of the scheme area.

Loss of whooper swan foraging fields

The disposal of spoil within the scheme is highlighted to occur within areas currently recorded as supporting whooper swans.

Loss of nesting habitat and noise and disturbance impacts to breeding great crested grebe due to construction activities

Dredging activities and aquatic weed removal required to initially re-establish navigation within the aquatic portion of the scheme. Three great crested grebe territories were recorded within the proposed scheme area during the Breeding Waterfowl and Wader Survey. Two territories were located within dense reed swamp habitat along the banks of the River Finn and the third in sporadic vegetation within the proposed navigation channel. The dense reed swamp habitat long the banks of the River Finn will not be removed as part of the proposed scheme and will be left intact. Emergent vegetation within the proposed navigation channel will however be removed. One great crested grebe territory will therefore be lost as a result of the proposed development.

Dredging activities and vegetation removal within the aquatic portion of the scheme area will be scheduled outside of the breeding bird season to conform with existing wildlife legislation, Wildlife Order (NI) and Wildlife Act (ROI). No disturbance impact on breeding great crested grebes is therefore likely.

Operational Impacts

Potential long-term disturbance impacts to wintering Whooper swans

Displacement may occur to farmland outside SPA, thus decreasing SPA population size. The shift from open water to field feeding by Northern European whooper swans is a relatively recent phenomenon (Brazil, 2003). It appears that Danish (Laubek, 1995), and Irish (Colhoun, 1995) wintering populations now occupy wetland sites primarily in autumn/early winter (September–January) after which they shift to farmland. This is shown by the early winter peak, and late winter absence of swans in the Derryvelvin Channel, Gortnacarrow Bridge, and Wattle Bridge (refer to tabulated BTO data in **Tables 10.4.1 – 10.4.5**), and by observations of flocks 3km northeast of the SPA, ca. 6km north of the scheme.

The disturbance period of September-January when swans are on water is likely to correspond to a period of relatively low boat traffic. September may have 300 passages per lock, falling to very low volumes of traffic from November-mid-February. This compares to peaks of approximately 600 passages per lock in mid-summer. Swans may therefore be primarily susceptible to low level disturbance by boats during the early winter months only. Significant disturbance is not likely to result in a significant magnitude of impact to overwintering whooper swans.

Potential long-term disturbance impacts to wintering great crested grebe and wigeon

In contrast to whooper swans other overwintering wildfowl show no seasonal shift to farmland feeding habitats, and are therefore likely to be disturbed on water throughout winter. As previously noted, boat traffic is anticipated to drop significantly during the winter period. The impact without additional mitigation is slight adverse.

Ramsar Sites

The Upper Lough Erne Ramsar Site is located within the western portion of the scheme area. A summary of the potential impacts of the proposed scheme on the Ramsar Site is detailed in **Table 10.2.6**.

Areas of Special Scientific Interest

A through-flow will be created in the canal to help maintain viable habitats and to prevent stagnation either in the canal or the marina. This through-flow will occur via abstracting water from the River Finn at Gortnacarrow into the canal. The water will flow along the canal to Clones, where it will pass through a filtering mesh screen chamber prior to discharge to a tributary of the River Finn and subsequently into the River Finn, 19km upstream of the abstraction site at Gortnacarrow. **Section 17** assesses the water abstraction from and discharge to the Finn and water quality of the discharge. An additional 40ls⁻¹ through-flow (or 1.4% increase) shall not result in any significant change to River Finn base flows or River Finn water quality parameters (**Section 17**). This water recirculation design will not result in any adverse effect upon water levels in the Finn Floods ASSI.

Upper-Lough Erne-Galloon ASSI qualifies for protection due to its naturally eutrophic lake, species-rich grassland, swamp, sedge-dominated fen, wet woodland habitats. Nationally rare Frogbit

Hydrocharis morsus-ranae is known to occur within the site. The site is also important for wintering wildfowl including Mute Swan, Teal, Wigeon and Goldeneye *Bucephala clangula* and breeding waders including Snipe *Gallinago gallinago*, Lapwing *Vanellus vanellus* and Curlew.

A summary of the potential impacts of the proposed scheme on ASSIs is detailed in **Table 10.2.7**.

10.2.3 Mitigation Measures

Special Areas of Conservation

General mitigation relating to both the operational and construction phases of the proposed scheme is listed below.

A detailed Construction Management Plan (CMP) will be submitted by the contractor prior to commencement of works. This Plan will detail the construction activities associated with the works. The CMP is to be submitted to NIEA, DCAL, IFI and NPWS for approval. The CMP will be adhered to at all times by the successful contractor. **Section 6** of this EIS gives an outline of the likely construction activities.

An operational Environmental Management Plan (EMP) has been prepared by Waterways Ireland for the Ulster Canal (Upper Lough Erne to Clones) and is submitted as part of this EIS at **Appendix A**. This Plan details the operational activities associated with the works and the operation and maintenance of the completed canal.

Section 9 and **17** present EIA findings for Aquatic Ecology, Fisheries and the Water Environment. A comprehensive suite of mitigation measures has been proposed to ensure no deterioration of the aquatic environment, within which many of the source-receptor pathways for potential effects upon important features of Lough Oughter and Associated Loughs SAC and Upper Lough Erne SAC have been identified.

Mitigation relating to habitats and species has been described in **Sections 10.3 – 10.5**. Due to the interdependent relationships between habitats and species in the Erne wetlands, all mitigation as proposed throughout **Sections 10** and in **Sections 9** and **17** assist in delivering favourable conservation status to the aquatic environment of the Erne Natura 2000 sites.

Temporary elevations in suspended solid levels during dredging events

The slow flowing nature of the canal means that any re-suspended sediment resulting from dredging activities will not be transported far downstream. In order to minimise suspended solids from entering the water column the following options will be adopted:

- Selective dredging – dredging will only take place where absolutely necessary to retain required water depth for safe navigation;
- Dredging technique – suction dredging, dewatering and installation of silt curtains will reduce sediments entering the water column;

- Containing water within lock gates or canal sections – closure of lock gates at Gortnacarrow during dredging activities will allow re-suspended material to settle out of the water column.
- All waste will be transported to/disposed of at a licensed facility immediately. Waste will not temporarily be stored at depots or on the roadside. Standard procedures for transporting waste will be adopted at all times.
- An emergency spill response plan will be implemented in the event of a spill within the Ulster Canal (Upper Lough Erne to Clones) or its environs. All staff will be properly trained in its implementation and suitable material required in clean-ups will be made available.

Special Protection Areas

The Management Plans outlined in **Section 10.2.3.1** are applicable for SPA mitigation also. EIS **Sections 9** and **17** present EIA findings for Aquatic Ecology, Fisheries and the Water Environment. A comprehensive suite of mitigation measures has been proposed to ensure no deterioration of the aquatic environment, within which many of the source-receptor pathways for potential effects upon important features of Upper Lough Erne SPA (and Ramsar) have been identified.

Mitigation relating to habitats and species has been described in **Sections 10.3 – 10.5**. Due to the interdependent relationships between habitats and species in the Erne wetlands, all mitigation as proposed throughout **Section 10** and in **Sections 9** and **17** assist in delivering favourable conservation status to the aquatic environment of the Erne Natura 2000 sites.

Areas of Special Scientific Interest

The Management Plans outlined in **Section 10.2.3.1** above are applicable for SPA mitigation also. **Sections 9** and **17** present EIA findings for Aquatic Ecology, Fisheries and the Water Environment. A comprehensive suite of mitigation measures has been proposed to ensure no deterioration of the aquatic environment, within which many of the source-receptor pathways for potential effects upon important features of Upper Lough Erne-Galloon ASSI have been identified.

Mitigation relating to habitats and species has been described in **Sections 10.3 – 10.5**. Due to the interdependent relationships between habitats and species in the Erne wetlands, all mitigation as proposed throughout **Section 10** and in **Sections 9** and **17** assist in delivering favourable conservation status to the aquatic environment of the Erne wetland ASSI sites.

10.3 HABITATS AND FLORA

10.3.1 Existing Environment

Protected Flora Species (Existing Records)

The Flora of Northern Ireland, NIEA Northern Ireland Priority Species, National Biodiversity Data Centre, NPWS red-list, and National Biodiversity Network databases were trawled to search for any protected flora species present in either of these grid squares. The flora species listed in these resources are specially protected at all times in Northern Ireland under various schedules of The Wildlife Order (NI) and in Ireland under the Flora Protection Order and Wildlife Act (ROI).

The scheme area lies within the 10km grid squares H32, H41, and H42. All protected, priority or red-listed species previously recorded within these grid squares are detailed in **Table 10.3.1**.

Table 10.3.1: Protected Flora & Priority Flora recorded in existing databases

Common Name	Scientific Name	Habitat	Protected NI ¹	Priority NI ²	Protected ROI ³	Present in 10km Square within scheme (NI)	Present in 10km Square within scheme (ROI)	Grid Squares
A moss	<i>Weissia brachycarpa</i> var. <i>brachycarpa</i>	-	-	√	√	√	-	H32
Bee Orchid	<i>Ophrys apifera</i>	Dry banks limestone grass	√	-	√	√	-	H42
Bird's Nest Orchid	<i>Neottia nidds-avis</i>	-	√	-	√	√	-	H32
Cowslip	<i>Primula veris</i>	Fields and hedge banks on limestone or as garden escape	√	-	√	√	-	H32, H42
Greater Water Parsnip	<i>Sium latifolium</i>	marshes and riverbanks	-	√	√	√	-	H32, H41, H42
Lesser-bearded Stonewort	<i>Chara curta</i>	-	-	√	√	√	-	H42
Marsh Helleborine	<i>Epipactis palustris</i>	Marshes bogs lakeshores	√	-	√	√	-	H32, H42
Marsh Pea	<i>Lathyrus palustris</i>	marshes and wet meadows	√	-	√	√	-	H32
Key to Table 10.3.1 ¹ Protected at all times, and subject to special penalties under The Wildlife Order ² Priority species are those identified by Northern Ireland Biodiversity Group (1998) as under threat and requiring conservation ³ Protected at all times, and subject to special penalties under The Wildlife Act								

Habitat Survey

Table 10.3.2 summarises the diversity of habitats recorded within the survey area during the Extended Phase 1 Habitat Survey and their classification according to the JNCC and Heritage Council

categories. Each habitat has been assigned an ecological value based on the criteria in **Table 10.1.1**. this section should be read with reference to **Figures 10.3 to 10.3.12**.

Key Habitat Descriptions

Habitats recorded during the Extended Phase 1 Habitat Survey are described using notes from both the Phase 1 and Phase 2 surveys.

Wet Neutral Grassland (B2)/Semi-natural neutral grassland (GS1)

Grass dominated habitat, slightly species rich in parts with species typical of neutral and wet grasslands. Dominant Grass Species include Rough Meadow Grass *Poa trivialis* Common Couch Grass *Elytrigia repens*, Yorkshire Fog *Holcus lanatus*, Meadow Foxtail *Alopecurus pratensis* and Sweet Vernal Grass *Anthoxanthum odoratum*. Forb diversity is high with notable species including Ragged-Robin, Forget-me-not *Myosotis* spp, Creeping Buttercup *Ranunculus reptans*, Meadow Buttercup *R. acris*, Cuckoo Flower *Cardamine pratensis*, Common Spotted Orchid *Dactylorhiza fuchsia*, Lesser Stitchwort *Stellaria media*, Meadow Vetchling *Lathyrus pratensis*, Red Deadnettle *Lamium purpureum*, Birds Foot Trefoil *Lotus corniculatus* and Yellow Rattle *Rhinanthus minor*. Notable sedges include Hairy Sedge *Carex hirta*, Common Sedge *C. Nigra*, Glaucous Sedge *C. flacca* and Carnation Sedge *C. panicea*. Species indicative of wet conditions include Marsh Willowherb *Epilobium palustre*, Marsh Foxtail *Alopecurus geniculatus*, Marsh Horsetail *Equisetum palustre*, Marsh Cinquefoil *Potentilla palustris*, Common Marsh Bedstraw *Galium palustre*, Meadow Sweet *Filipendula ulmaria* and Mint *Mentha* spp. Rushes *Juncus* spp. also present but not >25%.

Semi-improved neutral grassland (B2.2)/Semi-natural neutral grassland (GS1)

Grass dominated habitat artificially reseeded in parts but retaining species typical of neutral grasslands. Dominant and common grasses include Yorkshire Fog, Rough Meadow Grass, Meadow foxtail, Timothy *Phleum pratense*, Cocks-foot *Dactylis glomerata*, Tufted-hair Grass *Deschampsia cespitosa*, Common Couch Grass and Sweet Vernal Grass. Ryegrass *Lolium* spp. also present but not abundant. Soft rush *Juncus effusus* and Hard Rush *J. inflexus* present but sporadic and always <25% of vegetation cover. Occasional forbes and sedges include Common Mouse Ear *Cerastium fontanum*, Forget-me-not, Germander Speedwell *Veronica chamaedrys*, Cuckoo Flower, Creeping Buttercup, Meadow Buttercup, Tufted Vetch *Vicia cracca*, Cleavers *Galium aparine*, Red Clover *Trifolium pratense*, White Clover *T. repens*, Meadowsweet, Hairy Sedge, Common Sedge, Glaucous Sedge and Carnation Sedge. Local enrichment is indicated by Broad-leaved Dock *Rumex obtusifolius*, Common Nettle *Urtica dioica*, Common Ragwort *Senecio jacobaea*, Marsh Thistle *Cirsium arvense* and Spear Thistle *C. vulgare*. Swarms of Common Spotted Orchid are also infrequent. Yellow Rattle was noted to be relatively abundant in one field and present infrequently elsewhere.

One protected mammal species was recorded within this habitat; Badger *Meles meles* along with anecdotal evidence of one protected plant species Cowslip *Primula veris* along the banks of the old canal. Both species are protected under the Wildlife Order and Badger is protected under the Wildlife Act.

Improved Grassland (B4)/Improved Agricultural Grassland (GA1)

Species poor agriculturally improved grasslands are as a result of intensive applications of fertilisers, herbicides, artificial seed mixes combined with a long history of livestock grazing. Characterised by >50% Ryegrass species typical of artificial seed mixes. Bread Wheat and Clovers *Trifolium* spp. also present. Broad-leaved Dock, Common Nettle, and Thistles *Cirsium* spp. indicate areas of high nutrient enrichment. Habitat of low floristic diversity.

Marshy Grassland (B5)/Wet Grassland (GS4)

Characterised by >25% Soft Rush, Hard Rush and Articulated Rush *J. acutiflorus*. Typical grasses include crested dogs-tail, Common Couch Grass, Yorkshire Fog, Sweet Vernal Grass Meadow Foxtail. Additional herbs and sedges include Ragged-Robin, Creeping Buttercup, Meadow Buttercup, Daisy *Bellis perennis*, Silverweed *Potentilla anserina*, Meadowsweet, Cuckoo Flower, Common Spotted Orchid, Common sedge, Hairy Sedge, Brown Sedge *Carex disticha* and Carnation Sedge. Marsh Thistle, Common Sorrel *Rumex acetosa*, Broad-leaved Dock and occasional Common Ragwort indicate areas of localised nutrient enrichment.

Other Habitat (J5)/ + Buildings (J3.6)/Stonework (BL1) + Buildings (BL3)

There were several stone bridges recorded within the scheme area with the potential to support bat roosts. One derelict building also exists at Gortnacarrow.

Standing Water (G1.1)/Eutrophic Lakes (FL5)

Key aquatic plant species recorded within eutrophic water habitats included Arrowhead *Sagittaria sagittifolia*, Ivy-leaved Duckweed *Lemna trisulca*, Common Duckweed *Lemna minor*, Flowering Rush *Butomus umbellatus*, Amphibious Bistort *Persicaria amphibia*, Yellow Water Lily *Nuphar lutea*, White Water Lilly *Nymphaea alba*, Water-plantain *Alisma plantago-aquatica*, Frogbit *Hydrocharis morsus-ranae*, Spiked Water Milfoil *Myriophyllum spicatum*, Branched Bur-Reed *Sparganium erectum*, Unbranched Bur-Reed *Sparganium emersum*, Small Bur-Reed *Sparganium natans*, Pondweeds *Potamogeton* spp. incl. *P. crispus*, Gibbous Duckweed *Lemna gibba* and Greater Duckweed *Spirodela polyrrhiza*.

One invasive species Canadian Pondweed *Elodea canadensis* was also recorded within this habitat.

Marginal Vegetation (F2.1)/Reed & Large Sedge Swamps (FS1)

This habitat type occurs in the Gortnacarrow to Lough Erne section of the scheme on the periphery of open water, but also in remnant portions of the canal in the Gortnacarrow to Clones section. Greater Water Parsnip *Sium latifolium* was recorded on waterway margins at Castle Saunderson demesne; at Edergool; and in marginal reedbeds throughout waterways in west of scheme. This is priority species and protected by the Wildlife Order.

Running Water (G2) / Eutrophic Running Water (G2.1) / Depositing/Lowland Rivers (FW2)

South of Derryleggan the Finn flows parallel to the course of the old Ulster canal in a south westerly direction, passing to the south of Clones before being joined by the Lackey River which flows to the

west of Clones and meets the River Finn at Cloncumber. The Lackey River flows in a generally southerly direction, originating to the north of Clones and is approximately 20 river kilometres long. The River Finn continues in a south westerly direction from Clonbumber, meandering widely at Annaghmullin Bridge to form Drumully Lough, west of Gortnacarrow Bridge. The River Finn flows due northwest from Gortnacarrow, through Quivvy Lough to meet the Upper Erne.

The River Finn is a designated salmonid water under the EC Freshwater Fish Directive, as is its tributary the River Lackey. The River Finn is also designated within the Upper Lough Erne SPA and the Upper Lough Erne SAC, while it is also designated within the Lough Oughter SAC from Castle Saunderson Estate. The aquatic environment is described in the Aquatic Ecology chapter in further detail.

Semi-natural Broad-leaved Woodland (A1.1.1)/Semi-natural Wet willow-alder-ash woodland (WN6)

Willow, alder and ash woodland occurs west of Gortnacarrow and at Castle Saunderson demesne. Oak and ash woodland occurs less frequently also. Ground flora comprises remote Sedge *Carex remota*, Hogweed *Heracleum sphondylium* ssp. *Sphondylium*, Wood sedge *Carex sylvatica*, Hart's-tongue *Phyllitis scolopendrium*, Raspberry *Rubus idaeus*, Wild Oat *Avena fatua*, Herb Bennet *Geum urbanum*

Highly modified non-native mixed broad-leaved/coniferous woodland (WD2)/ Mixed Plantation Woodland (A1.3.2)

Around Connagore and Clonlura is a mixed plantation block. It comprises alder, birch and ash with occasional larch and spruce.

Species-poor treeline (J2.1/2)Treelines (WL2)

Excluding belts of willow which are categorised under scrub (below), where the route of the former canal runs adjacent to the A3 road, treelines are dominated by sycamore with occasional ash occurring beyond the road verge. Some mature and semi-mature ash occur to the east of Munnilly Bridge.

Scrub (A2)/Scrub (WS1)

Willow scrub occurs between the A3 road and the former canal between Clonfad and Munnilly, occasionally spreading across the former canal. It also occurs adjacent to the scheme on the border at Clonnagore.

Tall Herb Swamp (C3.2)

This habitat occurs occasionally at Clonocurry and Munnilly and again at Clonlura and Clonoony in wet areas of the former canal. Key species recorded included Soft Rush *Juncus effusus*, Hard Rush *Juncus inflexus*, Meadowsweet *Fillipendula ulmaria*.

Inundation Vegetation (F2.2)

Key species recorded within this habitat included Common Club-rush *Schoenoplectus lacustris*, Water Forget-me-not *Myosotis scorpioides*, Common Marsh bedstraw *Galium palustre*, Flag Iris *Iris pseudacorus*, Bladder Sedge *Carex vesicaria*, Bottle Sedge *Carex rostrata*, Brown Sedge *Carex disticha*, Cyperus sedge *Carex pseudocyperus*, Reed Canary Grass *Phalaris arundinacea*, Great Water Parsnip *Sium latifolium*, Water Cress, Bulrush *Typha latifolia*, Monkey Flower *Mimulus guttatus* x *lutea*.

Drainage Ditches/Canals (FW3)

Where the former canal is still evident and contains water, generally around the border at Clonnagore, vegetation includes Marsh Woundwort *Stachys palustris*, Marsh cinquefoil *Potentilla palustris*, Fool's Water-cress *Apium nodiflorum*, Reed Sweet Grasses *Glyceria* spp., Water Mint *Mentha aquatica*, Brooklime *Veronica beccabunga*.

Table 10.3.4 summarises habitats encountered and highlights any association with priority or annex habitat type.

Protected Floral Species & Habitats Recorded During Survey

This section should be read with **Figures 10.3 to 10.3.12**. There were six Northern Ireland Priority Habitats recorded within the scheme area during the Extended Phase 1 and Phase 2 Habitat Surveys (**Table 10.3.2**). UK priority habitats that occur in Northern Ireland are considered to be automatically selected as priority habitats in Northern Ireland.

Table 10.3.2 Northern Ireland Priority Habitats within the study area

Priority Habitat	Distribution
Eutrophic Standing Waters	Extensive in west of scheme
Lowland Meadow	Total of 16ha scattered throughout scheme
Mixed Ashwoods	Scattered throughout scheme
Wet woodland	Extensive in west of scheme
Species-rich Hedgerow	Single 75m hedge parallel with N54 by old canal
Reedbeds	Absent only from east of scheme

During the Extended Phase 1 Habitat Surveys in 2009 and Phase 2 Habitat Surveys in 2011, there were no flora species protected under The Flora Protection Order in Ireland recorded within the scheme area. There was an anecdotal record of one species protected under The Wildlife Order (NI) (**Table 10.3.3 & Figure 10.3.7**) and one Northern Ireland Priority Species recorded within the survey area (**Table 10.3.3**). Several rare aquatic plant species were also recorded during surveys including *Spirodela polyrhiza*, *Lemna gibba*, and Frogbit *Hydrocharis morsus-ranae*.

Table 10.3.3 Protected and Priority Flora within Scheme Area

Common Name	Latin Name	Status	Distribution
Cowslip	<i>Primula veris</i>	WO	Neutral grassland habitats within old canal
Greater Water Parsnip	<i>Sium latifolium</i>	NI Priority	In marginal reedbeds throughout waterways in west of scheme

Table 10.3.4: Habitats Recorded within study area

Heritage Council Category ¹	JNCC Category ²	Ecological Value (Table 10.1.1)	Protected/ Rare species recorded	Notes ³	NI Priority Habitat ³	Annex 1 Habitat Link (* = Priority Habitat)
Semi-natural Broadleaved Woodland (WN)	Semi-natural Broadleaved Woodland (A1.1.1)	Medium (if bats present)	-	-	√	-
Semi-natural Wet willow-alder-ash woodland (WN6)	Semi-natural Broad-leaved Woodland (A1.1.1)	Very High	-	Recorded outside scheme area.	√	*Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, Alnion incanae, Salicion albae) (91E0) occurring on Castlesaunders banks.
Highly modified non-native mixed broad-leaved/coniferous woodland (WD2)	Mixed Plantation Woodland (A1.3.2)	Medium (if bats present)	-	-		-
Scrub (WS1)	Scrub (A2)	Low	√	Common Newt <i>T. vulgaris</i> in old canal recorded in vicinity. Nesting bird habitat.	-	-
	Scattered Mature Trees (/A3)	Medium (if bats present)	-	Numerous scattered mature trees (predominantly Ash) within scheme area with potential for roosting bats.	-	-
Semi-natural neutral grassland (GS1)	Wet Neutral Grassland (B2)	Medium	-	-	-	Displays some characteristics of Lowland hay meadows (<i>Alopecurus pratensis</i> , <i>Sanguisorba officinalis</i> (6510).
Semi-natural neutral grassland (GS1)	Semi-natural neutral grassland (B2.2)	Medium	-	Badger and Cowslip <i>Primula veris</i> in old canal protected by WO in NI	√	Displays some characteristics of Lowland hay meadows (<i>Alopecurus pratensis</i> , <i>Sanguisorba officinalis</i> (6510).
Improved Agricultural Grassland (GA1)	Improved Grassland (B4)	Low	-	Fields heavily grazed and re-seeded for silage.	-	
Wet Grassland (GS4)	Marshy Grassland (B5)	Low	-	-	-	<i>Molinia</i> meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) (6410)
Reed & Large Sedge Swamps (FS1)	Tall Herb Swamp (C3.2)	Low	-	-	-	-
Reed & Large Sedge Swamps (FS1)	Marginal Vegetation (F2.1)	Medium	√	Greater Water Parsnip <i>Sium latifolium</i> on River Finn margins priority species and protected by	√	-

Heritage Council Category ¹	JNCC Category ²	Ecological Value (Table 10.1.1)	Protected/ Rare species recorded	Notes ³	NI Priority Habitat ³	Annex 1 Habitat Link (* = Priority Habitat)
				WO in NI		
Eutrophic Lakes (FL5)	Standing Water (G1.1)	Very High	√	Rare aquatic flora <i>Spirodela polyrhiza</i> and <i>Lemna gibba</i> in River Finn Section. Smooth Newt within habitat between Gortnacarrow and Clones.	√	Natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation (3150)
Depositing/Lowland Rivers (FW2)	Eutrophic Running Water (G2.1)	Very High	-	River Lackey a tributary of the Finn River.	-	-
Hedgerows (WL1)	Species-poor hedgerow (J2.1/J2.2)	Low	-	Potential nesting bird habitat.	-	-
Hedgerows (WL1)	Species-poor hedgerow with trees (J2.3)	Medium	-	Nesting bird habitat.	-	-
Hedgerows (WL1)	Species-rich hedgerow with Trees (J2.4)	Medium	-	Nesting bird habitat.	√	-
Stonework (BL1)/ Buildings (BL3)	Other Habitat (J5)/ Buildings/Hardstanding (J3.6)	Low (to medium if bat present)	-	Several Stone bridges in scheme with bat potential	-	-

Invasive Flora Species Recorded During Survey

A number of invasive flora species were recorded during habitat surveys. Their distribution within the scheme area is detailed in **Table 10.3.5**.

Table 10.3.5: Invasive Species recorded within the scheme area

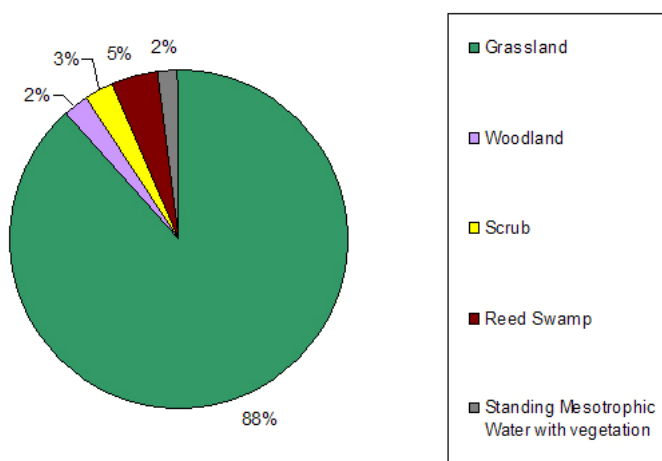
Common Name	Latin Name	Habitat	Status ¹	Distribution within scheme
Canadian Pondweed	<i>Elodea canadensis</i>	Aquatic	ISI	Lakes & Waterways -abundance unknown
Monkey Flower	<i>Mimulus guttatus</i>	Terrestrial	WO Review	Apparently rare along lakeshore
Rhododendron	<i>Rhododendron ponticum</i>	Terrestrial	WO	Occasional ornamental hedgerow species
Snowberry	<i>Symphoricarpos alba</i>	Terrestrial	WO	Occasional-frequent ornamental hedgerow species
Water Fern	<i>Azolla filiculoides</i>	Aquatic	ISI, IANI	On river Finn near Canal on fringes of Clones
Water Soldier	<i>Stratiotes aloides</i>	Aquatic	(WO)	Lakes & Waterways -abundance unknown
<u>Key to Table 10.3.5</u> ¹WO listed on Schedule 9 to the Wildlife Order. Those found to release into the wild are subject to special WO Review Not currently listed on WO, but listed on Draft Review of WO (2008), and may be included in Future ISI Listed as established on Invasive Species in Northern Ireland website				

10.3.2 Impact Assessment

Impact assessment has been undertaken in accordance with **Section 10.1.4.3**. Potential impacts on local habitats and flora are summarised in **Tables 10.3.6**. The impacts on local habitats and flora can be broadly categorised into:

- Potential Habitat and Species Loss/Disturbance
- Potential Pollution Impacts
- Habitat deterioration/loss and species loss due to spread of invasive species

Habitat loss has been quantified using Mapinfo GIS application, and is based on the red line boundary of the scheme shown in planning drawing TS/NUC/CC001/P50-67. In summary, almost 90% of the scheme (77ha) is comprised of grassland habitats, with the remainder made up of woodland (2.1ha), scrub (2.4ha), reedswamp (4ha) and standing water (1.7ha). The following graphic summarises this.



Non-native invasive species can negatively transform native ecosystems, thereby threatening indigenous and endangered flora and fauna. The problems caused by invasive species are so serious that the introduction of these species is identified as one of the main causes of biodiversity loss worldwide. This has been recognised in decisions on alien species agreed by the contracting parties to the Convention on Biological Diversity including Ireland and the United Kingdom (*source: Invasive Species in Ireland Report, 2006*).

The vectors and pathways by which non-native species are transported are numerous. They result from the diverse range of human activities which operate over a range of scales. Primary introductions often result from the accidental transport of species, for example via hull fouling or ballast water. Secondary introductions result from the expansion of species from the initial place of establishment. Secondary spread will normally include a wider range of vectors that may act either separately or together.

As this scheme remains within the catchment of the River Finn and Upper Lough Erne the risk of spread is contained. However efforts will to be made to prevent infestation of the canal system to ensure compliance with the WFD and to minimise accidental/natural spread to watercourses adjacent to the canal.

There is potential for the spread of invasive aquatic and terrestrial species along the canal during the construction phase, where plant machinery enters the construction site, both along the riparian corridor, at the mooring facilities and also along the Finn River to undertake dredging works. The spread and colonisation via waterways from a source outside the Erne catchment is ruled out as the project is a contained system with water remaining within the Erne catchment at all times. The risk of spread of invasive species beyond the catchment is very low.

10.3.3 Mitigation Measures

Landscape Planting

The Landscape Plan (**Appendix B**) outlines planting proposals. It should be noted that this Plan outlines proposed measures for the canal corridor from Clones to Gortnacarrow; no landscape measures are proposed for the riverine section of navigation from Gortnacarrow to Quivvy Lough.

At the entrance to the Clones Marina, large specimen trees can be used as the underlying root system will not impact the canal embankment and/or breach canal liner. This location allows for a greater diversity of tree species to be used (alternating every second species if desired) and will add to overall tree diversity. The following principal species will be planted:

- Sessile Oak (*Quercus petraea*).
- Pedunculate Oak (*Quercus robur*).
- Alder (*Alnus glutinosa*).
- Ash (*Fraxinus excelsior*).
- Rowan (*Sorbus aucuparia*).
- Aspen (*Populus tremula*).
- Yew (*Taxus baccata*).
- Wych Elm (*Ulmus glabra*).

Along the length of the canal, species rich hedges will be created. Species selected for hedgerow treatments should aim to provide dense growth, especially at the base. The following principal species are appropriate:

- Hawthorn (*Crataegus monogyna*).
- Blackthorn (*Prunus spinosa*).
- Holly (*Ilex aquifolium*).

Complementary species to the above (in lower densities) can be comprised of:

- Spindle (*Euonymus europaeus*).
- Hazel (*Corylus avellana*).
- Guelder Rose (*Viburnum opulus*).
- Dog Rose (*Rosa canina*).
- Elder (*Sambucus nigra*).

Yew (*Taxus baccata*) is a popular hedge species but is toxic to livestock. It will not be used within the project scheme for hedges as the canal will border agricultural land for much of the scheme. At embanked sections of canal, hedgerows are not being proposed as they can lead to leaks and, more seriously, breaches. Furthermore establishment of hedges or scrub makes maintenance inspections very hard to undertake. Low height hedges are proposed around the amenity area in Clones.

In amenity areas, the following principal species will be planted:

- Sessile Oak (*Quercus petraea*).

- Pedunculate Oak (*Quercus robur*).
- Alder (*Alnus glutinosa*).
- Ash (*Fraxinus excelsior*).
- Rowan (*Sorbus aucuparia*).
- Aspen (*Populus tremula*).
- Yew (*Taxus baccata*).
- Wych Elm (*Ulmus glabra*).

Along grassed buffer zones towpaths and embankments, it is proposed to allow these areas to establish naturally from the in-situ seed bank. Monitoring of these areas will be ongoing following the construction phase to ensure establishment takes place.

Species rich grasslands will be planted. The precise species mix will be decided in conjunction with the WI Construction Phase Project Manager, Contractor and representatives from NPWS and NIEA. Of paramount importance is that the seeds will be native. It is proposed to establish seeded species rich grassland along the canal corridor. Seeding may be achieved by hand sowing, drill sowing or hydro-seeding. Depending on the area involved hand sowing could be most cost effective, but this will be dependent on the contract specification for the construction phase. Localised soil testing would also be prudent as nutrient rich topsoil may need to be stripped back to allow for a more favourable nutrient poor soil type.

Along the riparian fringe, instead of allowing for natural colonisation throughout it is proposed to seed with the following species:

- Reed Canary Grass (*Phalaris arundinacea*).
- Yellow Flag (*Iris pseudacorus*).
- Greater Pond Sedge (*Carex riparia*).
- Lesser Pond sedges (*Carex acutiformis*).

The reason for establishing a certain seed mix within the canal corridor is to minimise the potential establishment of species that would encroach into the waterways. This would affect ecological potential as well as navigation and recreational value. It is proposed to seed intermittent pockets of marginal aquatic habitat throughout the length of the canal with the above species list. Downstream movement of seeds will allow for eventual growth throughout the entire canal corridor.

Invasive Species

As part of the EMP submitted with this application (**Appendix A**), Waterways Ireland will –

- Implement targeted and focused biosecurity protocols for all works undertaken by Waterways Ireland to stop/ minimise the spread of non native invasive species.
- Participate in relevant invasive species working groups in order to be kept abreast of the latest information and developments with regard to invasive species management.

- Facilitate a focused, intensive canal boat-based survey on a periodical basis to document and locate potential new infestations by invasive species.
- Proactive removal of identified infestations prior to establishment, where feasible.
- Work in conjunction with relevant statutory agencies to increase and raise awareness with stakeholders and members of the public with regard to invasive species.

Table 10.3.6: Summary of potential impacts upon local habitats and flora

Potential Impact	Nature	Ecological Value	Magnitude	Significance of Impact	Impact Type	Phase of Occurrence	Duration	Direct/ Indirect	Likelihood of Occurrence	Mitigation Proposed	Significance of Residual Impacts
Loss of 2.03ha of Semi-natural Broadleaved Woodland	-ve	Medium	Minor	Slight Adverse	Habitat Loss	Construction	Permanent	Direct	Certain	No	S
Loss of 0.09ha of Mixed Plantation Woodland	-ve	Medium	Minor	Slight Adverse	Habitat Loss	Construction	Permanent	Direct	Certain	No	NS
Loss of 2.37ha of Scrub	-ve	Medium	Intermediate	Moderate Adverse	Habitat Loss	Construction	Permanent	Direct	Certain	No	S
Loss of Mature Trees, minimum c.64 excluding hedgerow trees	-ve	High (if bats present)	Intermediate	Large Adverse	Habitat Loss	Construction	Permanent	Direct	Unknown	Yes	NS
Loss of 3.6ha of Wet Neutral Grassland	-ve	Medium	Minor	Slight Adverse	Habitat Loss	Construction	Permanent	Direct	Certain	Yes	NS
Loss of 16.43ha of Semi-improved Neutral Grassland	-ve	Medium	Intermediate	Moderate	Habitat Loss	Construction	Permanent	Direct	Certain	Yes	S
Loss of 46.98ha of Improved Grassland	-ve	Low	Minor	Slight Adverse	Habitat Loss	Construction	Permanent	Direct	Certain	No	NS
Loss of 9.9ha of Marsh/Marshy Grassland	-ve	Low	Minor	Slight Adverse	Habitat Loss	Construction	Permanent	Direct	Certain	No	NS
Loss of 3.95ha of Tall Herb Swamp Vegetation	-ve	Medium	Minor	Slight Adverse	Habitat Loss	Construction	Permanent	Direct	Certain	No	NS
Loss of 0.62ha of Eutrophic Lakes with vegetation between Gortnacarrow and Clones	-ve	Medium	Intermediate	Moderate Adverse	Habitat Loss	Construction	Temporary	Direct	Certain	Yes	NS
Short term and recurring habitat degradation due	-ve	Very High	Intermediate	Large Adverse	Habitat degradation /disturbance	Construction/ Operation	Short term, recurring	Direct	Certain	Yes	S

Potential Impact	Nature	Ecological Value	Magnitude	Significance of Impact	Impact Type	Phase of Occurrence	Duration	Direct/ Indirect	Likelihood of Occurrence	Mitigation Proposed	Significance of Residual Impacts
to dredging or operational management of navigation zone of 1.1ha of Eutrophic Lakes with vegetation from River Finn											
Loss of 0.26ha of Exposed Mud	-ve	Low	Minor	Slight Adverse	Habitat Loss	Construction	Permanent	Direct	Certain	No	NS
Loss of Stonework/Buildings/Hard Standing	-ve	Medium (if bats present)	Intermediate	Moderate Adverse	Habitat Loss	Construction	Permanent	Direct	Likely	Yes (if bats present)	NS
Loss of 1.71km of Species poor Hedgerow	-ve	Low	Intermediate	Slight Adverse	Habitat Loss	Construction	Permanent	Direct	Certain	No	NS
Loss of 6.16km of Species poor Hedgerow with Trees	-ve	Medium	Intermediate	Moderate Adverse	Habitat Loss	Construction	Permanent	Direct	Certain	Yes	NS
Loss of 0.24km of Species Rich Hedgerow with Trees	-ve	Medium	Intermediate	Moderate Adverse	Habitat Loss	Construction	Permanent	Direct	Certain	Yes	NS
Loss of small population of Cowslip <i>Primula vulgaris</i> Protected under NI WO	-ve	Medium	Intermediate	Moderate Adverse	Species loss	Construction	Permanent	Direct	Certain	Yes	NS

NS = Non-significant

S = Significant

10.4 AVIFAUNA

10.4.1 Existing Environment

BTO WeBS Data

BTO WeBS survey data was requested for the most recent five survey years for the following count sites (coverage shown in **Figure 10.4**):

- Gortnacarrow Bridge Area (06316);
- River Finn/Edergool Area (06310) and;
- Wattle Bridge Area (06510).

A summary list of bird species recorded within these count sites is presented in **Table 10.4.1**. Maximum and mean peak counts for each species recorded within each count site between 2002/03 and 2006/07 are presented in **Tables 10.4.2 to 10.4.4**.

17 species including 11 waterfowl, five wader and one gull species have been recorded within the three BTO WeBS sites between 2002/03 and 2006/07. Together these WeBS sites cover the majority of the aquatic portion of the scheme area between Quivvy Lough and Gortnacarrow.

Table 10.4.1: Bird species recorded at BTO WeBS sites within the aquatic portion of the scheme area

Species	Conservation Status
Common Gull <i>Larus Canus</i>	Amber
Coot <i>Fulica atra</i>	Amber
Cormorant <i>Phalacrocorax carbo</i>	Amber
Curlew <i>Numenius arquata</i>	**WO, NI
Great Crested Grebe <i>Podiceps cristatus</i>	Amber
Grey Heron <i>Ardea cinerea</i>	WO S1
Greylag Goose (re-established) <i>Anser anser</i>	Amber
Lapwing <i>Vanellus vanellus</i>	**WO, NI
Little Grebe <i>Tachybaptus ruficollis</i>	Amber
Mallard <i>Anas platyrhynchos</i>	-
Moorhen <i>Gallinula chloropus</i>	-
Mute Swan <i>Cygnus olor</i>	Amber
Pochard <i>Aythya ferina</i>	Amber, NI
Teal <i>Anas crecca</i>	Amber
Tufted Duck <i>Aythya fuligula</i>	Amber, NI
Whooper Swan <i>Cygnus cygnus</i>	Annex 1, WO, NI
Wigeon <i>Anas penelope</i>	Amber
<u>Key to Table 10.4.1</u> WO – Protected at all times under the Wildlife Order (as amended); NI – Northern Ireland Priority Species, **Red BOCCI listing has been dropped as this only applies to breeding individuals not counted in wintering WeBS data sets.	

Whooper swans an Upper Lough Erne SPA qualifying selection feature have been regularly recorded within the aquatic portion of the scheme area during the over wintering period. Numbers generally tend to peak in the Wattle Bridge Area (Site 06150), which consistently holds the largest populations (**Table 10.4.4**). Numbers have not however, exceeded nationally or internationally important thresholds (130 and 210 individuals respectively) for the SPA feature species within the aquatic portion of the scheme area. Similarly counts for remaining waterfowl and wader species within the

aquatic portion of the scheme area have also not exceed national or international importance thresholds.

The SPA five-year mean peak count of whooper swans (1991/92 to 1995/96) was 352.

- Peak 06510 2002/03 to 2006/07 = 53 (15% of SPA population)
- Peak 06310 2002/03 to 2006/07 = 12 (3.4% of SPA population)
- Peak 06316 2002/03 to 2006/07 = 26 (7.4% of SPA population)

Table 10.4.2: Summary BTO WeBS Data for Site: 06316

Species	2002/03	2003/04	2004/05	2005/06	2006/07	Mean Peak
Mute Swan	5 (DEC)	0	0	3 (DEC)	8 (JAN)	3
Whooper Swan	0	0	0	1 (DEC)	26 (JAN)	5
Greylag Goose (re-established)	0	0	0	0	2 (JAN)	0
Wigeon	0	0	12 (JAN)	20 (FEB)	0	6
Teal	0	0	0	6 (FEB)	0	1
Mallard	0	0	1 (FEB)	4 (FEB)	2 (MAR)	1
Pochard	0	0	0	0	4 (JAN)	1
Tufted Duck	0	0	0	0	7 (MAR)	1
Great Crested Grebe	0	1 (DEC)	3 (FEB)	4 (JAN)	0	2
Cormorant	0	1 (DEC)	1 (DEC)	1 (JAN)	4 (JAN)	1
Grey Heron	1 (DEC)	1 (DEC)	1 (JAN)	0	0	1
Moorhen	1 (DEC)	0	0	0	3 (DEC)	1
Coot	0	1 (DEC)	2 (JAN)	0	4 (MAR)	1
Lapwing	N/C	0	0	0	20 (JAN)	5
Curlew	N/C	0	7 (DEC)	6 (JAN)	23 (MAR)	9

Table 10.4.3: Summary BTO WeBS Data for Site: 06310

Species	2002/03	2003/04	2004/05	2005/06	2006/07	Mean Peak
Mute Swan	12 (DEC)	N/C	3 (JAN)	6 (JAN)	20 (DEC)	10
Whooper Swan	0	N/C	0	0	12 (DEC)	3
Tufted Duck	0	N/C	16 (JAN)	0	0	4
Little Grebe	1 (DEC)	N/C	0	0	3 (DEC)	1
Great Crested Grebe	0	N/C	2 (FEB)	0	2 (DEC)	1
Grey Heron	1 (DEC)	N/C	0	0	0	0
Moorhen	1 (DEC)	N/C	0	1 (JAN)	1 (DEC)	1
Coot	0	N/C	3 (JAN)	1 (FEB)	0	1
Lapwing	N/C	N/C	0	0	55 (JAN)	18

Table 10.4.4: Summary BTO WeBS Data for Site: 06510

Species	2002/03	2003/04	2004/05	2005/06	2006/07	Mean Peak
Mute Swan	8 (DEC)	2 (DEC)	8 (JAN)	9 (FEB)	24 (JAN)	10
Whooper Swan	0	0	53 (DEC)	45 (DEC)	9 (DEC)	21
Wigeon	0	0	50 (FEB)	12 (JAN)	6 (DEC)	14
Mallard	0	0	0	0	2 (MAR)	0
Tufted Duck	0	0	0	0	2 (DEC)	0
Great Crested Grebe	0	0	0	1 (DEC)	1 (DEC)	0
Grey Heron	1 (DEC)	0	0	0	0	0
Moorhen	0	4 (DEC)	0	2 (FEB)	0	1
Coot	0	0	1 (JAN)	0	1 (MAR)	0
Lapwing	N/C	70 (DEC)	12 (DEC)	100 (JAN)	7 (JAN)	47
Common Gull	N/C	0	9 (JAN)	N/C	N/C	5

NIEA Whooper Swan Records

NIEA were consulted for the purposes of obtaining whooper swan data for relevant sites within or in close proximity to the scheme area and Upper Lough Erne SPA. NIEA held data for a number of sites illustrated in **Figure 10.4**. Summary counts of Whooper Swan for each survey site are presented in **Table 10.4.5**.

NIEA survey data also show the Wattle Bridge area to consistently have the highest numbers of whooper swans present during the wintering period however, numbers do not exceed nationally or internationally important population thresholds.

- Peak ULE106 2007/08 to 2009/10 = 0
- Peak ULE107 2007/08 to 2009/10 = 0
- Peak ULE108 2007/08 to 2009/10 = 32 (9.1% of SPA population)
- Peak ULE109 2007/08 to 2009/10 = 14 (4% of SPA population)

Table 10.4.5: Summary Whooper Swan Data held by NIEA for the Upper Lough Erne Area

Season	Survey Date	ULE106	ULE107	ULE108	ULE109
2009/10	26 th Feb 2010	-	-	-	-
2008/09	25 th Feb 2009	-	-	32	-
	21 st Jan 2009	-	-	8	-
	11 th Dec 2008	-	-	28	-
2007/08	21 st Feb 2008	-	-	2	-
	24 th Jan 2008	-	-	21	6
	05 th Dec 2007	-	-		14

Protected and priority Avifauna

Table 10.4.6 lists birds of conservation concern and protected species occurring in the study area grid squares.

Table 10.4.6: Priority Avifauna recorded in existing databases

Common Name	Scientific Name	Protect NI ¹	Protect ROI ³	Red-listed BoCCI ³	Birds Directive Annex I	Present in 10km Square within scheme (NI)	Present in 10km Square within scheme (ROI)	Grid Square
Barn Owl	<i>Tyto alba</i>	√	√	√		√	√	H41
Buzzard	<i>Buteo buteo</i>	√	√			√	√	H32, H41, H42
Fieldfare	<i>Turdus pilaris</i>					√	√	H41
Garden Warbler	<i>Sylvia borin</i>					√	√	H32
Grey Heron	<i>Ardea cinerea</i>	√	√			√	√	H32, H41
Sparrowhawk	<i>Accipiter nisus</i>	√				√	√	H32, H41,
Kestrel	<i>Falco tinnunculus</i>	√				√	√	H32, H41,
Merlin	<i>Falco columbarius</i>	√				√	√	H32
Peregrine	<i>Falco peregrinus</i>	√			√	√	√	H32,
Whooper Swan	<i>Cygnus cygnus</i>				√	√	√	H32, H42
Key to Table 10.4.6 ¹ Protected at all times, and subject to special penalties under The Wildlife Order ² Protected at all times, and subject to special penalties under The Wildlife Act ³ All-Ireland red-listed Bird Of Conservation Concern (Lynas et al., 2007) with severe declines of up to 50% in breeding population (or other criterion)								

Wintering Waterfowl Survey

This section should be read with **Figure 10.4** indicating the survey area and gaps in existing wintering waterfowl data provided by BTO WeBS counts. The survey area was visited three times between November 2009 and February 2010. Access to the 200m stretch of waterway to the west of Wattle Bridge was limited however, overall coverage of the survey area was considered to be good. **Table 10.4.7** presents the survey conditions during all bird surveys conducted within the proposed scheme area. **Table 10.4.8** summarises monthly counts and peak counts of species recorded within the survey area.

Table 10.4.7: Bird Survey Weather Conditions

Survey	Date	Survey Area	Weather
Wintering Waterfowl	13/11/2009	Kilgarrow Lough to Goladuff + 200m section west of Wattle Bridge	Clear skies, Wind Variable F0-1, Visibility Good
	05/01/2010		Clear skies, Wind N F2-3, Visibility Good, Lakes Frozen
	17/02/2010		Cloud 7/8, Wind SW F1-3, Visibility Good
Breeding Waterfowl	17/06/2010	Derrykerrib Bridge to Gortnacarrow	07h30 -14h00 Cloud: Patchy, Wind: Calm, Rain: NIL
Breeding Wader	18/06/2010	Agricultural fields Derrykerrib to Gortnacarrow	05h15-14h00 Wind: F 0 -2 , Rain: NIL, Cloud: Overcast.
Terrestrial Breeding Bird	14/04/2011	Gortnacarrow to Clonnagore	06h45 – 11h50 Wind: F1/SE, Cloud: 6/8, Rain: Light shower, Visibility: >3km
	15/04/2011	Clones to Clonnagore	06h30 -12h00 Wind: F1/SE, Cloud: 6/8, Rain: Nil, Visibility: >3km
	24/05/2011	Clones to Clonnagore	06h30-11h45 Wind: F1/SE, Cloud: 6/8, Rain: Light Shower, Visibility: >3km
	25/05/2011	Gortnacarrow to Clonnagore	06h15 – 11h30 Wind – F1/SE, Cloud – 7/8, Rain – NIL, Visibility >3km
	08/06/2011	Clones to Clonnagore	06h00 – 11h45 Wind: F1/SE, Cloud: 7/8, Rain: NIL, Visibility: >3km
	09/06/2011	Gortnacarrow to Clonnagore	06h00 – 11h15 Wind: F1/SE, Cloud: 8/8, Rain: Light shower, Visibility: >3km

Table 10.4.8: Wintering Waterfowl Data for Kilgarrow Lough to Goladuff

Species	Conservation Status	Survey Date			Peak Count
		13/11/2009	05/01/2010	17/02/2010	
Buzzard <i>Buteo Buteo</i>	WO	0	1	0	1
Cormorant <i>Phalacrocorax carbo</i>	Amber	1	1	0	1
Coot <i>Fulica atra</i>	Amber	10	2	8	10
Great Crested Grebe <i>Podiceps cristatus</i>	Amber	1	0	5	5
Goldeneye <i>Bucephala clangula</i>	Amber, NI	5	0	3	5
Grey Heron <i>Ardea cinerea</i>	WO	1	1	3	3
Little Grebe <i>Tachybaptus ruficollis</i>	Amber	13	8	8	13
Mallard <i>Anas platyrhynchos</i>	-	2	43	2	43
Moorhen <i>Gallinula chloropus</i>	-	12	3	3	12
Mute Swan <i>Cygnus olor</i>	Amber	7	10	3	10
Pochard <i>Aythya ferina</i>	NI	0	0	3	3
Teal <i>Anas crecca</i>	Amber	2	3	0	3
Tufted Duck <i>Aythya fuligula</i>	Amber, NI	22	40	16	40
Water Rail <i>Rallus aquaticus</i>	Amber	2	0	2	2
Wigeon <i>Anas penelope</i>	Amber	0	0	4	4

Whooper swans were not recorded within the survey area during the 2009/10 wintering waterfowl survey. However, whooper swans were recorded by the surveyor driving to and from survey locations outside the scheme area. A summary is provided in **Table 10.4.9**.

Table 10.4.9: Whooper swans recorded outside the survey area during wintering waterfowl surveys 2009/10 by RPS surveyors

Date	Location	Total
05/01/2009	Roadside (A34) improved fields between Newtownbutler and Lisnaskea	157
17/02/2010	Roadside (A34) improved fields between Newtownbutler and Lisnaskea	25

Breeding Waterfowl Survey

This section should be read with **Figure 10.4.2** which indicates the survey area and key results. The waterways between Derrykerrib Bridge and Gortnacarrow were visited by boat in June 2010 between the hours of 07h30-14h00 during which all evidence of breeding waterfowl within the survey area was recorded. **Table 10.4.10** provides a summary of species and breeding waterfowl territories recorded within the survey area. Three Amber-listed BOCCI species were confirmed as breeding within the survey area. In addition two species afforded special protection under the Wildlife Order (NI) were also recorded within the survey area, one of which was confirmed as breeding.

Table 10.4.10: Summary of Breeding Waterfowl Territories

Species	BTO Species Code	Breeding within scheme area	Estimated Territories	Conservation Status
Great Crested Grebe	GG	Confirmed	3	Amber
Heron	H.	Unlikely	0	WO
Little Grebe	LG	Confirmed	1	Amber
Mallard	MA	Unlikely	0	-
Moorhen	MH	Confirmed	10	-
Sand Martin	SM	Confirmed	3	WO, Amber
Key to Table 10.4.10 WO – Listed on Schedule I of the Wildlife Order (NI); Amber – Amber-listed BOCCI species				

Breeding Wader Survey

The breeding waterfowl survey area (**Figure 10.4.2**) was revisited on the 18th of June 2010 during which all evidence of breeding waders within the survey area, which included agricultural fields adjacent to the waterways, was recorded. Accessible fields were accessed by boat. **Table 10.4.11** provides a summary of breeding wader activity recorded during survey effort.

Table 10.4.11: Summary of Breeding Wader Territories

Species	BTO Species Code	Breeding within scheme area	Estimated Territories	Conservation Status
Lapwing	L.	Likely	3-4	WO, Red, NI
Snipe	SN	Likely	2	Amber
Key to Table 10.4.11 WO – Listed on Schedule I of the Wildlife Order (NI); Red – Red-listed BOCCI species (breeding); Amber – Amber-listed BOCI; NI – Northern Ireland Priority Species				

The extent of potential breeding wader habitat recorded adjacent to the River Finn is shown in **Figure 10.4.2**.

Terrestrial Breeding Bird Survey

This section should be read with **Figures 10.4.3 to 10.4.9**. The terrestrial section of the scheme area was walked three times over six days between April and July 2011 (**Table 10.4.12**). Sites outlined for the disposal of dredged spoil from the aquatic portion of the scheme area, were also visited during these surveys.

Thirteen protected species or species of conservation concern were identified within the survey area, including five of which were confirmed as breeding within the proposed scheme area. **Table 10.4.12** provides a summary of species observed during the terrestrial survey area along with the estimated number of territories recorded within the proposed scheme area.

Table 10.4.12: Summary of Bird Species and Breeding Bird Territories Recorded during the Terrestrial Breeding Bird Survey.

Species	BTO Species Code	Breeding within scheme area	Estimated Territories	Conservation Status
Blackbird <i>Turdus merula</i>	B.	Confirmed	17	-
Blackcap <i>Sylvia atricapilla</i>	BC	Confirmed	28	-
Blue Tit <i>Cyanistes caeruleus</i>	BT	Confirmed	11	-
Bullfinch <i>Pyrrhula pyrrhula</i>	BF	Possible	2	-
Buzzard <i>Buteo buteo</i>	BZ	Unlikely	0	WO
Canadian Goose <i>Branta canadensis</i>	CG	Unlikely	0	ISI (Amber)
Chaffinch <i>Fringilla coelebs</i>	CH	Confirmed	35	-
Chiffchaff <i>Phylloscopus collybita</i>	CC	Confirmed	16	-
Coal Tit <i>Parus ater</i>	CT	Confirmed	4	-
Collared Dove <i>Streptopelia decaocto</i>	CD	Possible	0	-
Dunnock <i>Prunella modularis</i>	D.	Confirmed	7	NI
Goldcrest <i>Regulus regulus</i>	GC	Confirmed	1	-
Goldfinch <i>Carduelis carduelis</i>	GO	Confirmed	6	-
Grasshopper Warbler <i>Locustella naevia</i>	GH	Confirmed	1	-
Great Crested Grebe <i>Podiceps cristatus</i>	GC	Unlikely	0	Amber
Great Tit <i>Parus major</i>	GT	Confirmed	14	-
Greenfinch <i>Carduelis chloris</i>	GR	Unlikely	0	-
Grey Heron <i>Ardea cinerea</i>	H.	Unlikely	0	WO
House Martin <i>Delichon urbicum</i>	HM	Unlikely	0	Amber
House Sparrow <i>Passer domesticus</i>	HS	Confirmed	1	Amber, NI,
Jackdaw <i>Coloeus monedula</i>	JD	Confirmed	6	-
Lapwing <i>Vanellus vanellus</i>	L.	Unlikely	0	WO, Red, NI,
Lesser Black-backed Gull <i>Larus fuscus</i>	LB	Unlikely	0	Amber
Lesser Redpoll <i>Carduelis cabaret</i>	LR	Likely	1	-
Linnet <i>Carduelis cannabina</i>	LI	Confirmed	1	Amber, NI,
Long-tailed Tit <i>Aegithalos caudatus</i>	LT	Confirmed	1	-
Magpie <i>Pica pica</i>	MG	Unlikely	0	-
Mallard <i>Anas platyrhynchos</i>	MA	Confirmed	1	-
Meadow Pipit <i>Anthus pratensis</i>	MP	Unlikely	0	-
Mistle Thrush <i>Turdus viscivorus</i>	MT	Likely	1	-
Pheasant <i>Phasianus colchicus</i>	PH	Unlikely	0	-
Pied Wagtail <i>Motacilla alba</i>	PW	Unlikely	0	-
Reed Bunting <i>Emberiza schoeniclus</i>	RB	Confirmed	5	NI
Robin <i>Erithacus rubecula</i>	R.	Confirmed	12	-
Rook <i>Corvus frugilegus</i>	RO	Unlikely	0	-

Sedge Warbler <i>Acrocephalus schoenobaenus</i>	SW	Confirmed	14	-
Snipe <i>Gallinago gallinago</i>	SN	Unlikely	0	Amber
Song Thrush <i>Turdus philomelos</i>	ST	Confirmed	4	NI
Starling <i>Sturnus vulgaris</i>	SG	Confirmed	3	Amber, NI
Swallow <i>Hirundo rustica</i>	SL	Unlikely	0	Amber
Whitethroat <i>Sylvia communis</i>	WH	Confirmed	1	-
Willow Warbler <i>Phylloscopus trochilus</i>	WW	Confirmed	40	-
Wood Pigeon <i>Columba palumbus</i>	WP	Confirmed	17	-
Wren <i>Troglodytes troglodytes</i>	WR	Confirmed	22	-

Table 10.4.13 summarises breeding bird territories recorded in sites outlined for potential dredged spoil disposal. No species of conservation concern were recorded at these sites.

Table 10.4.13: Summary of Terrestrial Breeding Bird Territories recorded in sites outlined for dredged spoil disposal during the terrestrial breeding bird survey.

Common Name	BTO Species Code	Breeding within scheme area	Estimated Territories	Conservation Status
Blackbird	B.	Confirmed	1	-
Blackcap	BC	Confirmed	1	-
Blue Tit	BT	Confirmed	3	-
Chaffinch	CH	Confirmed	8	-
Chiffchaff	CC	Confirmed	2	-
Duncock	D.	Confirmed	2	NI
Goldfinch	GO	Confirmed	1	-
Magpie	MG	Confirmed	1	-
Robin	R.	Confirmed	1	-
Sedge Warbler	SW	Confirmed	1	-
Wood Pigeon	WP	Confirmed	3	-
Willow Warbler	WW	Confirmed	1	-
Key to Table 10.4.13 NI – Northern Ireland Priority Species				

10.4.2 Impact Assessment

Potential impacts of the proposed scheme to avifauna fall into the following categories:

- Potential Habitat Loss Impacts which may result in loss of potential nesting habitat or loss of foraging fields for overwintering whooper swans;
- Potential Pollution Impacts which may result in direct pollution impacts to wintering and breeding bird populations resulting in bird fatalities or indirect pollution impacts to wintering and breeding bird populations causing disturbance via food resource depletion;
- Habitat Deterioration and Biodiversity Loss which may result in spread and establishment of invasive species leading to a change in nesting and foraging habitat quality; and
- Potential Disturbance Impacts which may result in noise and visual disturbance to breeding and overwintering bird populations during the construction and operational phases of the scheme.

Wintering Wildfowl

The aquatic portion of the scheme area passes through the Upper Lough Erne SPA designated for regularly supporting internationally important numbers of wintering whooper swan and nationally

important numbers of wintering great-crested grebe, cormorant, mute swan, tufted duck, wigeon, teal, goldeneye, coot, mallard, snipe, curlew and redshank.

Existing BTO WeBS datasets show whooper swan, great-crested grebe, cormorant, mute swan, tufted duck, wigeon, teal, coot, mallard and curlew associated with the Upper Lough Erne SPA to be regularly present within the aquatic portion of the scheme area during the overwintering period. In addition BTO WeBS datasets show greylag goose, pochard, grey heron, moorhen, lapwing, little grebe and common gull to be present. Goldeneye and water rail were additionally recorded during Wintering Wildfowl Surveys. Mute Swan was recorded regularly throughout the survey. Teal was rarely observed.

Numbers of whooper swans recorded within the aquatic portion of the scheme area appear to be highest in the section between Gortnacarrow and Wattle Bridge, as indicated by existing BTO WeBS and NIEA datasets. Fields adjacent to the River Finn at this location are predominantly improved. Whooper Swans is likely to be more sporadic during the overwintering season.

The majority of key sites for whooper swans are concentrated to the west of Lisnaskea and Newtownbutler owing to the broader area of low-lying wetland and grassland habitats found here. The River Finn is identified as a favoured site, with up to 70 whooper swans regularly using the marshy edges/adjacent rough pasture downstream of both Gortnacarrow Bridge and Wattle Bridge during the overwintering period.

In Ireland, whooper swans traditionally overwinter on freshwater habitats and surrounding agricultural land. Traditionally whooper swans fed mainly on aquatic vegetation however, the use of agricultural land has become more common since the 1960s.

Whooper swans are winter migrants to Ireland, generally arriving in October and departing in late March or early April for their breeding grounds in Iceland and Arctic Russia (McElwaine *et al.*, 1995; Rees *et al.*, 1997; Cranswick *et al.*, 2002). During the winter both they and Bewick's swans are traditionally found on inland wetlands (lakes, marshes and floodplains) and coastal estuaries. However in more recent times wintering birds have tended to utilize lowland agricultural lands (on improved pastures and cereal stubbles) near to waterbodies - which remain important nighttime roost sites. Both species usually feed during the daylight hours and leave their feeding sites at dusk to congregate at night-time roosts. Whooper swans arrive in greater numbers to Northern Ireland than the Bewick's swan with the largest flocks typically found in the Loughs Foyle and Swilly complex, Loughs Neagh and Beg and the wetlands of Upper Lough Erne. In Northern Ireland, small flocks of the less common Bewick's swan are generally restricted to Loughs Foyle, Neagh and Beg.

It is anticipated that boat traffic will be greatly reduced during the overwintering season. The canal may provide new foraging opportunities to whooper swans. Birds are likely to habituate to boat traffic over time. Birds will have the opportunity to return to disturbed areas once the disturbance has been

removed. Due to the relative absence of significant wildfowl flocks within the study area, no significant impact is predicted.

Breeding Waterfowl and Waders

This section should be read with reference to **Figure 10.4.2. Table 10.4.14** summarises impacts to waterfowl and waders. Fourteen breeding waterfowl territories were recorded within the aquatic portion of the scheme area during survey –

- 3 great crested grebe territories;
- 10 moorhen territories and;
- 1 little grebe territories.

In addition 6 sand martin territories were recorded beneath Wattle and Gortnacarrow bridges.

Article 4 of the Wildlife Order 1985 notes an offence as being the intentional or reckless damage to or destruction of a wild bird's nest that is in use, or obstructing a wild bird from using its nest. In the current legislation, there is no dated season in which the offence can be committed. This offence may be committed at any time of the year.

Section 22 of the Wildlife Acts 1976-2010 notes offences including wilful destruction of a nest, or wilful disturbance to a wild bird on or near a nest containing eggs or unflown young. The Wildlife Acts provide a defence (i.e. it is not an offence) when this is as a result of building operations or engineering construction.

Damage or destruction to birds' nests is most likely to occur as a result of vegetation clearance. Mitigation has been proposed.

Construction

Nesting Habitat Loss

Existing Reed Swamp habitat and sporadic emergent vegetation is currently providing important nesting opportunities for nesting waterfowl to the west of Gortnacarrow Bridge. Reed Swamp habitat will not be removed as part of the proposed construction works in the aquatic portion of the scheme. However, sporadic emergent vegetation within the proposed navigation channel will require removal to re-establish navigation. The large majority of nesting waterfowl recorded within the aquatic portion of the scheme held territories with nests within the Reed Swamp habitat with only one Little Grebe and one great crested grebe territories recorded outside this habitat. These nesting locations within the habitat will be lost. The impact without mitigation will be slight adverse due to the extensive availability of suitable nesting habitat for these species outside the scheme area.

Restoration works on the Wattle and Gortnacarrow bridges will result in the loss of current sand martin colonies within the scheme area. Mitigation is proposed and the impact on sand martins will be temporary. The residual impact will therefore be negligible.

Disturbance from Construction Activities and Habitat Removal

Construction activities and habitat removal will be scheduled outside of the breeding bird season (broadly acknowledged as March to August) following a pre-vegetation clearance survey by a competent ecologist. The impact is not significant.

Potential Pollution impacts to breeding birds from Construction Activities

Pollution events from plant machinery are unlikely to occur within the aquatic portion of the scheme area. The EMP outlines proposed pollution controls to prevent the risk of accidental spillage of fuel/oil from plant machinery. The impact without additional mitigation will therefore be negligible.

During initial dredging activities at construction phase, water quality (and hence aquatic and bankside foraging habitat for breeding and wintering wildfowl) can be impacted upon by the re-suspension of sediments within the River Finn. Increases in suspended solid levels can affect the respiratory systems of fish, reduce light penetration within the water column and restrict primary productivity and lead to depleted oxygen levels causing mortality in macroinvertebrates. Reduced invertebrate and fish populations may therefore impact upon foraging habitat quality of local breeding and wintering waterfowl populations. Released toxins from dredged sediments may also lead to direct wildfowl fatalities if ingested. **Section 15** describes the existing environment in relation to soils and geology. No contaminants have been identified through preliminary ground investigations in the River Finn. Mitigation is proposed to limit the impact of suspended solids on breeding and wintering wildfowl. With mitigation this impact will be non-significant.

Operation**Potential Disturbance from Aquatic Vegetation Management**

Annual vegetation management required to maintain navigation within the open channel will be undertaken between March and September. At the riparian fringe, works will be undertaken outside of the breeding bird season. Existing reedswamp habitat west of Wattle Bridge will not be included in such management and vegetation removal will be restricted to within the navigation channel. Direct disturbance impacts on breeding waterfowl as a result of aquatic vegetation clearance activities are therefore not anticipated. This impact will therefore be negligible.

Potential Disturbance from Dredging Activities

Intermittent dredging within the aquatic portion of the scheme will be required to throughout the operational phase to maintain navigation within the channel. It is anticipated that dredging activities will be scheduled largely outside of the breeding bird season. No direct disturbance impact as a result of dredging activity is therefore anticipated on breeding waterfowl within the scheme area during the operational phase.

Potential Pollution impacts to breeding birds from Operational Dredging Activities

During operational maintenance dredging foraging habitat for breeding and wintering wildfowl can be impacted upon by the re-suspension of sediments within the River Finn and new canal alignment. Potential impacts on wintering and breeding wildfowl are discussed above. Mitigation is proposed to limit the impact of suspended solids on breeding and wintering wildfowl. With mitigation this impact will be non-significant.

Potential Disturbance from Recreational Activities

During the operational phase potential impacts on nesting waterfowl may arise as a result of increased boat traffic within the aquatic portion of the scheme area. Towpaths are not scheduled for the riverine portion of the scheme area and there will be no high-impact disturbances as a result of walkers along the canal banks. Additional mitigation is proposed through the restriction of certain activities within this part of the scheme area and the residual impact is non-significant.

Wintering Waterfowl

Upper Lough SPA and ASSI feature species have already been dealt with in **section 10.2**. Impacts are not repeated here.

Table 10.4.14: Summary Impact table for waterfowl

Potential Impact	Nature	Magnitude	Ecological Value	Impact Significance	Potential Impact	Phase of Occurrence	Duration	Direct/ Indirect	Likelihood of Occurrence	Mitigation	Significance of Residual Impact
Loss of nesting waterfowl habitat	-ve	Minor	Low-Medium	Slight Adverse	Habitat Loss	Construction /Operation	Temporary	Direct	Certain	Yes	NS
Disturbance of nesting waterfowl during canal construction and maintenance activities	-ve	Minor	Low-Medium	Slight Adverse	Bird Disturbance	Construction	Temporary	Direct	Unlikely	No	NS
Disturbance of nesting waterfowl from canal recreation activities	-ve	Minor	Low-Medium	Slight Adverse	Bird Disturbance	Operation	Long-term	Direct	Unknown	Yes	NS
Pollution impacts to breeding waterfowl	-ve	Major	Very High	Very Large Adverse	Species Fatalities	Construction /Operation	Temporary /Long-term	Direct	Unlikely	No	NS
Loss of Sand Martin Colonies	-ve	Intermediate	Very High	Very Large Adverse	Habitat Loss	Construction /Operation	Long-term	Direct	Unlikely	No	NS
Disturbance of Sand Martin Colonies	-ve	Intermediate	Very High	Very Large Adverse	Bird Disturbance	Construction /Operation	Temporary /Long-term	Direct	Unlikely	No	NS

NS = Non-significant

Terrestrial Breeding Birds

249 breeding bird territories will be lost as the result of vegetation clearance to facilitate the creation of the new canal channel and facilities in the terrestrial portion of the scheme. **Table 10.4.15** summarises impacts to terrestrial breeding birds. **Figures 10.4.3 to 10.4.9** illustrate breeding territories along the scheme.

15 blackbird territories	1 grasshopper warbler territory	12 robin territories
25 blackcap territories	14 great tit territories	14 sedge warbler territories
11 blue tit territories	1 house sparrow territory	4 song thrush territories
2 bullfinch territories	6 jackdaw territories	3 starling territories
35 chaffinch territories	1 lesser redpoll territory	1 whitethroat territory
16 chiffchaff territories	1 linnet territory	37 willow warbler territories
4 coal tit territories	1 long-tailed tit territory	11 woodpigeon territories
7 dunnock territories	1 mallard territory	20 wren territories
1 goldcrest territories	1 mistle thrush territory	
6 goldfinch territories	5 reed bunting territories	

Construction

Nesting Habitat Loss

Birds will be displaced from the cleared area of the canal as vegetation removal will render the lands unsuitable for nesting. Removal of natural habitat will be undertaken only where necessary and will be kept to a minimum. Compensatory planting of hedgerow and woodland habitats consisting of native species will be undertaken.

Following the removal of habitat birds will be displaced into suitable habitat outside the scheme area. Wooded copses, hedgerows, scrub and wet grassland habitats were noted to be abundant outside the scheme area. It is accepted that the growth of new habitat features will take some time to mature into suitable nesting habitat.

Disturbance to Nesting Birds

Vegetation clearance during the construction phase will be undertaken outside the breeding bird season. Prior to vegetation clearance an ecologist will be contracted to undertake a pre-vegetation clearance survey to record any evidence of breeding bird behaviour within vegetation to be cleared.. Disturbance as a result of vegetation clearance is therefore not anticipated.

Construction activities within the terrestrial portion of the scheme between Clones and Gortnacarrow, will not be restricted to outside the breeding bird period. Disturbance to breeding birds in the vicinity of the scheme area from noise and increased human presence may therefore occur due to an increase in noise and visual disturbance. This disturbance will however be temporary.

In accordance with the Waterways Ireland Environmental Management Plan (**Appendix A**) and construction proposals (**Section 6**) dredging and spoil disposal activities will be undertaken outside of

the breeding bird season (March to September) so no disturbance impact will occur. During terrestrial breeding bird surveys a single mallard territory was recorded to the north of Cloncorrick within Reedswamp habitat. This habitat will be lost to facilitate the construction of the new canal channel. More habitats will be available once the canal is operational.

Sites outlined for dredged spoil disposal

Other than for the purposes of creating access, the disposal of dredged spoil will not result in the loss of boundary vegetation including hedgerows and scattered trees at disposal sites. Potential nesting bird habitat will therefore not be lost. As outlined above sites selected for the on-site disposal of dredged spoil were also selected based on their potential as suitable breeding wader habitat. Dredging activities and spoil disposal will be undertaken largely outside the breeding bird season and thus disturbance of nesting birds is unlikely to occur.

10.4.3 Mitigation

Mitigation for avifauna impacts are largely by way of restrictive timing of activities at construction or operation. Sites of significant vegetation removal are restricted to the scheme area between Clones and Gortnacarrow, where scrub, hedgerows and scattered trees may require removal to facilitate the new navigation channel. Prior to any vegetation clearance an ecologist will be contracted to undertake a 'pre-vegetation clearance' survey for signs of nesting birds. Vegetation clearance will occur outside the main breeding bird season - September to March.

By way of habitat enhancement, the Landscape Plan (**Appendix B**) outlines measures to incorporate features for sand martins and kingfisher into the project at the Clones end of the project. Existing sand martin colonies will be retained at Wattle Bridge and Gortnacarrow Bridge. Towpaths will be absent under bridges and therefore prevent significant disturbance by recreational users during the operational phase of the scheme.

It is proposed to stagger wider sections of riparian habitat (up to 2m) to maximise the potential for nesting waders and wildfowl, as detailed in the Landscape Plan.

Native shrub and tree species to be used in compensatory planting will include Alder, Ash, Birch, Blackthorn, Spindle, Guelder Rose, Hawthorn, Hazel and Willows. Such species complement those present within existing habitats and will be attractive to nesting bird species currently utilising the scheme area, as detailed in the Landscape Plan.

Table 10.4.15: Summary of impacts to terrestrial breeding birds

Potential Impact	Nature	Magnitude	Ecological Value	Impact Significance	Potential Impact	Phase of Occurrence	Duration	Direct/ Indirect	Likelihood of Occurrence	Mitigation Proposed	Significance of Residual Impact
Loss of 249 terrestrial breeding bird territories	-ve	Intermediate	High	Large Adverse	Habitat Loss	Construction	Temporary	Direct	Certain	Yes	NS
Disturbance of terrestrial breeding birds during construction activities	-ve	Intermediate	High	Large Adverse	Bird Disturbance	Construction	Temporary	Direct	Certain	Yes	NS
Disturbance of terrestrial breeding birds during vegetation maintenance activities	-ve	Intermediate	High	Large Adverse	Bird Disturbance	Operation	Temporary	Direct	Certain	Yes	NS

NS = Non-significant

10.5 FAUNA

10.5.1 Existing Environment

Protected Vertebrates – Existing Records

A search of the biological records databases (NBN; CEDaR, NBRC, NIBG, BCI) yielded many protected vertebrate records for the 10km grid squares within which the study area is located. **Table 10.5.1** summarises these records.

Table 0.5.1: Priority Vertebrate Fauna recorded in existing databases

Common Name	Scientific Name	Protected NI ¹	Priority NI ²	Protected ROI ³	Species Action Plans ⁴	Protected EU ⁵	Present in 10km Square within scheme (NI)	Present in 10km Square within scheme (ROI)	Grid Squares
Badger	<i>Meles meles</i>	√		√			√	√	H41
Brown long-eared bat	<i>Plecotus auritus</i>	√	√	√	AI ⁴	√	√	√	H42
Common Frog	<i>Rana temporaria</i>			√			√	√	H41, H42
Daubenton's bat	<i>Myotis daubentonii</i>	√	√	√	AI ⁴	√	√	√	H42
Freshwater Crayfish	<i>Austropotamobius pallipes</i>	√					√	√	H41, H42
Irish Hare	<i>Lepidus timidus hibernicus</i>		√	√	AI ⁴		√	√	H41, H42
Leisler's bat	<i>Nyctalus leisleri</i>	√	√	√	AI ⁴	√	√	√	H42
Nathusius's Pipistrelle	<i>Pipistrellus nathusii</i>	√	√	√	AI ⁴	√	√	√	H42
Natterer's bat	<i>Myotis nattereri</i>	√	√	√	AI ⁴	√	√	√	H42
Otter	<i>Lutra lutra</i>	√	√		ROI	√	√	√	H41
Pine Marten	<i>Martes martes</i>	√		√			√	√	H32
Common Pipistrelle	<i>Pipistrellus pipistrellus</i>	√	√	√	AI ⁴	√	√	√	H42
Red Squirrel	<i>Sciurus vulgaris</i>		√		AI		√	√	H41
Soprano Pipistrelle	<i>Pipistrellus pygmaeus</i>	√	√	√	AI ⁴	√	√	√	H42
Stoat	<i>Mustela erminea subsp. hibernica</i>	√		√			√	√	H32, H42
Whiskered bat	<i>Myotis mystacinus</i>	√	√	√	AI ⁴	√	√	√	H42

Key to Table 10.5.1
¹ Protected at all times, and subject to special penalties under The Wildlife Order
² Priority species are those identified by Northern Ireland Biodiversity Group as under threat and requiring conservation
³ Protected at all times, and subject to special penalties under The Wildlife Acts
⁴ All-Ireland Species Action Plan

Badger

An initial badger survey was undertaken within the terrestrial portion of the scheme area, during Extended Phase 1 Habitat Surveys in June 2009. The results of this survey were subsequently updated during Phase 2 Habitat Surveys in July 2011. The results presented in this assessment illustrate the combined survey results.

A well-used outlier badger sett is located within semi-improved neutral grassland alongside a farm access track northeast of Gortnacarrow Bridge, next to the old canal route by Clonoony in the west of the proposed scheme area (**Figure 10.5**). No main sett was located despite intensive searches in June 2009 and July 2011 within 100m of the proposed scheme area.

In 2009 only one partially used entrance was recorded. However, in 2011 there was evidence to suggest the sett had expanded - with three well-used holes recorded. There were also additional signs of further holes being excavated. Fresh badger scats were located in both survey years within adjacent grasslands. Mammal paths within tall grass were also recorded between existing holes and leading into adjacent grasslands. No bedding was recorded in the entrance or close to the entrance of holes, suggesting that this is unlikely to currently be an established breeding sett.

The badger sett straddles the Northern Ireland/Ireland border, with two holes recorded in County Fermanagh and one in County Monaghan.

Otter

No otter spraints, tracks, potential couches or holts were recorded within the survey area despite intensive searches during multiple habitat surveys, bird and aquatic ecology surveys in 2009 and 2011.

Bats

A bat survey was undertaken by an experienced bat surveyor along the proposed development route in July and August 2011 to build upon the 2009 visual assessment survey of structures. This survey assessed the use of the proposed scheme area by bats aiming to identify potential roost locations. A summary of the key results and findings of the survey are presented in this assessment and a full copy of the commissioned report is provided in Appendix D. Existing bat records held by Bat Conservation Ireland (BCI) and the Northern Ireland Bat Group (NIBG) were obtained for the purpose of this assessment (**Figure 10.5.1**). Bat survey results are illustrated in **Figures 10.5.2 to 10.5.7**.

Existing Records

The nearest multi-species roost is Castle Saunderson (H419199) situated on the County Cavan/Monaghan border. The following species have been noted here:

- Soprano pipistrelle *Pipistrellus pygmaeus*
- Common pipistrelle *Pipistrellus pipistrellus*
- Leisler's bat *Nyctalus leisleri*
- Natterer's bat *Myotis nattereri*

- Nathusius's pipistrelle *Pipistrellus nathusii*
- Daubenton's bat *Myotis daubentonii*
- Whiskered bat *Myotis mystacinus*
- Brown long-eared bat *Plecotus auritus*

An identical species list is present at Crom Estate, County Fermanagh (H3324). This property lies several kilometres from proposed scheme area and it is unlikely that any of the changes brought about by the restoration of the Ulster Canal will have an impact upon this site (the bats present at each site may be the same populations but in all cases, Castle Saunderson is the more likely roost site to be affected).

Survey Results

Six species of bat were identified within the survey area:

- Soprano pipistrelle *Pipistrellus pygmaeus*;
- Common pipistrelle *Pipistrellus pipistrellus*;
- Leisler's bat *Nyctalus leisleri*;
- Natterer's bat *Myotis nattereri*;
- Nathusius's pipistrelle *Pipistrellus nathusii* and;
- Daubenton's bat *Myotis daubentonii*.

The order above represents the overall distribution and relative abundance of bats along the proposed scheme route, with soprano pipistrelle the most abundant and widely distributed species and Daubenton's bat the least abundant and widely distributed.

Additional species noted in previous surveys undertaken in close proximity to the scheme area include:

- Whiskered bat *Myotis mystacinus* and;
- Brown long-eared bat *Plecotus auritus*.

Soprano pipistrelles were noted throughout the study area and were seen and heard in towns such as Clones as well as in rural areas. A soprano pipistrelle was noted to enter a farm shed at Derrykerrib prior to dawn on 22nd July 2011. A soprano pipistrelle was also noted close to an old farmhouse along the former canal route at Drumcrin at emergence time. The building was the most likely roost site.

A soprano pipistrelle was noted at the commencement of observations at Clongowna feeding along the lane between relatively modern houses. This bat had only emerged within a minute or two of being noted and was certainly roosting in one of these houses.

Common pipistrelles were also widespread and were present throughout the survey area.

Leisler's bats were noted close to and within Clones (the bridge at Clonboy and along the road here) in particular but were also present at several sites including the bridge at Clonagore (whereat there is

a large collection of vehicles), the petrol station close to Annaghmore Glebe (close to the River Finn and the Canal route), around the Church of Ireland church at Drummully (Clonoony townland).

Natterer's bats were very much in evidence during this survey and are relatively common in this area. A roost of 69 Natterer's bats was discovered in Drummully Church, St. Mary's Church of Ireland on the N54 on the Monaghan side of the border and within 300 metres of the Canal.

This species was noted along the former Canal section at Edergool to the east of the proposed Canal line (River Finn) and along the former Canal section. Natterer's bats were noted at Drumsloe along the surviving Canal section, at Clonnagore close to a ruined house along the Canal and at Munnilly Bridge. Three Natterer's bats (minimum) were seen and heard in a farmyard at Rabbit Island between the proposed Canal line and the A3.

Nathusius's pipistrelles were present along the former Canal section at Edergool, were noted at Derrynure (to the south of the bridge and along forestry edge in Fermanagh) and along the former Canal at Clonnagore (a ruined house) in Monaghan.

Daubenton's bats were very much in evidence under the bridge at Edergool whereat three individuals were seen on the River Finn.

Bridges

None of the bridges examined were occupied by bats in the period of the survey. Suitable crevices and cavities were relatively rare in the structures examined and there is a low level of potential for bats in the following locations inspected:

- Clones (Mullanamoy)
- Munnilly
- Keelaghy
- Cloncorick
- Clonoony
- Drumsloe

There is no potential in bridges over the River Finn as these have been skimmed and offer no cavities within which bats might roost.

Trees

There are few old trees along the Canal alignment. Beech trees at Clones Bridge offer some roosting potential, while mature ash along the River Finn at Annaghmore Glebe offer moderate roosting potential. Willow trees are frequent along the proposed scheme route but few were found to show evidence of cavities or crevices. It is possible bats may also roost behind loose bark or in splits that are not easily seen, and there is potential for individual bats in some trees along the route including at Keelaghy.

There is some mature and semi-mature ash etc. to the east of Munnilly Bridge that at the very least provides good feeding but may also be a roost site. A soprano pipistrelle was seen immediately prior to dawn and was lost to view here. This bat may have flown to another building or may have entered a tree at this site. The resident of the house south of Munnilly Bridge reported encountering bats within the house on occasion.

Buildings

There are a number of buildings located within the temporary land take of the scheme, including temporarily acquired lands. Bat detector surveying was not undertaken on these buildings. There is a possibility of bat usage; however no evidence was available from an external inspection of the structures.

Irish Hare

No formal survey for Irish Hare was undertaken. Notes were however made of sightings and signs of Irish Hare observed within the proposed scheme area during visits by ecologists between 2009 and 2011.

- A single Irish Hare was flushed from wet grassland on the shore of Quivvy Lough at the western extremity of the scheme during the a wintering bird survey in November 2009;
- A single Irish Hare was observed foraging in improved grasslands at Clongowna during Phase 2 Habitat Surveys in 2011 (**Figure 10.5.3**);
- Two Irish Hares were flushed from tall semi-improved neutral grassland close to Gortnacarrow during terrestrial breeding bird surveys in 2011 (**Figure 10.5.6**).

Although no breeding evidence was gathered such as sightings of leverets or potential forms, suitable breeding habitat was recorded within the scheme area. It is therefore possible that the species may be breeding in the vicinity of the scheme area.

Reptiles & Amphibians

This section should be read with **Figure 10.5.8** to **10.5.11** which illustrates the survey area key survey results.

Smooth Newt Survey

Table 10.5.2 summarises the results of the smooth newt survey completed within the terrestrial portion of the scheme area in June 2011 under relevant licences obtained from NIEA and NPWS. Results from Phase 1 and 2 habitat surveys were used to identify key areas for survey. Habitat surveys identified nine waterbodies within or close to the scheme area between Gortnacarrow and Derrynure.

Smooth newts were recorded in four waterbodies surveyed by torchlight, however no newts were recorded during terrestrial refuge searches. Where possible submerged vegetation was inspected for eggs. No eggs were located. Several surveyed ponds were deemed inaccessible and were restricted to limited torchlight surveys due to health and safety concerns. The number of newts listed in **Table**

10.5.2 is therefore not therefore considered to be fully representative of populations, which may be present within waterbodies within the scheme area. Males and females were distinguished where possible. At one site a pregnant female was observed indicating breeding is very likely within the scheme area.

Newts were recorded in waterbodies within County Fermanagh. However due to the extensive and connective nature of potential smooth newt habitat (i.e. wet grassland habitats, drainage ditches and standing water), it likely that the potential for the newts to be present over a much large proportion of the scheme area (other than in what they were recorded) is high. It is therefore our clear view that the species may occur on both sides of the Northern Ireland/Ireland border.

Common Frog

Common Frogs are fully protected in the Ireland under the Wildlife Acts. They are also a red-listed species in Ireland (Whilde, 1993). No formal survey was undertaken to assess the potential for Common Frogs within the scheme area however, notes were made of live sightings and signs where possible.

Common Frogs were recorded in several reedswamp and wet grassland habitats (**Figure 10.5**). The species was also found to be abundance in semi-neutral grassland and standing eutrophic water habitats to the north of Cloncorick where surveys for smooth newts were undertaken (**Figure 10.5.4**). The presence of juveniles in these habitats suggested that breeding was likely to be occurring in the vicinity of the scheme area. However, no spawn was recorded in suitable breeding habitat within the scheme area.

Common Lizard

No formal survey was undertaken to record the presence of common lizard within the scheme area due to the lack of preferred common lizard habitat identified within the scheme area during Extended Phase 1 and Phase 2 Habitat Surveys. Although suitable common lizard habitat is variable the dominance of intensively grazed and lowland grasslands within the scheme area and lack of more preferred open habitats, suggests the potential of the species to be present is limited (Inns, 2009). Common lizards can be found in damp lowland habitats found extensively throughout the scheme area however, the species shows a preference for open, undisturbed habitats with good exposure to the sun for basking (Inns, 2009). Few populations of the species exist within intensively farmed environment (Inns, 2009). In areas where grazed grasslands are absent within the scheme area, overgrown marshy grassland and scrub habitats prevail reducing the availability of relatively open habitats preferred by common lizards.

Table 10.5.2: Smooth newt survey results

Date	Site	Location	Pond Length (m)	Pond Width (m)	Pond Perimeter (m)	Pond Area (m²)	Pond Depth	% Vegetation Cover	Newts	Frogs	Birds	Fish
09/06/2011	1	H43618,20505	3	4.5	15	13.5	<0.5m	40%	3 (1♀ 2♂)*		No	No
09/06/2011	2	H43986,20793	3.5	6	19	21	>0.5	30%	6		No	No
08/06/2011	3	H45443,21885	25	6	62	150	<0.5m	40%	-		No	No
09/06/2011	4	H45385,21922	47	5	104	235	<0.5m	10%	-		No	No
08/06/2011	5	H45902,22174	24	7	62	168	>1m	30%	-		No	Yes
08/06/2011	6	H45960,22210	104	5	218	520	>1m	30%	8		No	Yes
09/06/2011	7	H46016,22242	23	8	62	184	>1m	70%	-		No	Yes
08/06/2011	8	H46200,22402	113	7	240	791	>1m	50%	2		Yes	Yes
08/06/2011	9	H46206,22407	19	6	50	114	>1m	20%	-		No	Yes

*Note: A pregnant female was recorded here.

Invertebrates

Desktop Study

The following organisations and databases were consulted to retrieve existing invertebrate records for relevant 10km grid squares within the scheme area:

- CEDaR (NMNI)
- National Biodiversity Data Centre (NBDC) Records & Mapping
- National Biodiversity Network (NBN) database
- Butterfly Conservation
- The Coleopterist

A summary of rare, priority and protected invertebrate species recorded in relevant 10km grid squares within the scheme area is provided in **Table 10.5.3**. Relevant 10km grid squares for the scheme area include H32, H41 and H42. No Devil's-bit scabious *Succisa pratensis* was recorded in the habitats along the route of the canal. This is the larval foodplant of Marsh Fritillary butterfly. No Marsh Fritillary surveys were undertaken on this basis.

Terrestrial Beetle Survey

This section should be read with **Figure 10.5.12** and **10.5.13**, which indicates sampling locations. The commissioned report is presented in **Appendix D**, which provide full species lists for each sampling location. Notable beetle species recorded at each sampling location are summarised in **Table 10.5.4**.

Notable Beetle Species Accounts

***Eutheia scydmaenoides* - a scydmaenid beetle**

A tiny (1-2 mm) species which lives in patch habitats such as grass heaps, silage and manure. There are no previous Irish records. Due to the ephemeral nature of the habitat type in which it was found (old silage bales) the conservation significance of the find would appear to be small. Hyman & Parsons (1994) list the species as being found in sedge litter in lakes and fens, as well as in patch habitats. The species may therefore in fact occupy more natural habitats in the area. Due to its the species relative obscurity and small size it has probably been overlooked in Ireland until now.

***Atheta paracrassicornis* - a rove beetle**

Reported in the Ireland for the first time in 2011 (Anderson & Foster, *In Press*). Two Northern Irish sites are known, both in Co. Fermanagh: Inishfendra on the Crom Estate; and Florence Court (Anderson, 2010). This is a Red Data Book species. Although members of the group to which it belongs are primarily associated with decaying fungi, this species is less closely tied to that habitat. The Inishfendra record was for a flight intercept trap in lakeshore vegetation and the Florence Court record for decaying fungi in grassland. The species was recorded at this site within marginal riverine fen below Gortnacarrow.

It is likely that the species prefers riverine fen habitat and only occasionally forages farther afield, for example to decaying fungi or other patch habitats in the vicinity.

***Tachyporus pallidus* - a rove beetle**

Fairly widespread throughout local fen habitats. Found at this site within riverine fen below Gortnacarrow and on the River Finn above Munnilly Bridge. The area of suitable habitat for the species is shrinking through reclamation and drainage so the species is likely to decline in coming decades.

***Stenus palustris* - a rove beetle**

First reported in Ireland by Good (1989) who found a colony at Finlough, County Offaly. Since then it appears to have spread rapidly and is now recorded commonly across much of Ireland. It occupies fenny streambanks, marshes, interdrumlin fens and lakeshore. In Britain it is considerably rarer and confined to southern parts of England and Wales but only really common in the Norfolk Broads. The designation 'Nb' therefore only applies to its range in Britain and is not considered to be under any threat in Ireland.

***Atheta basicornis* - a rove beetle**

Associated with willow in flood plain marshes and fens, but generally widespread in Northern Ireland. There have been seven records since 2006 (CEDaR database) and is not considered to be under any immediate threat. The species is usually encountered under bark on dead willows and was found at the site within a dead willow in the bed of the old canal above Munnilly.

***Stenus palustris* - a rove beetle**

Recorded within discarded grass at the margins of a harvested silage field and is most likely to be present within the well vegetated margins along the River Finn.

***Tachyporus pallidus* - a rove beetle**

Also recorded within discarded grass at the margins of a harvested silage field and is also likely to be present within well vegetated margins along the River Finn.

Summary Site Assessment

The River Finn between Gortnacarrow and Wattle Bridge has an aquatic invertebrate fauna deemed typical for this part of County Fermanagh. The clarity of the water column achieved during the height of the zebra mussel invasion has now receded and the water is again opaque with macrophytes and large beds of thread algae and blue-green algae. The algal growth resulting primarily from the effects of phosphorus fertiliser runoff, which favours primitive plants over macrophytes and reduces both the clarity and oxygen content of water.

Eutrophication levels have not yet fundamentally affected aquatic life in this part although some of the more sensitive water margin beetles appear to be declining. The rare reed beetle *Donacia aquatica* has not been seen in its Crom Estate habitat since 1993. The donaciine beetles are sensitive to both disturbance and eutrophication and while still common in parts of Upper Lough Erne, were not seen at all during this survey. Preferred habitats such as extensive *Carex* beds in the river floodplain and

marginal beds of flowering *Sparganium* and *Schoenoplectus*, were in short supply. Grazing regimes in the areas visited seemed to be intensive.

Additional Invertebrate Species Accounts

A number of additional invertebrate species were recorded during the terrestrial beetle survey and Habitat Surveys (Table 10.5.5) including:

***Anisus vortex* - a ramshorn snail**

A species generally found in rich, slow-moving water of rivers and lakes. Common in the Lough Erne System but apparently declining in Ireland and is therefore registered as an Irish Red-list species (Byrne *et al.*, 2009). Its category is Vulnerable (VU) however this is of limited significance within Northern Ireland. The species was identified in the Wattle Bridge section of the proposed scheme area.

***Cochlodina laminata* - plaited door snail**

A large door snail associated with areas of ancient woodland in Ireland. It is widespread in County Fermanagh including the border area around Rosslea, but considered vulnerable. The Clonoony site where the species was observed constitutes a small extension of range. The habitat in which it was recorded here is atypical, being wet scrub along the route of the old Ulster Canal, instead of mature close canopy woodland. It occurs in similar sites near Rosslea and is possibly more adaptable than usual in the wet climate of this area.

***Notaris scirpi* - a weevil**

Very local in rich fenny vegetation by rivers and lakes. There are ten previous records for Northern Ireland, mainly in riparian habitats on Upper Lough Erne. Above Munnilly Bridge a single specimen was found in discarded grass at the margins of a harvested silage field. The species has also been recorded in the nearby Crom Estate.

***Anodonta anatine* - duck mussel**

Numbers of this species have declined severely since the appearance of the invasive zebra mussel in this area and more generally across Ireland. Settlement of the zebra mussels on duck mussel shells has reduced water flow and oxygen levels and killed large numbers. It is considered vulnerable. A large number of empty valves were found on the margins of the River Finn at H4895 2453. These probably date from the height of the zebra mussel invasion. No live animals could be found at this point on the River, only discarded shells.

Table 10.5.3: Priority Invertebrate fauna recorded in existing databases

Common Name	Scientific Name	Protected NI ¹	Priority NI ²	Protected ROI ³	Red-list ¹ ROI	IUCN Category	Present in 10km Square within scheme (NI)	Present in 10km Square within scheme (ROI)	Grid Squares
A ground beetle	<i>Lebia cruximinator</i>		√				√	√	H32
A ground beetle	<i>Pterostichus aterrimus</i>		√				√	√	H42
Brimstone	<i>Gonepteryx rhamni</i>	√					√	√	H32
Copper Diver	<i>Illybius chalconatus</i>				√	VU	√	√	H32
Hot-necked Scavenger Beetle	<i>Hydrochorus ignicollis</i>				√	NT	√	√	H42
Marsh Fritillary	<i>Euphydryas aurina</i>	√	√						H32
Mr. Scales' Beetle	<i>Hydroporus scalesianus</i>				√	NT	√	√	H41, H42
Reed Beetle	<i>Donacia aquatica</i>		√		√	VU	√	√	H32
Shady Whirligig	<i>Gyrinus natator</i>				√	NT	√	√	H32
Key to Table 10.5.3 ¹ Protected at all times, and subject to special penalties under The Wildlife Order ² Priority species are those identified by Northern Ireland Biodiversity Group (1998) as under threat and requiring conservation ³ Protected at all times, and subject to special penalties under The Wildlife Act ⁴ Red-listed Waterbeetle of Ireland (Foster <i>et al.</i> , 2009)									

Table 10.5.4: Notable beetle species recorded within the scheme area

Site Name & Description	Notable Species & Conservation Status*
<u>River Finn at Wattle Bridge & adjacent potential spoil deposition sites</u> This area for proposed spoil deposition comprised three fields on the south side of the River Finn and one to the north. Potential spoil Area 1 by Wattle Bridge was characterised by semi-improved pasture with moderately rich hedgerows and some fallen dead wood which was examined carefully. Potential spoil Area 2 across the road from the former, comprised a large intensive silage field with adjacent farmyard and moderately rich hedgerow habitat. Spoiled silage bales in the yard were examined as examples of local 'patch' habitat. Potential spoil Area 3 towards Gortnacarrow, was semi-intensive pasture with rich hedgerow habitat. The River Erne in the vicinity of Potential spoil Area 3 was also sampled but had only a narrow strip of tall fen vegetation.	<i>Eutheia scydmaenoides</i> - a scydmaenid beetle (Nb)
<u>River Erne at Gortnacarrow</u> The River Finn was sampled at H4345 2056 along with a patch habitat (H4345 2050) adjacent to a road, where grass cuttings had been deposited. A fenny ditch and wet area further upstream at H4337 2066 was also examined.	<i>Atheta paracrassicornis</i> - a rove beetle (pRDBK) <i>Tachyporus pallidus</i> - a rove beetle <i>Stenus palustris</i> - a rove beetle (Nb)
<u>Clonoony</u>	

Site Name & Description	Notable Species & Conservation Status*
The route of the old Ulster Canal, now defunct and infilled in places runs along here at H43962081. Small pools and fallen dead willow were examined and the area was surveyed using with sweep and water nets.	
<u>Munnilly Bridge to Clonfad and River Finn</u> This sample site comprised a mesotrophic lowland stream with dense marginal vegetation (River Finn, H48802438 and H48952453), extensively grazed wet grassland and fen vegetation, and areas of semi-intensive grazing and intensive silage grass along the River Finn. The main habitats of interest were the fenny margins of the Finn and wet grassland and scrub along the line of the old Ulster Canal. Cut grass lying around the margins of a large silage field (H48852440) was also productive and indicative of invertebrate populations in the vicinity. A moulded grass pile at H48492442 was also examined as an exemplar of a 'patch' habitat.	<i>Atheta basicornis</i> - a rove beetle (Nb) <i>Stenus palustris</i> - rove beetle (Nb) <i>Tachyporus pallidus</i> - a rove beetle (Nb)
<u>Key to Table 10.5.4</u> *Conservation Status: pRDBK – proposed Red Data Book Species; Nb - Notable; VU - Vulnerable	

Table 10.5.5: Invertebrates Recorded in Scheme Area during Extended Phase 1 and Phase 2 Habitat Surveys

Common Name	Scientific Name	Order	Protection	Status ¹
Common Green Grasshopper	<i>Omocestus viridulus</i> .	Orthoptera (Grasshoppers & Crickets)	-	-
Green-veined White	<i>Pieris napi</i>	Lepidoptera (Butterfly)	-	Stable
Large White	<i>Pieris brassicae</i>	Lepidoptera (Butterfly)	-	Decreasing
Meadow Brown	<i>Maniola jurtina</i>	Lepidoptera (Butterfly)	-	Increasing
Painted Lady	<i>Vanessa cardui</i>	Lepidoptera (Butterfly)	-	Increasing
Red Darter sp. (Unidentified)	<i>Sympetrum sp.</i>	Odonata (Dragonfly)	-	-
Small Copper	<i>Lycaena phlaeas</i>	Lepidoptera (Butterfly)	-	Stable
Small tortoise shell	<i>Aglaia urticae</i> ,	Lepidoptera (Butterfly)	-	Stable
Small White	<i>Pieris rapae</i>	Lepidoptera (Butterfly)	-	Stable
Speckled Wood	<i>Pararge Aegeria</i>	Lepidoptera (Butterfly)	-	Increasing
<u>Key to Table 10.5.5</u> ¹ Trends from Fox <i>et al.</i> , 2006				

10.5.2 Impact Assessment

Potential impacts on local terrestrial fauna are summarised in **Table 10.5.6**. Potential impacts to species where they relate to the conservation status of a designated site have already been considered in **Section 10.2** and are not repeated here.

Badger

Construction

Loss of an active outlier sett

The active outlier sett is located directly within the proposed scheme area and will require closure under licence from both NIEA and NPWS prior to the commencement of construction activities. No main sett was located within 100m of the scheme area. The badger is protected under the Wildlife Order (NI) and the Wildlife Acts (ROI). This impact is likely to be moderate adverse without mitigation.

Loss of foraging habitat

The loss of semi-neutral and improved grasslands within the scheme area is unlikely to result in a significant impact to badgers. This is due to the extensive nature of these habitats and therefore potential foraging habitat outside the scheme area.

Fragmentation of foraging habitat and local badger populations

During construction, the new canal will act as a barrier to movement to local badger populations between suitable foraging habitats and possible existing setts in the wider area. Signs of badger activity were restricted to grasslands adjacent to the outlier sett suggesting a paucity of badgers in the wider scheme area. This impact is likely to be slight adverse without mitigation.

Potential pollution impacts

Potential pollution impacts exist during the construction phase as a result of pollution events within the terrestrial portion of the scheme area. The leakage of fuels or hazardous materials from construction plant may result in direct badger fatalities if substances are ingested or result in indirect impacts due to decreased habitat quality. This potentially large adverse impact is however unlikely without mitigation.

Potential injury or death from excavations

Under the Ulster Canal's Environmental Management Plan (**Appendix A**), and Construction Management Plan (**Section 6**), fencing will be used to secure the site during the construction phase, preventing access to excavations and creating a risk of badger death or injury. This potentially large adverse impact is reduced to a non-significant level with this mitigation.

Operation

Potential disturbance impacts from increased pedestrian activity

As a nocturnal mammal, disturbance of foraging badgers is unlikely to be significant due to increased pedestrian activity on proposed towpaths. Pedestrian activity along towpaths at night is expected to be minimal. Public access into agricultural grasslands adjacent to the scheme area will be restricted by

permanent fencing of Waterways Ireland property. Hedgerow planting is also proposed along sections of the scheme boundary, which will enhance screening effects. This residual impact will be negligible.

Fragmentation of foraging habitat and local badger populations

Once operational the new waterway will hinder north-south movements of badgers. As discussed signs of badger activity were restricted to grasslands adjacent to the outlier sett, suggesting a scarceness of badgers in the wider scheme area. This impact is likely to be slight adverse without mitigation.

Otter

Potential impacts to otter are described in **section 10.2.2.1**.

Bats

Construction

Loss of roosts

There is unlikely to be significant loss of roosts within the proposed scheme area. The removal of mature trees is expected to be minimal with specimens retained where possible. Buildings to be removed along the route of the Canal include stables at Munnilly and sheds behind the Lock House at Gortnacarrow. A bridge at Drumsloe Lough is also scheduled for removal and similarly did not indicate a high roost potential. The surviving bridges will be restored with mitigation measures included for bats. Bridges may offer short-term roost opportunities for individual bats or very low numbers of bats.

Loss of feeding

There will be a reduction in land mass available to bats and their prey items (invertebrates) due to the construction of the Canal as well as the removal of trees as noted above. However, in contrast to this, there will be a return of aquatic habitat that will be available to bats within the Operational Phase.

In the case of brown long-eared bats, the noise from boat traffic may reduce the ability of the bat to locate prey using audible sound, as the background hum of traffic may exceed the noise generated by insect prey. Most boat movement is anticipated to be in the daytime.

Finally, new mooring facilities at Clones and the locks at Gortnacarrow will introduce lighting into areas that have previously been dark. This may deter feeding by some species of bat.

Loss of cover

Removal of trees and shrubs reduces the cover sought by bats to move about with reduced visibility to birds of prey. Bats fly along hedgerow both to feed on the insects and other invertebrates sheltering and to avail of the cover to avoid predators such as barn owls or long-eared owls. Removal of cover lessens the protection given by hedgerow to feeding or commuting bats.

Potential interference with commuting routes, feeding and severance

The introduction of a Canal to a formerly agricultural site (with overgrown canal elements in sections) involves the removal of trees, shrubs and scrub. These are feeding sites and commuting route for bats in many sites.

Potential deterioration in air quality

Construction traffic and the removal of vegetation may lead to a localised deterioration of air quality with possible effects on insect and other invertebrate abundance and distribution, which in turn may affect bats. This impact is possibly negligible but the polluting effect of such heavy plant is a feature of such major operations.

Potential injury or death during clearance or site investigations

Bats enter a deep state of inertia referred to as torpor on a daily basis and hibernation on a more sustained basis in winter. During such times, they are incapable of speedy response to a negative stimulus or life-threatening situation. Hence, tree felling or building demolition may lead to bat deaths because the bats are incapable of fleeing. This is predicted to be associated with the level of tree clearance and building demolition. Retention of mature trees where feasible avoid the potential for bat injury or death during construction.

Operational

Potential loss of feeding

There will be a reduction in mature vegetation along the route due to essential clearance procedures. This will be so over a period of years until any replacement vegetation has established.

Potential interference with commuting routes, feeding and severance

Lighting at the proposed mooring facilities at Clones and Gortnacarrow may prevent bats passing along foraging route and will possibly prevent roosting in close proximity.

Potential interference by traffic noise with bat social calls and passive feeding

Bats use calls within the upper range of audible sound as well as ultrasound for social interaction. In addition to this, species such as the brown long-eared bat avail of audible sound to locate prey.

The increase in noise levels from traffic decreases the availability of audible sound to bats and may affect the ability to establish mating roosts and feed passively on invertebrate prey.

In the case of brown long-eared bats, the noise from boat traffic may reduce the ability of the bat to locate prey using audible sound, as the background hum of traffic may/ will exceed the noise generated by insect prey. Most boat movement will be in the daytime. This effect is not considered to be significant.

Potential deterioration in air quality

Boat traffic may lead to a localised deterioration of air quality with possible effects on insect and other invertebrate abundance and distribution, which in turn may affect bats. This impact of this is likely to be immeasurable and possibly negligible.

Irish Hare

Irish hare was recorded in grassland habitats within the scheme area. However, no evidence of breeding within the scheme area was recorded. Only a small number of individuals were recorded during visits by ecologists to the scheme area and there is extensive suitable grassland habitat outside the scheme area.

Construction

Loss of potential foraging habitat

The loss of semi-neutral and improved grasslands within the scheme area is unlikely to be of significant impact to hares given the extensive nature of potential foraging habitats outside the scheme area.

Disturbance due to construction activity

Noise and increased human activity along the proposed development route may displace foraging or potentially breeding hares. This disturbance will however be temporary and the impact will be negligible.

Fragmentation of foraging habitat/local hare populations

The new canal will act as a barrier to movement to local hare populations between suitable foraging habitats. Sightings of hares were however rare along the proposed development route. This adverse impact is likely to be negligible adverse without mitigation.

Pollution Impacts

Potential pollution impacts exist during the construction phase as a result of pollution events within the terrestrial portion of the scheme. The leakage of fuels or hazardous materials from plant construction may result in direct hare fatalities if substances are ingested or result in indirect impacts due to decreased habitat quality. This potentially large adverse impact is unlikely.

Injury or death from excavations

Under the Ulster Canals EMP (Appendix A) and CMP fencing will secure the site during construction activity preventing access to excavations and creating a risk of death or injury. This potentially large adverse impact is therefore unlikely.

Operation

Disturbance from increased pedestrian and recreation activity

Increased human activity along proposed towpaths may displace hares due to disturbance from grasslands adjacent to the development over a more long-term period. Public access to adjacent agricultural land will be restricted by permanent fencing of WWI property. Additional hedgerow planting

is also proposed along sections of the development route and will enhance screening effects. This residual impact will be negligible.

Smooth Newt

Without mitigation, construction of the scheme is highly likely to result in the loss of a local population or part of a local population of smooth newts. A major negative impact upon a high value ecological feature will result in a very large adverse impact appraisal rating. This is likely to be considered an unacceptable environmental impact. Mitigation is proposed to safely collect newts prior to construction and translocate them to suitable habitat occurring within the landtake.

Invertebrates

The more important habitats in the area of the proposed development for beetles are the river and stream margins. The River Erne at Gortnacarrow and Wattle Bridge has an aquatic invertebrate fauna deemed typical for this part of Co. Fermanagh. The clarity of the water column achieved during the height of the zebra mussel invasion has now receded and the water is again opaque with macrophytes battling for space with large beds of thread algae and blue-green algae. The algal growth results primarily from the phosphorus component of fertiliser runoff which favours primitive plants over macrophytes and reduces both the clarity and oxygen content of water.

The climbing eutrophication levels has not yet fundamentally affected aquatic life although some of the more sensitive water margin beetles appear to be declining. The rare reed beetle *Donacia aquatica* has not been seen in its Crom Estate habitat since 1993. The *Donaciine* beetles are sensitive to both disturbance and eutrophication and while still common in parts of Upper Lough Erne, were not seen at all during the present survey. The habitats which they prefer were in short supply, notably extensive *Carex* beds in the river floodplain and marginal beds of flowering *Sparganium* and *Schoenoplectus*. Grazing regimes in the areas visited seemed intensive.

Those notable beetle species found in the area were all small, seemed fairly adaptable in a range of habitats within riparian vegetation zones, but were mostly recorded in alternative ‘patch’ habitats: *Eutheia scydmaenoides* [farmyard at Wattle Bridge]; *Atheta paracrassicornis* [riverine fen below Gortnacarrow]; *Stenus palustris* [silage field at Munnilly, river margins at Gortnacarrow]; *Tachyporus pallidus* [silage field at Munnilly, river margins at Gortnacarrow]; *Notaris scirpi* [silage field at Munnilly]. It is, however, unlikely that any of these will suffer from the canal works as they are widespread in Upper Lough Erne and should re-colonise modified habitats within a short time. Impacts due to habitat loss will therefore be temporary. No significant effects at a population level are predicted.

Table 10.5.6: Summary impacts on fauna

Potential Impact	Nature	Magnitude	Ecological Value	Impact Significance	Potential Impact Type	Phase of Occurrence	Duration	Direct/ Indirect	Likelihood of Occurrence	Mitigation Proposed	Significance of Residual Impact
Loss of outlier Badger Sett	-ve	Intermediate	High	Large Adverse	Disturbance & Habitat Loss	Construction	Permanent	Direct	Certain	Yes	NS
Loss of potential badger foraging habitat	-ve	Minor	High	Slight Adverse	Habitat Loss	Construction	Long-term	Direct	Certain	No	NS
Loss of potential Irish hare breeding / foraging habitat	-ve	Intermediate	High	Large Adverse	Habitat Loss	Construction	Long-term	Direct	Certain	No	NS
Loss of bat roost	-ve	Major	Very high	Very large adverse	Loss of shelter	Construction	Temporary	Direct	Unlikely	Yes	NS
Disruption to bat foraging	-ve	Intermediate	Very high	large adverse	Habitat loss	Construction	Short-term	Direct	Likely	Yes	NS
Loss of whole or partial newt population	-ve	Major	High	Very Large Adverse	Mortality; habitat loss	Construction	Permanent	Direct	Likely	Yes	NS
Loss or disturbance to invertebrate populations	-ve	minor	Medium	Slight adverse	Habitat loss, pollution, deterioration in habitat quality	Construction	Temporary	Direct /Indirect	Likely	Yes	NS

NS = Non-significant

10.5.3 Mitigation

Badger and Otter

As noted previously, an active outlier sett is located directly within the proposed scheme area and will require closure under licence from both NIEA and NPWS prior to the commencement of construction activities. No main sett was located within 100m of the scheme area.

As part of the derogation license application process with NIEA and NPWS and prior to construction, an updated mammal survey will be undertaken to establish the latest baseline with respect to the status of this sett and to ascertain if other setts have been excavated within the scheme landtake since EIA survey.

It has been noted previously that the operational canal may bring otters using the River Finn corridor closer to the A3/N54 at the A3 road bridge at Gortnacarrow, and from Clonnagore eastwards towards the proposed marina at Clones. For the protection of badger and otter using the canal corridor, mammal fencing shall be erected at the scheme boundary along the A3 road for distance of 50m on both sides of the carriageway.

A number of watercourses cross the site. These watercourses will be collected and directed under the canal in culverts. All new culverts require adaptation for mammals, and shall be no smaller than 600mm diameter.

Mammal mitigation will follow the Guidelines for the Treatment of Badgers Prior to the Construction of a National Road Scheme (NRA 2005) and Guidelines for the Treatment of Otters during the Construction of National Road Schemes (NRA 2007) across the scheme.

Bats

Construction

Vegetation Clearance

Any trees identified to have good to high potential for bats must be examined for the presence of bats prior to felling. These occur at a small number of sites including Edergool and west of Clones and are indicated in **Figure 10.5**. The inspection methodology to be used will be dependent upon the timing of felling. If mature trees are due to be felled in August through to October, it would be possible to check for bat presence by means of a bat detector assessment. Only trees within a given area can be fully assessed on any one night by one person and it would require one person per site if all trees were to be felled at once in the areas identified earlier.

Trees must be felled upon the day following a night time assessment if they are noted to be unoccupied by bats. An evaluation of a tree as possessing no roosting bats is only valid for a given date (i.e. the day of assessment) unless there are no roost sites available upon or within the tree.

It is preferable that tree felling be carried out prior to the period of hibernation and subsequent to the breeding period and bird nesting period. This would earmark the end of late August, September and October as the best period within which to fell trees. Trees may also be examined from a height using a hoist, teleporter with basket or through rope access.

Where bats are noted to be within a tree prior to felling operations, it will be necessary to postpone felling to create the opportunity for bats to cease usage. If bats do not leave a tree or building within a reasonable time frame (where the Canal schedule is facing a measurable disruption), it may be possible for a bat specialist to seek to exclude the bats (or otherwise remove them to safety).

This must be carried out by a qualified bat specialist with written permission from NPWS or NIEA, by way of a licence to derogate from the protection afforded to bats by Northern Irish, Irish and EU law. All licences should be in place prior to felling procedures.

Building demolition

Any of the buildings within the land take to be demolished must be checked for bats prior to demolition. If bats are found to be present a derogation licence must be sought from NPWS or NIEA. This will require a specific proposal for mitigation to protect the bat fauna found to be present.

Bridge Demolition or Repair

All masonry arch bridges should be considered to have roost potential and must be examined prior to any operation that might affect bats including demolition or re-pointing and renovation. Any associated stone walls or structures must also be checked in advance of demolition.

Lighting Control

Lighting at proposed mooring facilities at Clones and Gortnacarrow must be kept to a minimum.

Planting

Any lands that are purchased due to their non-viability due to severance should serve as a site for the replacement of removed trees and hedgerow and the provision of feeding areas for bats. The loss of an area of scrub may affect feeding bats but this has not been examined fully to date. The planting of ash and oak at these locations would provide future feeding sites for bats.

Planting should be dense enough along this stretch to provide feeding and commuting corridors for brown long-eared bats (and Natterer's bats etc.) and to connect to the over bridges in this area. The use of native plants along any areas of the Canal that will be subject to planting will increase their value to native invertebrates, birds and mammals. Trees such as ash and oak would be of benefit in the long-term. Shrubbery and native scrub are also advantageous.

All trees and shrubs must be properly maintained to prevent drought, root damage or other problems that may lead to poor growth or death. These plants shall be examined to ensure that they are viable after a period of establishment.

Bat boxes

18 bat boxes of mixed designs including the Schwegler 2FN and Schwegler 2F designs, should be erected on retained mature trees to provide roost sites along the Canal route. The location for the bat boxes will be earmarked following pre-construction surveys.

Operation**Lighting Control**

There will be minimal lighting at the proposed mooring facilities at Clones and Gortnacarrow. Boat users must be discouraged from installing and using excessive lighting or decorative lighting whilst moored at these facilities and outside of these areas.

Monitoring

All planting or other mitigation for bats including the placement of bat boxes must be assessed by a bat specialist to ensure that all proper mitigation measures have been put in place.

Residual Impacts

There will be no long-term negative impact from the Canal proposal with appropriate implementation of the proposed measures including roost replacement if necessary. Overall, there is the potential for a moderate positive impact with planting and lighting control.

Smooth Newts

An “Ulster Canal: Smooth Newt Mitigation Plan” will be produced based on consultation between Waterways Ireland, NPWS and NIEA to ensure that appropriate mitigation measures are put in place to minimise the impact of the development on smooth newts. This will also ensure compliance with relevant wildlife legislation, namely the Wildlife Order (NI) and Wildlife Act (Ireland).

The plan will be prepared and approved prior to the commencement of any construction works including advance enabling contracts, dredging, excavations or any site preparation work. The Plan will include the following:

- Smooth Newt distribution within the proposed scheme area;
- Sensitive Waterbodies;
- Creation of new Habitat;
- Translocation;
- Monitoring.

Invertebrates

The most sensitive native habitats for terrestrial beetles identified during survey were found along the floodplain of the River Finn, to the north of Munilly and between Gortnacarrow and Wattle Bridge. Where possible the riparian habitats in these areas should be protected from ongoing operations and bankside vegetation should be left in a natural state. Any sediment runoff during canal excavation should be collected and all spoil from excavated areas should be removed to designated depositories.

Field drainage should not be undertaken in the floodplains of the Erne and Finn as part of any management of the scheme and bankside vegetation should be left in a natural state wherever possible. These measures will be implemented through the detailed Construction Management Plan and the Environmental Management Plan for the scheme.

11 LANDSCAPE AND VISUAL

11.1 INTRODUCTION

This section of the EIS assesses the landscape and visual impacts associated with the construction and operation of the proposed restoration and reopening of the Upper Lough Erne to Clones section of the Ulster Canal. The assessment begins with a description of the existing landscape setting and visual resources to establish baseline conditions. The proposed scheme is then applied to the baseline and the impacts of the scheme upon the existing landscape setting and visual resources are then predicted. Mitigation measures are then recommended for any significant landscape and visual impacts arising as a result of the proposed scheme.

11.2 METHODOLOGY

11.2.1 General Approach

The landscape and visual assessment methods are derived from the *Guidelines for Landscape and Visual Impact Assessment* (The Landscape Institute and Institute of Environmental Management & Assessment, 2002) and the DOE and Local Government *Landscape and Landscape Assessment Guidelines* (June 2000). The landscape has been appraised to allow it to be described and classified into landscape character areas that in turn enable the categorisation of landscape quality. The capacity of a landscape to accept change of the type proposed is assessed. The key landscape components are landform, vegetation and historical and cultural components. Landform relates to topography, drainage characteristics and geology. Historical and cultural components include historic landscapes, protected structures, conservation areas and historic designed landscapes. Vegetation plays an important role in how the landscape and visual resources of an area are viewed and is an integral component of a landscape character.

Assessment was undertaken through analysis of up to date digital copies of OSI Discovery Series raster and OSI vector maps and aerial photography, in conjunction with detailed drawings of the proposed Ulster Canal scheme. Site visits were undertaken during winter 2010 to assess the existing environment and the landscape and visual impacts associated with the proposed scheme.

Existing visual resources are established along with sensitive receptors, i.e. residential properties, scenic viewpoints and visitor amenity areas.

The proposed scheme is then applied to this landscape and visual baseline and potential impacts predicted.

Where significant impacts are predicted landscape mitigation measures are recommended.

11.2.2 Landscape Assessment Methodology

Landscape Assessment Definitions

The following text describes the key criteria and terminology used in the landscape assessment.

Landscape Resource

The combination of elements that contribute to landscape context, character and value.

Landscape Value

The relative value or importance attached to a landscape that expresses national, regional or local consensus because of intrinsic characteristics.

Landscape Character

The distinct and homogenous pattern that occurs in the landscape reflecting geology, landform, soils, vegetation and mans impact.

Landscape Quality

The assessment of the landscape quality assesses the value of the landscape in relation to its rarity, location and landscape character attributes. In general, the higher the quality of landscape the more sensitive it will be to change.

Based on information gathered as part of the classification of the landscape, it is possible to assess the landscape quality of the study area using the methodology described in the DMRB. This has been completed using a 5-point scale as follows:

- a) Highest quality - the landscapes of highest quality are, by definition, landscapes of an 'awe inspiring' or 'sublime' nature and are important on an international and national level.
- b) Very attractive - this definition relates to landscapes which are still of high value nationally and can be defined as highly scenic.
- c) Good landscape - this category contains areas that, although still attractive, have less significant and more common landscape features.
- d) Ordinary landscape - this category contains areas that have only common landscape features and some intrusive elements such as conspicuous infrastructure with scope for improvement in management.
- e) Poor landscape – this category includes areas that contain frequent detracting aspects and/or lack of management results in a degraded landscape with very few valued features.

Landscape sensitivity is used to establish the capacity of the landscape to accommodate the type of development proposed and is defined as follows:

High Highest/Very Attractive landscape quality with highly valued or unique characteristics susceptible to relatively small changes;

- Medium** Good landscape quality with moderately valued characteristics reasonably tolerant of changes;
- Low** Ordinary/Poor landscape quality with common characteristics capable of absorbing substantial change.

Magnitude of Landscape Resource Change: Direct resource changes on the landscape character of the study area are brought about by the introduction of the proposal and its effects on the key landscape characteristics. The following categories and criteria have been used:

Category	Criteria
High	Total loss or alteration to key elements of the landscape character, which result in fundamental and / or permanent long-term change.
Medium	Partial or noticeable loss of elements of the landscape character and / or medium-term change.
Low	Minor alteration to elements of the landscape character and / or short-term/ temporary change.

Significance of Landscape Impact: The level of significance of impact on landscape character is a product of landscape sensitivity and the magnitude of change in landscape resource as indicated in the **Table 11.1**.

Table 11.1 Significance of Landscape Impact

Magnitude of landscape resource change	Landscape Sensitivity		
	Low	Medium	High
No change	No change	No change	No change
Low	Slight	Slight / moderate	Moderate
Medium	Slight / moderate	Moderate	Moderate / substantial
High	Moderate	Moderate / substantial	Substantial

11.2.3 Visual Assessment Methodology

Visual Assessment Criteria and Terminology

The following text describes the key criteria and terminology used in the visual assessment.

Visual Amenity

Visual amenity is the value of a particular area or view in terms of what is seen by the viewer. This value may be influenced by the physical condition of the landscape viewed and the contribution the characteristics of the view make to the local environment.

Visual Resources

Visual resources are the overall key elements/features/characteristics that combine to make a view.

Viewer Sensitivity

Viewer sensitivity is a combination of the sensitivity of the human receptor (ie resident; commuter; tourist; walker; recreationist; or worker) and the quality of view experienced by the viewer.

Category	Typical criteria
High sensitivity	eg users of an outdoor recreation feature which focuses on the landscape; valued views enjoyed by the community; tourist visitors to scenic viewpoint; occupiers of residential properties with a high level of visual amenity.
Medium sensitivity	eg users of outdoor sport or recreation which does not offer or focus attention on landscape; occupiers of residential properties with a medium level of visual amenity.
Low sensitivity	eg regular commuters, people at place of work; occupiers of residential properties with a low level of visual amenity.

Magnitude of Visual Resource Change: the magnitude of change in visual resource or amenity results from the scale of change in the view with respect to the loss or addition of features in the view and changes in the view composition, including proportion of the view occupied by the proposed development. Distance and duration of view must be considered. Other infrastructure features in the landscape and the backdrop to the development will all influence resource change.

Category	Criteria
High	Total loss or alteration to key elements/ features/ characteristics of the existing landscape or view and/or introduction of elements considered totally uncharacteristic when set within the attributes of the receiving landscape or view.
Medium	Partial loss or alteration to key elements/ features/ characteristics of the existing landscape or view and/or introduction of elements that may be prominent but not necessarily substantially uncharacteristic when set within the attributes of the receiving landscape/view.
Low	Minor loss or alteration to key elements/ features/ characteristics of the existing landscape or view and/or introduction of elements that may not be uncharacteristic when set within the attributes of the receiving landscape/view.

No change	Very minor loss or alteration to key elements/ features/ characteristics of the existing landscape or view and/or introduction of elements that are not be uncharacteristic when set within the attributes of the receiving landscape/view.
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Significance of Visual Impact: Significance of visual impact can only be defined on a project by project basis responding to the type of development proposed and its location. The principal criteria for determining significance are magnitude of visual resource change and viewer sensitivity.

Table 11.2 illustrates significance of visual impact as a correlation between viewer sensitivity and magnitude of visual resource change.

Table 11.2 Significance of Visual Impact

Magnitude of visual resource change	Visual Sensitivity		
	Low	Medium	High
No change	No change	No change	No change
Low	Slight	Slight / moderate	Moderate
Medium	Slight / moderate	Moderate	Moderate / substantial
High	Moderate	Moderate / substantial	Substantial

Zone of Visual Influence (ZVI)

The visual assessment is assisted by the production of a ZVI. The ZVI is the area within which views of the proposed scheme and associated works during construction and operation can be obtained. The extent of the ZVI is determined primarily by the topography of the area.

The ZVI is then refined by field studies to indicate where relevant buildings, woodlands, hedges or other local features obscure visibility from the main roads, local viewpoints/landmarks and settlement etc and it is through such field studies that prediction of visual impacts take place. The ZVI for the proposed scheme is illustrated in **Appendix E Figure 11.1**.

11.3 EXISTING ENVIRONMENT

11.3.1 General Overview

The proposed route of the reopened section of the Ulster Canal lies between Lough Erne and Clones predominantly crossing Counties Fermanagh and Monaghan with a small section within County Cavan. The Ulster Canal is an existing non-prominent feature within the local environs most noticeable where local roads cross the canal and at Clones where the canal runs near the N54/A3 road. The

River Finn flows southwest through an enclosed landscape of drumlins that interlock to restrict views out. Numerous small loughs and poorly drained fields are located either side of the Finn and between drumlins. Housing avoids the poorly drained low lying fields and is located on drumlin sides and tops. The Finn flows into Upper Lough Erne where drumlins again are dominant but the low lying lands between drumlins have been drowned by water and create the distinctive Lakeland landscape that this part of Cavan and Fermanagh is renowned for. Frequent archaeological features are found on the drumlins including raths, cairns and churches. There are several historic estates located within the study area at Hilton Park near Scothouse, Castle Saunderson on the southern shore of the River Finn and further west in Upper Lough Erne at Crom Castle. Clones is the largest settlement in the area and dates back to the 6th Century and the site of a monastic settlement (associated with St Tiernach). The town centre sits on a drumlin top at the junction of the N54 and R189 roads commanding east west and north south routes. Landmark spires in Clones town centre are intermittently visible from the surrounding landscape.

The distinctiveness of the landscapes in the study area can be sub-divided into three landscape character areas (**Appendix E Figure 11.2 Landscape Character Areas**) as follows:

- Undulating Drumlin Agricultural Landscape
- Urban Landscape
- Upper Lough Erne Drumlin Landscape

11.3.2 Landscape Character

Undulating Drumlin Agricultural landscape

This landscape character area is a typical feature of the area between Clones and Upper Lough Erne and along the corridor of the River Finn. The Ulster Canal is located within this landscape but is non-prominent. The strong drumlin topography consists of drumlins mostly aligned on an SW-NE axis that interlock and enclose views. The low lying ground between drumlins consists predominantly of wet pasture with only occasional lough found as distinct from the Upper Lough Erne Drumlin Landscape found further west. Frequent small roads wind across the drumlins mostly avoiding the lower lying lands. Similarly there are frequent rural houses scattered across this landscape located on drumlin sides and tops. Rural houses are not very conspicuous in the landscape due to its very specific character. Field systems are generally small and fields are bounded by strong hedgerows with scattered trees that add to the sense of enclosure provided by the drumlins. Small stone bridges are frequent where roads cross the River Finn and Ulster Canal. Immediately north of Scotshouse the most extensive area of woodland is found at the 18th Century Estate at Hilton Park. The interlocking drumlins and strong hedgerows and trees readily absorb small scale development.

This landscape has been assessed as of “Good” Landscape Quality as although it contains some attractive features it also contains some intrusive elements and common landscape features. This landscape character area has a low sensitivity to change.

Urban Landscape

The main urban settlements within the study area are Clones and Scotshouse. Clones is the largest town in the area with a population of around 3,000 and it acts as market town for a wide hinterland. Located at the junction of the N54 (Monaghan to Cavan road) and R183 (Clones to Newtownbutler road) and the town has a strategic position on a drumlin top. Historically Clones is associated with the Ulster Canal and the now closed railway line. Clones consists predominantly of 2 to 3 story terraced houses of render finish and slate roofs that surround a central town square (The Diamond). The town square is dominated by the spire of the small Church of Ireland church that is also a feature in the surrounding landscape. A further church spire is also prominent off the main town square. Narrow streets extend out from the central square lined by 2 story terraced and detached houses. More recent linear development has taken place along the roads that spread from the town centre. There are also more recent housing estates located on the northern and northwestern side of the town. Scotshouse is a small village located on a cross road that is largely linear in character as development extends along roadsides with no central square. Modern development is found on the northern side of the village but the town predominantly consists of two storey terraced and detached housing of rendered finish.

This landscape has been assessed as of “Ordinary” Landscape Quality as it contains few features worthy of conservation and contains many intrusive elements. The urban landscape character has a low sensitivity to change.

Upper Lough Erne Drumlin Landscape

From Gortnacarrow Bridge the River Finn flows into Upper Lough Erne and a distinctive Lakeland landscape that consists of drumlins that are surrounded by flooded areas with rivers, lakes and loughs. Water dominates the landscape and restricts human movement across the landscape resulting in the use of the water for transport. The interlocking drumlins create an enclosed landscape. There are relatively few roads in this landscape and limited rural dwellings and where roads are found they meander around the drumlins and frequently terminate at the waters edge rather than act as through roads. Drumlins are frequently islands of various shapes and sizes. The shorelines are mostly wooded and occasional extensive woodlands are found at locations such as Castle Saunderson, Quivvy Lough, Crom Castle Estate. Apart from Belturbet to the south there are no settlements found in this landscape.

The scenic quality of Upper Lough Erne has been recognised by its designation as the proposed Erne Lakeland Area of Outstanding Beauty (AONB). This landscape has been assessed as of “Highly Attractive” Landscape Quality as it contains features worthy of conservation, is valued locally and nationally and has a high level of scenic quality. The Upper Lough Erne Drumlin Landscape Character has a high sensitivity to change.

11.3.3 Landscape Designations

A review took place of the Monaghan Development Plan 2007 – 2013, the Fermanagh Area Plan 2007 and the Cavan Development Plan 2008 – 2014 to establish any relevant landscape designations to assist in the appraisal of important landscape and visual features and landscape quality.

Monaghan Development Plan 2007 – 2013

Local Landscape Policies

The Council have not completed a Landscape Character Assessment for the County. However, Policy ENV 4 sets out policy for the protection of Local Landscape Policy Areas against detrimental developments. The nearest LLPA to the proposed scheme is located within the southwest portion of the Clones limit of development.

Areas of Primary/ Secondary /Visual Amenity Value

Areas of Primary Amenity Value are designated due to their outstanding landscape quality. Areas of Secondary Amenity Value are designated due to their landscape quality and potential for recreation. ENV 13 states that within Areas of Secondary Amenity Value all tree planting and felling will be strictly controlled to ensure minimal disturbance of landscape and the environment.

There are no Areas of Primary Amenity Value in proximity to the proposed scheme.

The nearest Area of Secondary Amenity Value covers the Ulster Canal and adjacent areas within County Monaghan (Plan Ref: Appendix 1:- SA6).

The plan has identified a number of areas that are of visual amenity importance within the County. ENV 14 protects views from scenic routes listed in Appendix 2 of the Plan. There are no scenic roads located in proximity to the proposal. The nearest scenic route is located approximately 7km south at Lough Annagh.

Protection of Trees and Hedgerows

The plan sets out a range of policies to protect trees and hedgerows from development that would adversely effect them. ENV 18 lists trees and hedgerows for protection (Appendix 3 of Plan). A review of the Plan has established that there are no trees of special amenity value located near the proposed scheme.

Cavan Development Plan 2008 – 2014

Heritage Gardens, Demesnes and Parks

The Plan recognises the value of Heritage Gardens, Demesnes and Parks within Cavan County that also contain champion trees as identified by the Tree Council of Ireland. The Plan states that it is a policy to encourage sensitive development that preserves the character of such sites. The nearest site identified to

the proposed scheme is Castle Saunderson that is stated should be preserved and valued for its educational, tourist and amenity value.

Hedgerows and Stone Walls

Hedgerows and stone walls are recognised by the Plan as important visual amenity features. It is a policy of the Plan to seek to retain hedgerows and stone walls as far as possible in rural areas.

Woodlands and Trees

Trees and woodlands are recognised by the Plan for their environmental and economic benefits. It is a policy to encourage the use of native broadleaved species in planting schemes. Tree Preservation Orders will be considered to protect important trees or groups of trees.

Areas of High Landscape Value or Special Landscape Interest

There are four Areas of High Landscape Value identified in the Plan and one Area of Special Landscape Interest. The nearest area designated is HL4 Erne-Shannon Canal Corridor. The proposal is not located near an Area of Special Landscape Interest. It is a policy to maintain the scenic and recreation value of these areas restricting all adverse uses and negative visual impacts.

Scenic Routes

There are three scenic routes identified in the Plan none of which are located in proximity to the proposed scheme. The three routes identified are all located in the west of the County.

Scenic Views and Viewing Points

There are seventeen scenic viewing points identified in the Plan. There are no locations identified in proximity to the proposed scheme. The nearest identified scenic viewing point is located approximately 3km south of the proposal at Drumgarry on the N54 road.

Fermanagh Area Plan 2007

Conservation Zones

The Plan identifies zones where the quality and character of the landscape is considered special and of such significance that no development for tourism or recreation will be permitted within the majority of their extent. Only very small scale development is likely to be acceptable depending on the location. There are four Conservation Zones identified in the Plan. The nearest zone to the proposed scheme is Zone 1 Crom. The Erne-Shannon Waterway is recognised within this zone and the Plan states that there is potential to exploit this tourism attraction through sensitively sited facilities.

Sensitive Zones

The Plan identifies five Sensitive Zones where the character of the landscape is such that whilst there is scope for development such proposals must be sensitive to the characteristics of the zone. There are no such zones located in proximity to the proposed scheme.

Trees

Policy Nat Env 4 states that the Department will promote measures which will protect and enhance the existing tree cover of Fermanagh. Landscape schemes should normally accompany planning applications. No specific trees are identified for protection in the Plan.

Local Landscape Policy Areas

Local Landscape Policy Areas (LLPA) are designated for those areas adjoining and within the development limit of towns and villages that are considered to be of greatest amenity value or local significance and worthy of protection from undesirable or damaging development. There are no LLPA located in proximity to the proposed scheme.

Important Views

The Area Plan has identified four important public views. The views are to and from the Enniskillen Castle and not in close proximity to the proposed development.

Area of Outstanding Natural Beauty (AONB)

AONB's are designated either under the Amenity Lands Act (Northern Ireland) 1965 or the Nature Conservation and Amenity Lands (Northern Ireland) Order 1985. These cover huge areas of land, embracing a range of landscape types including limestone cliffs, sweeping moorlands and important geological landforms. They also include farmland, forest, lakes, coastline, and settlement. They are generally subject to planning conditions. The proposed scheme lies within the proposed Erne Lakeland AONB.

The Ulster Way

The Ulster Way is a nationally designated Public Right of Way which was designated under the Access to the Countryside (NI) Order 1983. The Ulster Way is protected and maintained by the relevant District Council, through which it passes, and is promoted as a national walking route by the Northern Ireland Tourist Board. The proposed scheme is located at it's nearest 7km from the Ulster Way as it passes north of Newtownbutler.

Northern Ireland Landscape Assessment Series

The study area lies within the Fermanagh District covered by a research document produced by NIEA referred to as "Environmental Resources Management 1999 Northern Ireland Landscape Character Assessment, Environment and Heritage Service Research and Development Series, Nr 99/10". The documents were prepared by Environmental Resources Management (ERM) under a research

contract commissioned by NIEA and supported by Regional Planning Division and Planning Service. The documents aim to provide a broad overview of landscape character, diversity and forces for change including advice on how to address the effects of new development in the landscape. The documents are seen as a “Common Point of Reference” for statutory agencies.

Fermanagh 99/12 – The proposed scheme on the Ulster Canal is located directly within two landscape character areas namely Upper Lough Erne LCA and Newtownbultur and Rosslea Lowlands LCA.

The document states that the landscape within the Upper Lough Erne LCA has the following key characteristics:

- Complex landscape with small scale intricate pattern of land and water;
- Rolling drumlins and flooded hollows;
- Mosaic of small pastures;
- Thickly wooded shorelines and dense hedgerows and trees separating fields;
- Attractive wooded estates;
- Scattered small settlements;
- Occasional views across open water to islands.

The principles for new development in the Upper Lough Erne LCA state that the design, size and location of tourist development requires care so that it does not become visually prominent with lough shores stated as being very sensitive to development.

With regards to Newtownbultur and Rosslea Lowlands LCA the document states the following key characteristics;

- Broad widely spaced drumlins with occasional loughs and rivers;
- Mixture of farmland practices;
- Rivers in unmodified natural winding channels;
- Well wooded character;
- Small scale housing scattered throughout;
- Scattered raths and crannogs.

The principles for accommodating new development in the Newtownbultur and Rosslea Lowlands LCA states that the area can accommodate change within existing field boundaries as long as special landscape features such as the old canal are respected.

Historic Parks and Gardens

Country houses, some of which are listed buildings, set in landscaped parkland or within demesnes, are an important part of the landscape character of Northern Ireland. NIEA has identified a number of

these parks, gardens and demesnes that it considers represents a significant historic and landscape resource in its Register of Historic Parks, Gardens and Demesne. Any development that is likely to have an adverse impact on the planned layout, including views in and out of quality or character of these areas will normally be refused planning permission.

There are no registered historic park and gardens located within close proximity of the proposed site.

The nearest registered site is located approximately 7km west of the proposed scheme at Crom Castle Historic Park, Garden and Demesne.

11.4 POTENTIAL IMPACT

11.4.1 Potential Sources of Impact

The proposed scheme will result in new built elements in and alterations to the local landscape. The principal sources of impact of such a development include:

- i) Disturbance from construction and during operation
- ii) Imposition of new features in the landscape
- iii) Movement in a static landscape.

The following features have been taken into account during the prediction of impacts; the level of roads and bridges; side roads adjustments; lighting; water traffic on canal including lights; loss of trees and hedgerows.

11.4.2 Landscape Character Impact Assessment

An assessment of the significance of the impact of the proposed scheme on the landscape character of the area has been completed and summarised below.

Undulating Drumlin Agricultural Landscape

The proposed scheme crosses this landscape character between Gortnagarrow Bridge and Clones. The proposals will result in the removal/alteration of existing field boundaries and field patterns. The proposals will require the construction of new sections of canal at various locations along the length of the proposed route due to the housing development that has taken place since the canals closure as well as to meet modern infrastructural requirements. The canal will be excavated to increase the bed width and depth. Dimensions will vary along the canal. Marginal plants will be planted within the canal profile. The proposals will require new bridges to be built and existing bridges to be modified. A new marina will be constructed at Clones with access from the existing N54 road.

The canal has been a feature of this landscape since 1841. The re-opened canal will allow boats and cruisers to navigate to Clones.

The enclosed nature of this landscape results in extremely localised landscape impacts. The landscape has good potential to absorb small scale development. The loss of 1500m¹ of existing hedgerows and trees along the restored canal will locally alter the landscape character. However, extensive landscape planting is proposed along the scheme including 5.4km of new hedgerows.

Locations within non-ecologically sensitive fields along the canal have been selected for potential disposal of dredged and excavated material. This disposed material will create new but temporary landscape features in the local landscape until vegetation is established on disposed material.

The landscape quality of this landscape has been identified as “Good”.

This landscape character has been identified as having a low sensitivity. The predicted magnitude of change in landscape resource is high. The predicted significance of landscape impact for this landscape is moderate negative.

Urban Landscape

The proposed scheme does not cross this landscape and is located at it's nearest on the southern edge of Clones town. This landscape has been determined as robust and the proposed marina and recreational facilities near Clones will be sympathetic to the character of the urban setting of the town. The proposals will create a new recreational feature on the southern side of the town that will not intrude or alter significantly the urban landscape character of this part of the town. The proposed landscape planting will benefit the local landscape.

The landscape quality of this landscape has been identified as “Ordinary”.

The Urban Landscape has been identified as having a low sensitivity to change. The predicted magnitude of landscape resource change is medium. The predicted significance of landscape impact on the Urban Landscape is slight/moderate negative.

Lower Lough Erne Drumlin Landscape

The proposed scheme crosses this landscape character area west of Gortnacarrow Bridge. This landscape is particularly sensitive to new development and is located within the proposed Erne Lakeland AONB.

Dredging is required within the River Finn at locations through this landscape and adjacent fields have been identified for disposal. Such disposal sites will temporarily alter the existing landscape and be new features until vegetation established on disposal areas. Once vegetation is established the disposal sites will not be discernible from the adjacent landscape.

¹ Waterways Ireland estimate from removal of all tree and hedgerow within red line planning boundary.

A new channel is to be built at Derrykerrib Bridge and the Bridge is to be raised by 1m and the local landscape will be altered slightly at this location. However, the Bridge is an existing feature in the local landscape low levels of change in landscape resource will occur.

New moorings, facilities and car parking will be provided at Gortnacarrow. Access will be provided under the A3 Cavan Road and lock or lift system provided. A new private bridge will be constructed just north of Gortnacarrow. All new facilities at Gortnacarrow are well located within the local landscape and the proposed landscape planting at Gortnacarrow will combine with the local topography to prevent significant landscape impacts at this location.

The landscape quality of this landscape has been identified as “Very Attractive”.

The Lower Lough Erne Drumlin Landscape Character has been identified as having a high sensitivity. The predicted magnitude of landscape resource change is low. The predicted significance of landscape impact on the Lower Lough Erne Landscape Character Area is Moderate.

Table 11.3 Summary of Landscape Character Impact Assessment

Key Landscape Character	Impact Assessment
Undulating drumlin agricultural landscape	Moderate Negative
Urban landscape	Slight/Moderate Negative
Lower Lough Erne drumlin landscape	Moderate

11.4.3 Visual Impact Assessment

The assessment of the existing environment and the impact of the proposed scheme on visual receptors has established that there will be no protected views are prospects effected by the proposals.

Table 11.4 summarises the number of residential properties that will experience a visual impact from the proposed scheme. The locations of all properties affected are illustrated in **Appendix E Figure 11.3**. Specific Landscape Mitigation (SLM) has been identified in **section 11.5** to address the significant impacts established. The residual impact column assumes that the SLM has been implemented and attained 10-15 years growth.

Table 11.4 Summary of Visual Impact (without mitigation)

Degree of Visual Impact	Number of properties
Substantial negative impact	14
Moderate negative impact	35
Slight negative impact	33
No change	36
Slight positive impact	0
Moderate positive impact	0
Substantial positive impact	0

11.4.4 Landscape Designations

An assessment of the policies and designation within the relevant development plans has taken place.

Monaghan Development Plan 2007 – 2013

Local Landscape Policies

The nearest LLPA to the proposed scheme is located within the southwest portion of the Clones limit of development. The proposed scheme will not directly or indirectly impact on the nearest LLPA at Clones.

Areas of Primary/ Secondary /Visual Amenity Value

There are no Areas of Primary Amenity Value in proximity to the proposed scheme.

The nearest Area of Secondary Amenity Value is Ulster Canal and Environs. The proposed scheme is located within this zoning through its length in County Monaghan. The proposal will result in removal of approximately 1500m of hedgerow and trees resulting in an impact on Policy ENV 13. However, all removed hedgerows and trees will be replaced as set out in the Landscape Plan.

Scenic Roads

There are no scenic roads located in proximity to the proposal. The nearest scenic route is located approximately 7km south at Lough Annagh. The proposal will not impact on Scenic Roads designated in the County Development Plan.

Protection of Trees and Hedgerows

The plan sets out a range of policies to protect trees and hedgerows from development that would adversely effect them. ENV 18 lists trees and hedgerows for protection (Appendix 3 of Plan). A review of the Plan has established that there are no trees of special amenity value located near the proposed scheme. The proposed scheme will require the removal of approximately 1500m of existing hedgerow and trees. This will result in an impact on Policy ENV 13 as mentioned above that will be mitigated by replacement planting.

Cavan Development Plan 2008 – 2014

Heritage Gardens, Demesnes and Parks

The nearest site identified to the proposed scheme is Castle Saunderson that is stated should be preserved and valued for its educational, tourist and amenity value. There are no direct or indirect impacts on the Castle Saunderson estate.

Hedgerows and Stone Walls

Hedgerows and stone walls are recognised by the Plan as important visual amenity features. It is a policy of the Plan to seek to retain hedgerows and stone walls as far as possible in rural areas. The proposed scheme will require the removal of approximately 1,500m of existing hedgerow and trees however this will be mitigated by replacement planting.

Woodlands and Trees

Trees and woodlands are recognised by the Plan for their environmental and economic benefits. It is a policy to encourage the use of native broadleaved species in planting schemes. Tree Preservation Orders will be considered to protect important trees or groups of trees. A number of trees will be required to be felled as part of the scheme throughout its length in County Cavan however this will be mitigated by replacement planting.

Areas of High Landscape Value or Special Landscape Interest

The proposal is located directly within the designated Area of High Landscape Value HL4 Erne-Shannon Canal Corridor. While a number of trees will be lost as part of the scheme it can be argued that the proposed restoration of the Ulster Canal with new mitigating planting is consistent with this designation as the restoration project will result in the enhancement of the Canal for future generations.

The proposal is not located near an Area of Special Landscape Interest. It is a policy to maintain the scenic and recreation value of these areas restricting all adverse uses and negative visual impacts.

Scenic Routes

There are three scenic routes identified in the Plan none of which are located in proximity to the proposed scheme. The three routes identified are all located in the west of the County. There will be no direct or indirect impacts on Scenic Routes.

Scenic Views and Viewing Points

There are seventeen scenic viewing points identified in the Plan. There are no locations identified in proximity to the proposed scheme. The nearest identified scenic viewing point is located approximately 3km south of the proposal at Drumgarry on the N54 road. Due to the distance of Drumgarry to the proposed scheme no impacts are predicted.

Fermanagh Area Plan 2007

Conservation Zones

The nearest zone to the proposed scheme is Zone 1 Crom. The Erne-Shannon Waterway is recognised within this zone and the Plan states that there is potential to exploit this tourism attraction through sensitively sited facilities. The proposed scheme is located directly within this zone. The proposed restoration of the Ulster Canal is complimentary to this zoning.

Sensitive Zones

There are no such zones located in proximity to the proposed scheme.

Trees

There will be areas of tree felling required as part of the scheme. However, all trees felled will be replaced with additional landscape planting as set out in the Landscape Plan.

Local Landscape Policy Areas

There are no LLPA located in proximity to the proposed scheme.

Important Views

The Area Plan has identified four important public views. The views are to and from the Enniskillen Castle and not in close proximity to the proposed development. The proposed scheme will not impact on Important Views.

Area of Outstanding Natural Beauty (AONB)

The proposed scheme lies within the proposed Erne Lakeland AONB where it passes through Fermanagh. The Ulster Canal has been a feature of the AONB for many years. The restoration of the Canal will be complimentary to the objectives of the AONB designation and promote improved enjoyment of the AONB for both tourists and the local community.

The Ulster Way

The proposed scheme is located at its nearest 7km from the Ulster Way as it passes north of Newtownbutler. Due to the separation distance between the scheme and the Ulster Way there will be no direct or indirect impacts.

11.5 INTERACTIONS

11.5.1 General

This landscape and visual assessment has a direct interaction with the Ecology sections (**sections 9 and 10**) and the Noise and Vibration section (**section 13**) of the EIS. The loss of habitats is described fully in the Ecology sections and not elaborated in this landscape and visual assessment. The mitigation proposed will provide new and more extensive woodland and grassland habitats along the proposed canal corridor that will result in a beneficial impact on biodiversity. In completing the landscape and visual assessment liaison has taken place between the landscape architect and the ecologist.

The provision of noise barriers can create visual impacts while mitigating noise increases. The landscape and visual assessment has interacted with the noise assessment to insure that all potential landscape and visual impacts have been incorporated into the assessment.

11.6 MITIGATION

11.6.1 LANDSCAPE AIMS AND OBJECTIVES

Mitigation measures are those taken to help reduce the significant landscape and visual impacts arising as a result of the proposed scheme (See **section 11.4**).

Landscape Aims

- The physical and visual integration of the proposed scheme and associated features into surrounding landscape.
- Screening to minimise visual intrusion and to reduce any significant negative aspects regarding the visual impact of the canal, its structures and boat traffic on sensitive receptors.

General Objectives

- Retention of the existing hedgerows and trees as far as possible.
- Use of native species of tree and shrub.
- Restoration and enhancement of boundaries along the Canal corridor.

11.6.2 PLANTING

General Planting

Extensive landscape planting is proposed along the length of the proposed scheme. Full details are provided in the report titled “Waterways Ireland Landscape Plan Ulster Canal (Upper Lough Erne to Clones) September 2011”. In addition the locations of all planting works are shown in drawing nrs 1-28 titled “Landscape Plan”. The plans indicate use of native species of tree and shrub. It is also proposed to establish 5.4km of new hedgerow along the Canal corridor.

Specific Landscape Measures (SLM)

Table 11.5 Specific Landscape Measures

Location	Description of SLM
SLM 01:- Ch. 1600-1800 southside	Hedgerow and tree mix is necessary to mitigate significant visual impacts at residential property (See Appendix E Figure 11.3 for location of properties)
SLM 02:- Ch. 2900-3300 southside	Hedgerow and tree mix is necessary to mitigate significant visual impacts at residential property (See Appendix E Figure 11.3 for location of properties)
SLM 03:- Ch. 4400-4800 southside	Hedgerow and tree mix is necessary to mitigate significant visual impacts at residential property (See Appendix E Figure 11.3 for location of properties)
SLM 04:- Ch. 5250-5450 bothsides	Hedgerow and tree mix is necessary to mitigate significant visual impacts at residential property (See Appendix E Figure 11.3 for location of properties)
SLM 05:- Ch. 6300-6600 bothsides	Hedgerow and tree mix is necessary to mitigate significant visual impacts at residential property (See Appendix E Figure 11.3 for location of properties)
SLM 06:- Ch. 8200-8500 southside	Hedgerow and tree mix is necessary to mitigate significant visual impacts at residential property (See Appendix E Figure 11.3 for location of properties)
SLM 07:- Ch. 9100-9400 bothsides	Hedgerow and tree mix is necessary to mitigate significant visual impacts at residential property (See Appendix E Figure 11.3 for location of properties)
SLM 08:- Ch. 10600-10750 northside	Hedgerow and tree mix is necessary to mitigate significant visual impacts at residential property (See Appendix E Figure 11.3 for location of properties)
SLM 09:- Ch. 11200-11450 northside	Hedgerow and tree mix is necessary to mitigate significant visual impacts at residential property (See Appendix E Figure 11.3 for location of properties)

11.6.3 Monitoring and Maintenance

Full details of maintenance are provided in the report titled “Waterways Ireland Landscape Plan Ulster Canal (Upper Lough Erne to Clones) September 2011” as well as the submitted Environmental Management Plan.

11.7 RESIDUAL IMPACTS

This section of the report assesses the impact of the proposed scheme on the visual receptors (previously identified in **section 11.5**), and after the mitigation (described above in **section 11.6**) has attained 10 years of growth.

After 10 years of growth the proposed planting help to integrate the restored canal scheme into the existing landscape. Loss of existing views will remain a significant impact to a few properties where the canal is at close proximity to the property. In general the visual impacts are slightly reduced. The predicted residual visual impacts for all properties are provided in detail in **Table 11.4** and summarised in **Table 11.6**.

Table 11.6 Residual Visual Impacts (after mitigation)

Degree of Visual Impact	Number of properties before Mitigation	Number of properties after Mitigation
Substantial Negative Visual Impact	14	0
Moderate Negative Visual Impact	35	14
Slight Negative Visual Impact	33	67
No Change	36	37
Slight Positive Visual Impact	0	0

11.8 CONCLUSION

A landscape and visual impact assessment has been completed for the proposed Ulster Canal Lough Erne to Clones project.

The proposals are located in a largely undulating drumlin landscape. The Ulster Canal has been a feature of this landscape for many years. The proposed scheme and associated facilities are directly located within an Undulating Drumlin Agricultural Landscape, an Urban Landscape and the Upper Lough Erne Drumlin Landscape Character Area. Due to the nature of the proposals along the existing Canal only temporary/short term impacts are predicted and no significant landscape impacts will result.

When visual impacts were assessed the majority of properties with potential views of the proposed scheme will not be significantly affected. A total of 14 properties in close proximity to the proposals will be significantly affected. All such visual impacts will be short term in duration and specific mitigation measures have been proposed.

With regards to impacts on designated landscapes the assessment has established that the proposals are not located directly within any designated landscape and has no potential impact on Historic Parks, Gardens and Demesnes.

No significant visual impacts are predicted for views from the Ulster Way. No significant landscape or visual impacts are predicted for designations and zonings in the Cavan, Monaghan and Fermanagh Development Plans.

A range of mitigation measures have been proposed including a landscape planting consisting of a native woodland framework as well as retention and protection of existing trees and hedgerows as far as practicable and reinstatement of existing and new hedgerows.

Overall, the broader landscape character area and visual context around the proposed Ulster Canal project identified has the capacity to absorb a development of this scale and the proposal is acceptable in landscape and visual terms.

12 CULTURAL, ARCHITECTURAL AND ARCHAEOLOGICAL HERITAGE

12.1 METHODOLOGY FOR ESTABLISHING BASELINE CONDITIONS

The Cultural Heritage section of the EIS is compiled so as to be compliant with the guidelines set out in legislation in both Northern Ireland and Ireland.

For legislation 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 their contents are taken into account when development plans are being prepared. The contents are also material 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).

The relevant legislation in 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;
- 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).

Additionally, under the terms of the Planning and Development Act 2000, each county is required to produce a 6-year development plan in accordance with the Planning and Development Act 2000 which sets out an overall strategy for the proper planning and sustainable development of a county. Under the 2000 Act, 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 policy is referenced and amplified in both the County Monaghan Development Plan 2007-2013 and the County Cavan Development Plan 2002-2012. These development plans consider archaeological remains, both known and as yet unidentified, important evidence of each county's past. They also consider 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

Given this, Development Plan policies that relate to archaeological heritage and are relevant to the proposed development are:

- To secure the preservation (i.e.: preservation *in situ* or, as a minimum, preservation by record) of all archaeological monuments included in the Record of Monuments as established under Section 12 of the National Monuments (Amendment) Act, 1994;
- To secure the preservation (i.e.: preservation *in situ* or, as a minimum preservation by record) of sites which are newly discovered as a result of ground disturbance works associated with development.

The County Monaghan Development Plan 2007-2013 also encourages archaeological investigations at pre-approval stage where development is proposed on areas of archaeological potential.

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 section.

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.

The guidelines set out by Advice Notes on Current Practice (EPA, 2003) were also taken into account in the compilation of this Cultural Heritage section and mitigation measures.

These guidelines include advice on assessing the impact of a proposed development on a landscape in the existing environment which includes the physical setting of a development and any impact that it may have on a monument or its surroundings.

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 Northern Ireland and Ireland.

Information for the Northern Ireland 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 topographical records of the Ulster Museum were also consulted.

Information for the Ireland 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 desk based study 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.

12.2 BASELINE CONDITIONS

The proposals for the restoration of this section of the Ulster Canal commence at Clones to the northeast and run southwest towards Quivvy Lough in Upper Lough Erne. A study area 1km wide on either side of the line of the proposed restoration was examined and the descriptions of the baseline conditions will follow the line of the proposed restoration starting at the northeast in Clones. All recorded features within the study area are shown in **Figure 12.1**. **Appendix F** gives full details of all sites, monuments and buildings assessed in this section.

12.3 SITES AND MONUMENTS

The proposed restoration of this section of the Ulster Canal commences on the southwest extent of the town of Clones, Co. Monaghan. Clones was the site of a monastic settlement founded by St. Tigernach during the 6th century. St. Tigernach was reputedly buried in the town in 584AD. The abbey was burned in 836AD and again in 1095AD while both abbey and town were burned by Hugh De Lacy in 1207AD. The town and abbey were rebuilt in 1212AD by the English who also built a castle at the site.

There are a number of recorded archaeological sites within the town relating to both its ecclesiastical and military past as well as other monuments. None of these monuments are located within the boundaries of the proposed restoration of the Ulster Canal and none of them will be impacted upon. These sites are listed in **Table 12.1**.

Figure 12.1 Heritage Features within the Study Area

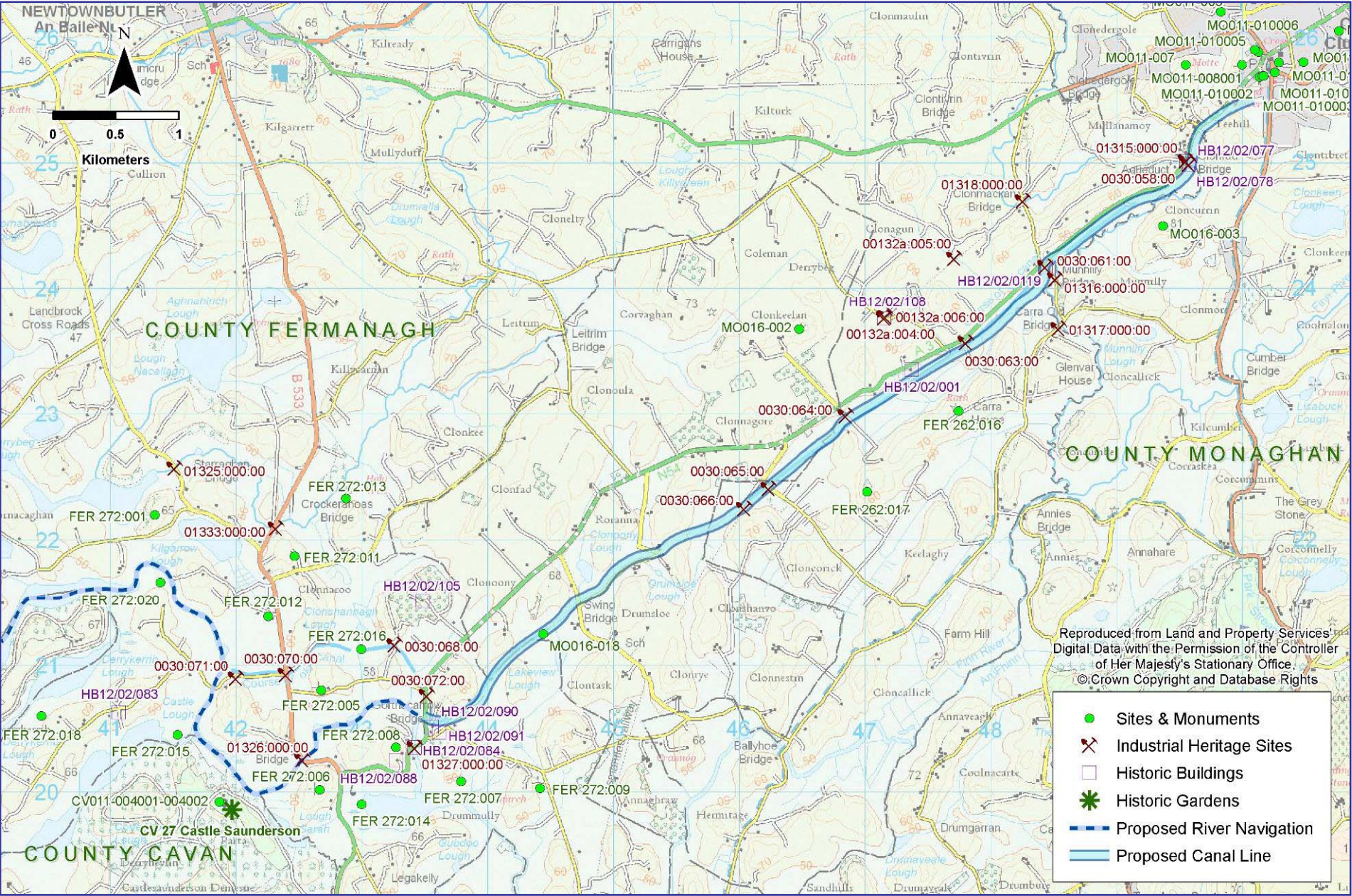


Table 12.1 Sites and Monuments in Clones Area

SMR/MBR Number	Type of Site	Grid reference	Condition	Impact
MO011:005	Cairn	H32622498	Not archaeological	None
MO011:007	Rectilinear Earthwork	H32572495	Some remains	None
MO011:008:001	Motte and bailey	H32572500	Some remains	None
MO011:008:002	Castle	H32572500	Some remains	None
MO011:008:03	Souterrain	H32572500	No visible remains	None
MO011:009	Earthwork	H32602507	No visible remains	None
MO011:010:01	Church	H32572502	Substantial remains	None
MO011:010:02	Round Tower	H32562501	Substantial remains	None
MO011:010:03	Graveyard	H32562501	Some remains	None
MO011:010:04	Coffin Shrine	H32562501	Substantial remains	None
MO011:010:05	High Cross	H32582501	Substantial remains	None
MO011:010:06&7	Church	H32592501	No visible remains	None
MO011:010:08	Town Defences	H32572502	Some remains	None
MO011:011	Enclosure	H32582504	Some remains	None

The closest of these sites are located on a hillside approximately 160m to the northeast of the Clones commencement point. These sites are two ecclesiastical sites; a round tower (MO011:010:02) and a coffin shrine (MO011:010:04). The round tower (MO011:010:02) is closer to the scheme and consists of a tower of undressed sand and limestone standing approximately 40m high on a narrow plinth that is only visible on the west side. The tower measures 4.5m in diameter and features a doorway set 3.5m above the plinth facing east. The tower also has three windows; the upper most of these windows is set above the doorway and is located 37m above ground level while the lower windows face north and south and are set 24m above ground level. The tower originally had four other windows at the top as well as a conical roof, however, these features are now missing.

The round tower (MO011:010:02) is set within a graveyard which contains a number of gravestones dating to the 18th century. These headstones generally consist of decoration of discs with very short

arms on one face with decoration consisting of skulls, hourglasses, bible, cross bones etc on the reverse. The most interesting feature within the graveyard is a coffin shrine (MO011:010:04). This shrine is house shaped with finials at either end and is constructed from a single block of sandstone which is broken in two parts. It is badly worn though some decoration can still be discerned. A figure with an uplifted sword in his right hand and possibly a dog or devil to his left is evident on the south face towards the west end while, on the east gable end is a figure with outstretched arms. There are also small projections on the north and south sides, one in the centre of each side and one towards the east. The central projections are larger than the others and all are triangular in shape, resembling locks or locking attachments on chests. An inscription is evident running across the roof of the shrine from the head of the sword holding figure. Both the round tower (MO011:010:02) and coffin shrine (MO011:010:04) are noted on the Record of Protected Structures as being of national status.

The next recorded archaeological site is a graveyard (MO011:010:03) which is located approximately on the south facing side of a hill some 75m to the north of the canal and on a similar level to the graveyard containing the round tower (MO011:010:02) and house shaped shrine (MO011:010:04) to the west. The graveyard is rectangular though it is unlikely that this was its original shape. It contains the remains of a church (MO011:010:01) and gravestone dating to the 18th/19th centuries. The 18th century gravestones are similar to those within the graveyard to the west though two were noted bearing coats of arms. There is also a large block of stone lying to the east of the church (MO011:010:01) within the graveyard and it is surmised that this was formerly part of the church.

The church (MO011:010:01) is rectangular and orientated east-west. It has been constructed from drystone walling which has been faced with well cut, regularly laid blocks of sandstone. The best preserved part of the church is the west gable which stands to almost its original height and contains a doorway with a rounded arch. This doorway is straight sided and the present arch springs from adjacent stones. There would originally have been carvings and mouldings around the doorway though these have since been largely removed. However, the badly eroded remains of two beast masks are evident on either sides of the door and the remains of moulding are evident on the south side of the door. The south wall of the church contains a small round headed window with moulding and there are a number of other window fragments incorporated into the building. The east wall, north wall and east half of the south wall all stand to an average height of 1m on a footing of black/gray roughly shaped boulders. The east end is not angled and the presence of the corner stone suggests that the building terminates at this location, though it is possible that the stone was placed here during reconstruction with the original building continuing further to the east. A large portion of the north wall has also been rebuilt and a sandstone block at the west end of the north wall bears the depiction of a high cross. Another stone located towards the east of the south wall may be decorated with interlaces.

The line of the proposed restoration of the canal runs southwest from the outskirts of Clones to the River Finn. The local topography of the area consists of ridges of higher ground running southwest to northeast with level, marginal ground in between. The Ulster Canal runs along this level ground while the majority of recorded archaeological sites are located on the higher ground to the north and south.

These sites represent a range of monument types from different periods providing evidence of activity within the area dating back to, at least, the Early Christian period. These sites are given in **Table 12.2**.

Table 12.2 Sites and Monuments along Canal Line

SMR/MBR Number	Type of Site	Grid reference	Period	Condition
FER 262:016	Rath	H4771023040	Early Christian	Substantial remains
FER 262:017	Enclosure	H47000022450	Uncertain	No visible remains
FER 272:007	Rath	H4379020080	Early Christian	Substantial remains
FER 272:009	Ecclesiastical Site	H4427020060	Early Christian/Med/Late Medieval/Post Medieval	Traces only
MO11:007	Rectilinear Earthwork	H49552578	Uncertain	Some remains
MO16:002	Enclosure	H46482367	Early Christian?	Some remains
MO16:003	Enclosure	H49372449	Uncertain/Modern?	Some remains
MO16:018	Tree Ring	H44431245	Modern	Some remains

As mentioned, the majority of these sites are located on higher ground to the north and south of the canal and will not be impacted upon by the restoration of the canal. However, one site is located immediately adjacent to the south-southeast of the proposed restoration. This site is a tree ring (MO16:018) which is located towards the southwest end of the canal in the townland of Clonoony. It consists of a small, circular flat area which is surrounded by a small sharply profiled earth and stone bank with an exterior small ditch. The site is located on a slight eminence in boggy ground and is covered in vegetation including blackthorn bushes and fir trees. The site was marked as a fort on the First Edition Ordnance Survey map sheet (1835) though a subsequent site visit by DoEHLG (now DECLG) identified the site as a modern landscape feature. The site remains largely extant though the construction of the Ulster Canal appears to have truncated the north-northwest facing side of the tree ring.

The southwest extent of the proposed restoration of the canal does not follow the original line of the canal but instead utilizes the River Finn as part of the navigation. The River Finn runs approximately northeast to southwest before curving sharply to run to the north before curving to run to the west-southwest into Upper Lough Erne. There are seven recorded archaeological sites within the vicinity of the River Finn though none of these will be impacted upon by the proposed development. These sites will be discussed in turn starting at the southeast end of this section.

The closest recorded site to the southeast end of this section is a platform rath (FER 272:008) which is located on the summit of a drumlin approximately 195m to the west-southwest overlooking the River Finn to the east. The monument consists of a sub-circular platform of earth measuring 28.5m north to south by 32m east to west. The interior of the site slopes gradually down to the south and stands 1.4m above the enclosing ditch which measures 3.5m wide and 0.6m deep. The majority of the perimeter of the rath has been planted with ash and thorn trees though the section from east to south has been damaged with the ditch obscured. There is no visible trace of the original entrance to the site.

A graveyard (FER 272:016) is located approximately 500m to the north-northeast of this section in the townland of Clonshannagh and immediately to the south of Clonshannagh Lough. This site was identified when a local inhabitant donated a bullaun stone to the Ulster Museum. This bullaun is square in plan with a bowl shaped depression measuring 0.06m deep and was uncovered in an area known locally as the 'graveyard field'. Further enquiries by the Ulster Museum revealed that another piece of cut stone and some human bones had been uncovered within the field when it was ploughed during the Second World War. The bullaun and human bones suggest that this may be an ecclesiastical site dating to the Early Christian period.

A possible crannog (FER 272:014) is located approximately 400m to the south of the section in the northwest corner of an inlet on the River Finn. This possible monument is not marked on any Ordnance Survey edition map sheet and appears as a large, tree-covered island. It was noted as a possible crannog during fieldwork by NIEA: Built Heritage in 1977 but this could not be verified as dangerous conditions around the island prevented a visit.

The next recorded site is a church (FER 272:005) which is located approximately 293m to the north-northeast of the section. This church was built around 1773 and was demolished in 1844. There are no longer any visible traces of this site.

A cairn (FER 272:006) is located approximately 300m to the south of the section within the townland of Annaghmore Glebe. The site currently consists of the kerb of a destroyed round cairn which surrounds the summit of a drumlin hill. This kerb consists of 67 stones surviving in various sizes and set in a circle, 35m in diameter. The majority of these stones have fallen from their original positions with only 10 remaining in place. The site was described in 1712 as being a large heap of stones encircled by very large stones set on their ends. The report also stated that most of the cairn had been removed to provide stone for nearby roads. Burial urns set in stone 'coffins' were uncovered within the

cairn during this work. NIEA: Built Heritage has surmised that this site may have been a passage tomb and has awarded it scheduled monument protected status.

The next two recorded sites are located within the Castle Saunderson Estate which is located directly to the south-southwest of the section in County Cavan. These two sites are a castle (CV011:004:001) and a bawn (CV011:004:002). The bawn (CV011:004:002) was reputedly built by Captain William Saunderson in 1573. The bawn had two flanking towers and a house of lime and stone was set inside the bawn (O'Donovan, 1995). The Saundersons fought on the side of King William of Orange and the bawn was destroyed in 1689 by Jacobite forces under Lord Galmoy from Belturbet. The current Castle Saunderson (CV011:004:001) is a composite structure with elements dating to the late 18th, 19th and early 20th centuries. It is set on the site of the previous bawn which occupied a low hill in a heavily wooded area. It is noted on the Record of Protected structures for County Cavan as (CV 11:001).

The next recorded site within the vicinity of this section is a mound (FER 272:015) which is located approximately 100m to the west in the townland of Derrykerrib though is not marked on any Ordnance Survey edition map sheet. This site is located in flat, damp pasture on the west bank of the river and consists of a grass covered mound composed of earth with a dome shaped profile and standing approximately 1.2m high. It is sub-circular in shape measuring 16.4m north to south by 15.4m east to west. The mound is largely intact apart for the south where it has been disturbed. A line of small stones are visible inside the line of the perimeter from north to east to southeast and these have been interpreted as the possible remains of a kerb. NIEA: Built Heritage has awarded the site scheduled protected status.

The next recorded site along the line of this section is another mound (FER 272:012) which is located behind Wattle Bridge Primary School approximately 450m to the east-northeast. A visit by NIEA: Built Heritage found that there are no remains of this site which was reported as a long mound by a local informant.

The last recorded archaeological site within the vicinity is located towards the northwest end of the section in the townland of Derrykerrib. This is a group of burnt mounds (FER 272:020) which are located close to the water's edge on the south bank of the River Finn. The site comprises a concentration of at least five burnt mounds which are visible as quite upstanding grassy mounds within a field of rushes. The mounds are mostly oval in shape and range in size from 3m to 10m in length and stand up to 0.8m high. The mound to the southeast is the largest of the group measuring 10m east to west by 7m north to south and standing 0.7m high. A slightly smaller mound measuring 6.5m east to west by 5.3m is located 7m to the west. A third mound is located to the north. This, too, measures approximately 6.5m east to west by 5.3m but is 0.8m high. A smaller mound lies 1.3m to the west of the previous mound. This mound is circular measuring 3.3m in diameter. A possible fifth mound is located to the north. This mound is circular and measures 4.8m in diameter. Burnt Mounds generally date to the Prehistoric period, most usually the Bronze Age.

Four further recorded archaeological sites are noted within the area of the section. However, these sites are located further away. These sites are given in **Table 12.3**.

Table 12.3 Sites and Monuments along River Finn Section

SMR/MBR Number	Type of Site	Grid reference	Period	Condition
FER 272:001	Non-antiquity	H4137022190	Unknown	Not applicable
FER 272:011	Non-antiquity	H4247021860	Unknown	Not applicable
FER 272:013	Crannog	H4293021580	Early Christian	Substantial remains
FER 272:018	Lakeside Settlement Site	H4015020280	Early Christian/Uncertain	Substantial remains

12.4 INDUSTRIAL HERITAGE RECORD

The Industrial Heritage Record records 22 Industrial Heritage sites within the vicinity of the proposed restoration of the Ulster Canal (Upper Lough Erne to Clones) including several which are directly within the line of the restoration. The Ulster Canal (IHR 0030:000:00) is itself, an industrial heritage site and these features within the line of the restoration are related to the canal.

The Ulster Canal (IHR 0030:000:00) was constructed between 1825 and 1842 by the Ulster Canal Company, initially for the purpose of linking the lowlands around Lough Neagh with the Erne Basin (McCutcheon, 1980). The Newry Canal and Lagan Navigation were fully operational at this time with both accessing Lough Neagh and it was envisaged that the Ulster Canal would form part of a network with these canals linking the ports of Belfast and Newry with the area of the Erne Basin (McCutcheon, 1980). It was also envisaged that Upper Lough Erne could be linked to the River Shannon by carrying out navigational improvements to Upper Lough Erne and by the construction of a canal running across County Leitrim. This would enable canal barges to access the southwest of Ireland as far as Limerick.

Construction of the Ulster Canal began in the northeast and by 1838 had reached Monaghan town. By 1840, the short summit level between Monaghan town and Smithborough was completed with the final section to Upper Lough Neagh (incorporating the line of the restoration) completed by late 1841. The waterway opened for commercial traffic in early 1842 (McCutcheon, 1980). Unfortunately, the Ulster Canal was beset by difficulties from the start. The initial survey of the line of the Ulster Canal had been carried out by John Killaly in 1814. Killaly had formed his recommendations based on the construction of a canal of similar dimensions to the Royal Canal which linked the River Liffey at Dublin to the River Shannon at Cloondavin in County Longford. Unfortunately, the breadth of the Royal Canal limited barge width to 13ft three and three-quarter inches while the width of barges on the Lagan and Newry Canals was around 14ft, six inches (McCutcheon, 1980). This meant that, from the outset, barges used on the Lagan and Newry Canals would have been too large to access the Ulster Canal and the concept of through traffic between the different systems was compromised. This problem was further compounded in 1831 when the line of the canal was resurveyed again by Killaly in advance of

construction commencing. This resurvey resulted in the width of the locks along the proposed canal being reduced to 12ft and meant that all cargoes travelling between the canal systems had to be switched between boats (McCutcheon, 1980).

Further problems included water supply to the canal. The canal was fed by a water supply from Quig Lough located just outside Monaghan town. This lough is quite small and even Killaly had questioned its viability as a water source in 1814 and had recommended deepening the lake. Unfortunately this was never carried out and water supply remained a major problem for the canal with often insufficient water depth during the summer months. Another problem was that the projected link to the River Shannon (the Ballinamore and Ballyconnell Canal) was not actually completed until 1860 nearly 20 years after the Ulster Canal was completed (McCutcheon, 1980). By this stage, the Ulster Canal had changed hands from the Board of Public Works to William Dargan to the Dundalk Navigation System and then back to the Board of Public Works (McCutcheon, 1980). The Ulster Canal was virtually derelict and required extensive works to bring it back to operation. These works took eight years by which time the Ballinamore and Ballyconnell Canal, itself, was virtually impassable and was derelict from the 1870s.

The Lagan Navigation Company took control of the Ulster Canal in 1888 and did have some success. However, the cost of maintenance related to the lack of water outweighed any profits and the canal was quickly in direct competition with rail networks and, later, improved road transport. These combined factors meant that the canal was last used commercially in 1929 and was officially abandoned in 1931 (McCutcheon, 1980).

The first site recorded on the Industrial Heritage Record is a bridge (IHR 01315:000:00) which carries the road between Counties Monaghan and Fermanagh over an unnamed stream which forms the county and international boundary approximately 870m from the northeast end of the Clones end of the restoration. This bridge, known locally as Clonfad Bridge, was shown on the First Edition Ordnance Survey map sheet (1835) but only identified as Clonfad Bridge on the Second Edition Ordnance Survey map sheet (1860). It was also shown on the subsequent 1909 edition map sheet. This bridge is not within the direct line of the proposed restoration and will not be affected.

The next Industrial Heritage site is an aqueduct/siphon (IHR 00030:058:00) which is located at Clonfad approximately 970m along the line of the proposed restoration. This feature carried the canal over the unnamed stream which forms the county/international border and was first marked on the Second Edition Ordnance Survey map sheet (1860). The final treatment of the proposed line of the restoration within this area has not yet been finalised and there are two possible options. The first option would see the proposed line of the restoration diverted around the aqueduct/siphon (IHR 00030:058:00) with no impact to the structure. The second option would see the aqueduct/siphon retained and restored (IHR 00030:058:00). However, the original internal workings of the feature have collapsed since the Ulster Canal went out of use. As such, this option would see the aqueduct/siphon (IHR 00030:058:00) dismantled, modern internal workings inserted and the original stonework rebuilt.

The next recorded Industrial Heritage site is a bridge (IHR 00030:061:00) which is located in the townland of Clonfad approximately 2.1km along the proposed line of the restoration. This bridge carried the road to Munnilly Bridge (IHR 01315:000:00) and the border with County Monaghan and was first shown on the Second Edition Ordnance Survey map sheet (1860). It is proposed that the new towpath will run under this bridge with the new alignment set further to the southeast.

As mentioned, the previous feature carried the road over the canal towards Munnilly Bridge (IHR 01316:000:00). This bridge (IHR 01316:000:00) is located approximately 140m to the south-southeast of the previous feature and outside the line of the proposed restoration. Munnilly Bridge (IHR 01316:000:00) was first shown on the First Edition Ordnance Survey map sheet (1835) but only identified on the subsequent Second Edition Ordnance Survey map sheet (1860). It is proposed that the existing road alignment to Munnilly Bridge (IHR 01316:000:00) will be changed with a new alignment running in from the southwest. Munnilly Bridge will be replaced as a canal bridge under the current proposals but will be repaired and maintained as a feature of the canal corridor.

Approximately 3km along the line of the restoration is a bridge (IHR 00030:063:00) which carried a local road to Belturbet over the canal. This bridge has since been replaced and there are no signs of the original structure. Similarly, another bridge (IHR 00030:064:00) was located approximately 4.1km along the line of the restoration of the canal. This bridge gave pedestrian access over the canal. A modern lane now runs over the site and there are no longer any signs of the original structure.

The next recorded Industrial Heritage site is a bridge (IHR 00030:065:00) located approximately 5.1km from the northeast end of the proposed restoration in the townland of Cloncorrick. This single span bridge carried the road allowing pedestrian access across the Ulster Canal while vehicular traffic may have been possible by 1909. The canal width will be restricted in this area due to the presence of an adjacent property and the bridge will not be impacted upon.

The next recorded Industrial Heritage site along the line of the proposed restoration is a bridge (IHR 00030:066:00). This site is also located in the townland of Cloncorrick approximately 5.3km from the northeast end of the proposed restoration. This single span girder bridge carried the Great Northern Railway Branch line between Clones and Cavan over the Ulster Canal. This railway branch line was opened in 1862 and closed in 1957 (McCutcheon, 1980). The bridge is also noted as a railway related feature on the Industrial Heritage Record and has been given the number (IHR 00132a:066:00) in relation to the railway line. This former railway bridge is located directly along the line of the proposed restoration though it is intended that the canal width will be restricted within this area with the railway bridge left *in situ*.

The southwest extent of the proposed restoration will join the River Finn curving around to the northwest and Upper Lough Erne. This route will bypass the original line of the canal which curved around to the northwest to run adjacent to the Cavan Road. Canal related features along this former section of the canal include a bridge, lock and mooring post (IHR 00030:072:00) at Gortnacarrow adjacent to the Cavan Road. Although major works are planned for this area including a berthing

marina, double lock chamber and parking, these will not impact upon these features. An accommodation bridge (IHR 00030:068:00), wooden bridge (IHR 00030:070:00), lock and mooring post (IHR 00030:071:00) are located to the northwest towards the west end of the canal. None of these features will be impacted upon by the proposed restoration.

As mentioned, the line of the restoration will run along the River Finn towards Upper Lough Erne. One Industrial Heritage feature is located along this section. This is Wattle Bridge (IHR 01326:000:00) which carries the Enniskillen to Newtownbutler Road over the river. This bridge was shown on the First Edition Ordnance Survey map sheet (1835) where it was depicted with three main supports and cutwaters. The bridge was shown on the subsequent Second Edition Ordnance Survey map sheet (1860) with four main supports. This bridge is located directly along the line of the restoration and while the structure of the bridge will not be affected works will affect some of the approach wall and the road surface may be altered.

There are eight other Industrial Heritage sites within the vicinity of the line of the proposed restoration. These sites are all located away from the project and will not be impacted upon. These sites are given in **Table 12.4**.

Table 12.4 Industrial Heritage Sites

IHR Number	Type of Site	Grid reference	Townland	Condition
IHR 00132a:004:00	Railway watch house at level crossing/milepost		Derrygoas	Unknown
IHR 00132a:005:00	Railway Bridge		Derrygoas	Unknown
IHR 00132a:006:00	Railway watch House/Level Crossing		Derrygoas/ Derrybrack	Unknown
IHR 01317:000:00	Road bridge	H48542368	Carra	Extant
IHR 01318:000:00	Road bridge	H48252469	Clonfad/ Clomacken	Extant
IHR 01325:000:00	Road bridge	H41512257	Kilgarrow/ Starraghan	Extant
IHR 01327:000:00	Road bridge	H43422035	Annaghmore Glebe/ Gortnacarrow	Extant
IHR 01333:000:00	Road bridge	H42302209	Clonaroo/ Crockerahoas	Extant

12.5 HISTORIC BUILDINGS DATABASE

Examination of the Historic Buildings database as maintained by NIEA: Protecting Historic Buildings revealed 13 Historic structures within the search corridor along the line of the proposed restoration of the canal. Five of these structures are located within the immediate vicinity of the canal.

Starting at the northeast of the line of the proposed restoration, the first Historic Structure is Clonfad Bridge (HB 12/02/077) which has already been mentioned in relation to the Industrial Heritage Record where it is noted as (IHR 01315:000:00). This bridge carries the Clones-Cavan Road over the River Lacky and spans the county boundary between Fermanagh and Monaghan and also the international boundary between Northern Ireland and Ireland. It consists of two small segmental arches with half of the bridge actually located within County Monaghan. The abutments, pier and angled cutwaters are constructed with squared limestone rubble and the spandrels with random rubble. The voussoirs are constructed with finely dressed stone with elongated keystones and the parapets have coping blocks with rustication to all faces. The inside surfaces of the southwest arch have been strengthened with a skin of concrete. This bridge dates to the early 19th century, however, NIEA: Protecting Historic Buildings considers this bridge is of no special architectural merit and it is noted as 'Record only' on the Historic Buildings database. This feature will not be impacted upon by the proposed restoration of the canal.

The next Historic structure has also been mentioned in relation to the Industrial Heritage Record. This is the aqueduct (IHR 00030:058:00) which is noted on the Historic Buildings Database under (HB 12/02/078). The aqueduct consists of two shallow segmental spans which carried the Ulster Canal over the Lacky River with the northeast half of the aqueduct located within County Monaghan. It is constructed of regularly laid limestone blocks and the arch soffits slope down on each side to accommodate the depth of the canal. The upstream, southwest face consists of a chamfered cutwater and only fragments of the random rubble parapet walls now survive. The wing walls are constructed of more coarsely dressed and randomly laid blocks and these curve out as quarter circles terminating in square piers. The wing walls and piers have oversailing dressed copings. The bridge is heavily overgrown and derelict though the principal elements of this well executed bridge are still apparent. Given this, NIEA: Built Heritage has awarded the bridge Grade B1 listed protected status. As mentioned, this feature is partially located within County Monaghan and is regarded as a Structure of Regional Importance by Clones Town Council.

Also as mentioned, the final treatment of the line of the proposed restoration has not yet been decided though there are two options. The first option would see the aqueduct (HB 12/02/078) bypassed with no impact to the structure, while the second option would see the structure retained and restored. The second option would require the dismantling of the structure with new modern internal workings added. The original stonework would then be rebuilt around the new internal workings.

Another feature already noted in relation to the Industrial Heritage Record is the bridge (IHR 00030:061:00) which formerly carried the road over the canal approximately 2.1km from the northeast end of the proposed realignment. This feature is also noted on the Historic Buildings Database under (HB 12/02/119) and consists of a single semicircular arched bridge carrying a one and a half lane road over the canal to the immediate south of the main Clones-Cavan Road. It is constructed from irregularly laid, roughly dressed limestone blocks and is embellished with finely dressed voussoirs with a similarly detailed string course over the arch crown and projecting parapet copings. The parapets end in square out-projecting piers and continue as random rubble approach walls.

The canal towpath runs through the arch on the south side and the edge of the tow path is marked with large dressed stones. The bank of the canal is also faced with masonry for a short distance on either side of the bridge. The span of the arch is 6.12m with the canal occupying 4.09m. The approach road makes a right angle turn towards the north end of the bridge and drops gradually to meet the main road some distance to the east. The present road now bypasses the canal bridge and this road cuts through the approach. The former road had a pronounced hump back though this has been removed exposing the exterior curve of the arch. NIEA: Protecting Historic Buildings consider the principal elements of this bridge to be well executed and still intact despite the realignment of the road and the infilling of the canal. It has been awarded Grade B2 listed protected status. This feature is located adjacent to the line of the proposed realignment though it is proposed that the new towpath will run under the bridge.

The next Historic Structure has also been mentioned in relation to the Industrial Heritage Record. This is the road bridge (HB 12/02/079) which has been discussed in relation to the Industrial Heritage site (IHR 00030:065:00). This bridge provides access over the canal and consists of a single semi-circular arch with dressed limestone block abutments and finely dressed voussoirs. The parapets have been rebuilt in random rubble. The bridge (HB 12/02/079) has been awarded Grade B2 listed protected status. This bridge will be retained under the current proposals though the towpath will be removed.

The next Historic Structure is a former canal store (HB 12/02/091) located approximately 7960m from the northeast end of the proposed restoration. This site consists of a canal store and an adjoining house which are aligned east to west on the south side of the former canal. The store consists of a large two storey, single bay building with a pitched natural slate roof and dressed limestone verges and kneelers. The principal elevation of the store faces south towards the road and the walls are constructed with random rubble limestone. There is a wide doorway located centrally on the ground floor. This doorway has dressed stone jambs and a segmental brick head and is flanked to each side by a shuttered window opening. All windows in the store have flat, brick heads, brick jambs, sandstone cills and wrought-iron security bars.

A narrower loading door is located in the centre of the first floor which has brick jambs and head. The north face of the building was originally exposed at first floor level only with the towpath against the outside face of the ground floor. The removal of the towpath has revealed the facing wall while a coped facing wall is located on the near side of the canal. There is a wide segmental door located at

the centre of the first floor of the block. The adjacent house butts against the southwest facing gable end of the store. This building is two-storey high by two storey wide and is detailed exactly as the canal store. Its principal elevation faces south and there are the remnants of a chimney on the west gable. The towpath formerly ran along the outside ground floor face of the rear elevation. The entire complex is enclosed to the east, west and south by a random rubble wall with access via an opening in the south wall. This opening is flanked by square dressed stone gate pillars with shallow pyramidal caps though the left pillar has been damaged and the gate removed. The banks which formerly enclosed the canal have also been removed.

NIEA: Protecting Historic Buildings consider this complex to be an unusual combination of buildings with the large store of interest due to its good condition and relation to the Ulster Canal. It, the adjacent house and the enclosing wall have been awarded Grade B1 listed protected status. The canal store and enclosing wall are in private ownership and will be retained under the restoration of the canal.

The next Historic Structure is also located at Gortnacarrow. This is the former lock keeper's cottage (HB 12/02/090) which is a single storey, three bay building orientated towards the southwest. There are no signs of the former canal immediately adjacent and the cottage has been extensively modernized. NIEA: Protecting Historic Buildings consider the cottage to have historic merit due to its former connections with the canal. However, recent modernizations have compromised the building so that it is not worthy of listed protected status. It is noted as record only. It is intended that this building will be retained in private ownership under the current proposals.

The last Historic structure located along the line of the proposed restoration of the canal is Wattle Bridge (HB 12/02/084) which has already been discussed in relation to the Industrial Heritage site (IHR 01326:000:00). Wattle Bridge (HB 12/02/084) carries the main road over the River Finn and comprises three equi-sized segmental arches constructed of coursed limestone rubble. The quoins of the abutments, piers and voussoirs are constructed with finely dressed masonry blocks as are the cutwaters to both faces. The cutwaters are rounded in cross section and embellished at arch crown level with moulded conical sandstone caps. Both parapets have been completely rebuilt within the recent past, though the original thin coping flags have been reused. Wattle Bridge was marked on Herman Moll's map of 1714 though the current bridge appears to date from the early 19th century. The road was originally the mail coach route between Enniskillen and Dublin via Cavan. NIEA: Protecting Historic Buildings considers this bridge to be well executed and maintained giving character to the landscape hereabouts. The bridge has been awarded Grade B2 listed protected status.

Wattle Bridge (HB 12/02/084) is located towards the southwest extent of the proposed restoration of the canal. This area of the scheme proposes to utilize the River Finn as part of the navigation and the proposed route will run in a by-pass channel not affecting the bridge structure but impacting on the approach walls which will be taken down and rebuilt on the eastern bank with a new navigation channel underneath.

The remaining Historic Buildings within the study corridor are located further away from the line of the proposed restoration and will not be impacted upon. These buildings are given in **Table 12.5**.

Table 12.5 Historic Buildings Not To Be Impacted Upon

HB Number	Type of Site	Address	Protection
HB12/02/001	Dwelling	68 Cavan Road Clongowna Newtownbutler Enniskillen County Fermanagh BT92 6ED	Grade B1 listed
HB 12/02/083	Dwelling	Donaghue's Cottage 19 Derrykerrib Road Newtownbutler County Fermanagh BT92 8GB	Grade B1 listed
HB 12/02/088	Dwelling	The Old Rectory (aka Drummully Rectory) Annaghmore Glebe Newtownbutler County Fermanagh BT92 8FA	Grade B2 listed
HB 12/02/089	Bridge	Gortnacarrow Bridge Annaghmore Glebe Newtownbutler County Fermanagh BT92 8GA	Grade B1 listed
HB12/02/105	Dwelling	Thatched Cottage Clonshannagh Newtownbutler County Fermanagh BT92 8EY	Grade B1 listed
HB12/02/108	Dwelling/railway related structure	Railway Watch House Derrygoas Newtownbutler County Fermanagh BT92 8GD	Grade B2 listed

12.6 HISTORIC GARDENS

There is one Historic Garden located within the vicinity of the proposed restoration. This is the Castle Saunderson Estate (CV-27) which is located adjacent to the southwest corner of the proposed restoration in County Cavan. The Historic Garden is centred around Castle Saunderson (CV011-004-001) which has already been mentioned. The current building has elements dating to the late 18th century though the site was originally occupied by a bawn (CV011-004-001) built in 1573.

The Castle Saunderson Estate is bordered by Castle Lough, Lough Sarah, Drumlaney Lough and contains Rahultan Lough East. The area of the estate has been increased by planting and there are lawns and mature planting visible near the current castle building. Woodland walks are also visible within the estate though there are no signs of garden structures, gateways or gatehouses. The buildings and woodland associated with the estate are indicated on all edition Ordnance Survey map sheets where they are labeled Castle Saunderson Demesne. The site, today, is owned by Scouting

Ireland and has its main features substantially present though its peripheral features are unrecognisable. As mentioned, Castle Saunderson is listed on the Record of Protected Structures for County Cavan under CV11001. The Castle Saunderson Demesne will not be impacted upon by the proposed restoration of the canal.

12.7 PREVIOUS ARCHAEOLOGICAL INVESTIGATIONS

Examination of *Excavations: Archaeological Investigations in Ireland* revealed that several previous archaeological investigations have been carried out within the vicinity of the proposed restoration of the canal. However, none of these are directly related to the actual line of the proposed restoration.

Of these previous archaeological investigations, three have taken place in County Monaghan and one within County Cavan. The County Monaghan archaeological investigations all relate to Cara Street in the town of Clones. The first of these took place in 1998 in relation to the proposed development of a site previously used as a car park located approximately 50m from the boundary wall of the graveyard containing the round tower (MN011-010-02) and stone sarcophagus (MN011-010-04). A trench measuring 9m by 1.8m and orientated northeast to southwest was excavated revealing the remains of a flat bottomed ditch at a depth of 0.7m (Moore, 1998). This ditch was 1.3m wide at the point where it was dug into subsoil by 1.1m wide at its base by 0.3m deep. A pottery sherd with green glaze on its inner surface and three clay pipe fragments were uncovered at the interface between the undisturbed ditch fill and the topsoil suggesting that the ditch dates to the 17th century when the town underwent considerable change. Two modern rubbish pits were also uncovered towards the centre of the test trench.

The next archaeological investigation also took place in Cara Street in 2005 and related to a proposed residential development close to the round tower (CV011-010-02). The site consisted of vacant dwelling houses which were to be demolished and replaced by a three storey dwelling house (Clarke, 2001). Two test trenches were excavated within the footprint of the development though nothing of archaeological significance was uncovered. It was noted that the previous buildings had been scarpred into the existing hillside and it is likely that this removed any archaeological deposits that may have existed.

The last archaeological investigation in County Monaghan within the vicinity of the proposed restoration also took place in Cara Street. This testing took place in 2005 in relation to a proposed housing development adjacent to the round tower (MN011-010-02). Testing within took the form of four trenches which revealed that the ground level within the site had been raised with clay imported from elsewhere and covered with a layer of hardcore (McLoughlin, 2005). The proposed development involved piling for the house foundations which were to be located a maximum of 0.6m below the present ground level with site services totally within the imported material. Given this, it was deemed unnecessary to test trench in areas outside the house footprints. The trenches were excavated to depths between 2.1-2.6m exposing natural yellow clay in the north part of the site and peat in the south end. The clay and peat was overlain with topsoil, between 0.9-1.3m thick. This was in turn

sealed with a layer of dumped clay and building debris 0.8-1.5m. Nothing of archaeological significance was uncovered during the testing.

12.7.1 National Museum and Ulster Museum Topographical Records

The topographical records held by the National Museum in Dublin and the Ulster Museum in Belfast were examined for evidence of possible archaeological artefacts uncovered within the townlands where the proposed restoration of the canal will take place.

Records examined within the National Museum related to the townlands of Teehill, Cloncurrin, Munnilly, Clonshanvo, Drumully, Drumsloe and Clontask in County Monaghan and the townland of Castle Saunderson in County Cavan.

Records examined in the Ulster Museum related to the townlands of Annaghmore Glebe, Cloncorrick, Clonfad, Clongowna, Cornaghan, Derrybrack, Derryelvin, Derrykerrib, Derrynure, Drumcrin, Edergool, Goladuff, Gortnacarrow, Rabbit Island and Tievegarrow in County Fermanagh.

Neither Museum had records of artefacts being recovered from any of the townlands along the line of the proposed restoration.

12.7.2 Historic Cartographic Evidence

The First Edition Ordnance Survey map sheet (1835) showed the layout of the canal during the first half of the 19th century. The canal had not yet been constructed though its intended route was shown on this map sheet. The line of the canal was shown curving southwest to south of Clones. Many of the recorded archaeological sites were marked within the town though the area of the intended canal was shown as largely featureless and this included the area where the proposed marina will be located at Clones.

The proposed line of the canal continued southwest crossing the original Cavan Road and passing to the immediate west of Teehill House. This property was shown as located on the Cavan Road at this stage and it was obvious that the current Cavan Road has been realigned because of the canal. The proposed realignment follows the existing line of the canal from Clones and no features were noted along its path. Several limestone quarries were noted within the vicinity though the area appeared to be largely agricultural.

The intended line of the canal was shown running southwest across the unnamed stream that forms the County boundary between Monaghan and Fermanagh. Clonfad Bridge (IHR 01315:000:00) was shown but not identified. The proposed restoration of the canal will see the stretch of canal run to the south of the intended line. This area was shown as featureless on this map edition.

The intended line of the canal continued southwest running adjacent to the Cavan Road. The proposed restoration will follow this line and no features were indicated along the intended line of the canal until the townland of Munnilly. Here, the intended line of the canal was shown to run across an existing road which ran southeast to the unnamed Munnilly Bridge (IHR 01316:000:00) which carried the road over the stream forming the county boundary and into Monaghan. A small rectangular building was shown on the southwest side of the road to the southeast of the intended line of the canal. The proposed restoration will see the new line of the canal run across this location. No other features were shown within this area.

The intended line of the canal was shown to continue southwest adjacent to the Cavan Road crossing two watercourses which ran southeast to join the stream forming the county boundary. The proposed restoration will run to the south of the intended line of the canal and also crosses the two watercourses which are still extant. Further to the southwest the intended line of the canal crossed a road at Clongowna. Several buildings were shown along this road suggesting a small community. The intended line of the canal avoided these buildings. The proposed restoration follows the line of the canal in this area and also avoids the locations of these buildings. Several gravel pits were shown in the vicinity though the area appeared largely agricultural with any field boundaries shown as straight features. The rath (FER 262:016) was clearly shown to the south of the intended line of the canal as a heavily vegetated circular feature labelled *fort*.

The proposed restoration follows the intended line of the canal to the southwest with the ground shown as featureless agricultural land with scattered dwellings. At the townland of Derrynure, the intended line of the canal was shown to curve south-southwest while the line of the restoration continues southwest. This area was depicted as marginal wet, terrain. The intended line of the canal continued curving south-southwest clipping the north extent of Cloncorrick Lough before curving northwest again around the top of Drumsloe Lough and over several dwellings. The proposed restoration continues southwest to the north of the intended line running to the north of Cloncorrick Hill though an area of marginal ground, agricultural land and scattered dwellings with some attached orchards.

The intended line of the canal and proposed restoration rejoin one another at Drumsloe continuing southwest through an area of marginal ground. The tree ring (MO16:018) was clearly marked with the intended line of the canal clipping its north side. The intended line of the canal continued southwest to Gortnacarrow where it turned sharply to the north before curving northwest to join the River Erne. The proposed restoration follows the intended line to Gortnacarrow before running west-northwest across the Cavan Road into the River Erne. A small scattering of buildings was shown close to Gortnacarrow Bridge (IHR 01327:000:00) while the ground to the west of the Cavan Road adjoining the River Finn was shown as marginal with a quarry in its south extent adjacent to the bridge. No structures or other features were indicated along the path of the restoration.

The restoration followed the River Finn from this point and few features were shown on the river other than Wattle Bridge (IHR 01326:000:00). A new section will be created taking the canal to the

immediate south of the bridge and bypassing it. This area was shown as marginal ground. Similarly, the restoration will see a new section created at Derrykerrib. This new section will also run through marginal ground. The majority of terrain adjacent to the river consisted of marginal ground and agricultural fields. However, Castle Saunderson Demense was clearly visible as a planned landscape to the immediate south of the river.

The 1909 Ordnance Survey map sheet showed the area of the proposed restoration at the start of the 20th century. The northeast extent of the proposed restoration was still located on the south outskirts of Clones though the Ulster Canal was now extant forming a highly visible feature. Other development was evident including a horse fair set partly in the location of the proposed marina. The remainder of the proposed marina consisted of open ground. The Cavan Road had now been realigned onto its current route to the west of the canal.

The proposed realignment follows the line of the existing canal south from Clones with canal related features evident such as the canal stores adjacent to the marina and the bridge giving access to Teehill Cottage across the canal. Further to the southwest, the line of the canal crossed into County Fermanagh with the aqueduct (IHR 00030:058:00) and Clonfad Bridge (IHR 01315:000:00) clearly visible. The proposed realignment will likely run to the south of these sites though no features were marked within the line of the proposed realignment on this map edition.

The proposed realignment rejoins the line of the existing canal further to the southwest and continues so until the area of Munnilly Bridge (IHR 01316:000:00). The bridge (IHR 00030:061:00) carrying the road over the canal was shown but not identified and the house noted on the previous map edition was still extant adjacent to the road. The proposed restoration will see the new canal pass to the east of the bridge (IHR 00030:061:00) and continue southwest to the east of the original line of the canal. Additionally, a new road layout will be created to Munnilly Bridge (IHR 01316:000:00). This area was shown as agricultural ground on this map edition.

The proposed restoration merges with the original line of the canal further to the southwest passing under the road bridges (IHR 00030:064:00 and 00030:065:00). Further to the southwest, the railway line was clearly evident running northeast to southwest across the area and crossing the canal on the bridge (IHR 00030:066:00). The original line of the canal continued southwest crossing under Kellys Bridge in the townland of Clonlura as it ran towards Drumsloe. A swing bridge was marked at Drumsloe carrying the road over the canal. This area was shown as featureless agricultural ground on this map edition. The tree ring (MO16:018) was clearly visible and its north extent had obviously been truncated by the canal.

The original line of the canal was seen to continue to Gortnacarrow where it turned to the north to run adjacent to the Cavan Road before turning to the northwest and running to the River Finn. Several buildings were shown at Gortnacarrow including the canal warehouse (HB12/02/091) which was shown as an unidentified building immediately adjacent to the south of the canal. The proposed restoration will see moorings, a double lock and other features created at this location. This map

edition showed the area to consist of an agricultural field with higher ground to the north. The ground to the west of the Cavan Road was still indicated as marginal and liable to floods though there were no signs of the former quarry shown to the south on the previous map edition. The bridge, lock and mooring post (IHR 00030:072:00) were clearly shown to the north adjacent to the Cavan Road.

The proposed restoration joins the River Finn at this location and continues curving round to the northwest to join Lough Erne. The adjacent ground was generally shown as marginal and prone to flooding though better, higher ground was shown inland. The recorded archaeological sites marked on this map edition within the area tended to be on this higher ground. The route of the proposed restoration will take it past Wattle Bridge (IHR 01326:000:00) with the canal skirting around to the south of the bridge. This area was shown to consist of marginal ground on this map edition.

The general area adjacent to the river appeared to consist of a mixture of agricultural and marginal ground liable to flooding and cut with drainage ditches. Few dwellings were shown though the exception to this was Castle Saunderson which was highly visible as a designed landscape to the south. The lock and mooring post (IHR 00030:071:00) were clearly shown marking the west extent of the Ulster Canal and no other notable features were visible along the ring banks on the final stretches of the River Erne towards Lough Erne.

12.8 SITE VISIT

The line of the proposed restoration was walked in order to verify the results of the baseline study as well as to assess the potential impact of the proposed scheme. The line of the proposed restoration was walked starting at its northeast extent at Clones and the discussion of the site visit will follow this. All Plates for reference in this section can be found in **Appendix F**, along with full details of all sites, monuments and buildings assessed in this section.

It is proposed that a marina will be created at Clones adjacent to the existing canal (**Plate 1**). This area currently consists of level, marginal ground which is overgrown with vegetation and wet underfoot. The area immediately adjacent to the west was shown on cartographic sources as the site of a Horse Fair. This area is now a Children's play area which includes a hand ball alley and is designated for redevelopment by Clones Town Council. Immediately adjacent to the southwest are the former canal stores (**Plate 2**). These are in very good condition and are currently used as tearooms.

The original canal is extant along this stretch leaving Clones and the proposed restoration follows this. The bridge at Teehill House is still extant providing access across the canal and this bridge will be retained though will require remedial works (**Plate 3**). The line of the original canal is still very visible in this area though it is largely choked with vegetation while modern disturbance is evident in the form of a metal pipe running across the canal (**Plate 4**).

The line of the canal becomes less distinct further to the southwest and has been in-filled with modern housing built over its former route at Clonfad on the border between Monaghan and Fermanagh. The aqueduct (IHR 00030:058:00) is largely overgrown though still visible while Clonfad Bridge (IHR 01315:000:00) is also clearly visible though this structure appears to have been replaced by a modern bridge (**Plate 5**). NIEA: Protecting Historic Buildings considers both sites historic structures though it is apparent that the former Clonfad Bridge no longer exists having been replaced by a modern structure. The final treatment of the line of the proposed restoration has yet to be decided at this location with options to either bypass the aqueduct (IHR 00030:058:00/HB 12/02/078) or refurbish it for use in the scheme. The line of the proposed restoration will run to the southeast to avoid the adjacent modern dwelling which will take it through an agricultural field. The terrain within this field is level and it was under long pasture at the time of the site visit (**Plate 6**).

The line of the proposed restoration continues southwest curving around the existing dwellings before rejoining the original line of the canal. As mentioned, the terrain within this area is level though higher ground is located to the east. The rath (MO016-003) is located on a hill to the southeast of the proposed restoration though is not visible from the lower ground (**Plate 7**). The original line of the canal has been in-filled within this area.

Further to the southwest, the line of the original canal passed under the bridge (IHR 00030:061:00) which carried the road southeast to Munnilly Bridge (IHR 01316:000:00). Although the canal has been in-filled with the road running adjacent to the north, the bridge (IHR 00030:061:00) is intact and will be retained under the current scheme with a towpath running under it (**Plate 8**). The main line of the restored canal will be diverted to the south and will run through the current road. A building was noted at this location on the cartographic evidence though there are no longer any visible signs of this.

An existing shed on the Cavan Road located adjacent to the bridge (IHR 00030:061:00) will be demolished while the junction to Munnilly Bridge (IHR 01316:000:00) will be closed. According to local information, the shed formally contained stables associated with the canal. A new junction and section of road will be created further to the southwest which will link to Munnilly Bridge (IHR 01316:000:00). Examination of Munnilly Bridge (IHR 01316:000:00) revealed that this is a modern concrete structure and the original bridge noted on the Industrial Heritage Record no longer exists (**Plate 9**).

As mentioned, the original line of the canal has been in-filled to the southwest and modern dwellings have been built over it. These constrain the line of the restoration and it will run slightly further to the southeast. The terrain within this area is flat and under pasture though higher ground is evident to the southeast. The rath (FER 262:016) and enclosure (FER 262:017) are located on this high ground and prominently visible within the area (**Plate 10** and **Plate 11**).

The original line of the canal becomes apparent once more further to the southwest in Derrynure though the canal is still choked with vegetation. While the line of the original canal is clearly visible, the surrounding terrain changes from improved pasture to marginal ground. A large derelict limekiln is

evident within this area though it is uncertain whether it was linked to the canal or was simply an agricultural feature to treat the marginal surrounding ground (**Plate 12**).

The canal bridge (IHR 00030:065:00) is located to the southwest of the limekiln carrying a local road over the canal (**Plate 13**). This bridge will be retained under the scheme. The original line of the canal remains extant further to the southwest though the canal is choked with vegetation. The former piers of the bridge (IHR 00030:066:00) which carried the railway over the canal are still evident though there is little other evidence of the former railway (**Plate 14**). These bridge piers will be retained under the scheme and the re-established canal will be narrowed accordingly at this location.

The canal remains extant as it runs southwest through good quality level, farmland towards Kelly's Bridge. Here, the ground becomes steeper on each side with dwellings on each side of the canal. Kelly's Bridge is an original canal feature carrying the local road over the canal and it will be retained under the scheme (**Plate 15**).

Further to the southwest, the original line of the canal runs under a road bridge at Drumsloe (**Plate 16**). The canal has been in-filled with soil and other debris though the bridge is still exposed. This structure appears to consist of a concrete lintel with concrete block side walls running over the former line of the canal which has been culverted. This structure is obviously not a swing bridge and appears to be a later addition probably constructed after the original swing bridge was removed. Under the proposed restoration, this structure will be replaced with a new fixed bridge with the approach roads re-profiled to modern standards. The terrain to the northeast of the existing canal/bridge consists of level marginal pasture currently used for grazing (**Plate 17**) while the terrain to the northwest consists of better quality pasture with higher ground to the northwest (**Plate 18**).

The original line of the canal continues to the southwest and is discernible though in-filled or choked with vegetation. The former towpath has been modified into a gravel trackway which changes to grass further to the southwest. This trackway appears to be regularly used as a thoroughfare by local vehicles. The proposed restoration follows the original line of the canal along this section with the towpath also being reinstated while a new agricultural access will be created running southwest adjacent to the towpath. The closest recorded archaeological site to the scheme is the tree ring (MO 16:018) which is located directly adjacent to the south.

Historic cartographic evidence suggested that the north extent of this feature was truncated by the line of the original canal though the site appears largely intact (**Plate 19**). It consists of an earth bank enclosing an interior heavily overgrown with vegetation and is most apparent from the southeast. The earth bank shows some signs of erosion and modern lightweight, plastic fence posts have been driven into the bank on the northeast side of the tree ring. A modern access also runs past adjacent to the tree ring on this side though this feature does not appear to have encroached upon the site. The dense vegetation continues to the southwest of the tree ring with the result that this side of the site is completely obscured. The agricultural access proposed under the scheme will run through the tree ring (MO 016:018).

The original line of the canal and proposed restoration continue to the southwest and the former canal complex at Gortnacarrow. The line of the original canal is still very apparent though the canal itself has been in-filled at this location (**Plate 20**). The former canal stores (HB 12/02/091) are still extant with the north facing first floor elevation level with the former level of the canal. This suggests that the original line of the canal has been removed in this area (**Plate 21**).

The canal stores (HB 12/02/091) will be retained in private ownership within the scheme with the area to the immediate north and east developed as a car park and marina leading onto a double lock chamber to the northwest. The footprint of the marina will also incorporate part of an adjacent field to the north (**Plate 22**). This field consists of good quality pasture with the terrain sloping uphill to the northwest and north.

The original line of the canal turned north at Gortnacarrow to run adjacent to the Cavan Road. There are few traces of the original line past the canal stores (HB 12/02/091) with most of the canal removed by modern development. However, one feature that is still extant is the former lock house (HB 12/02/090) which is located in a prominent position overlooking the Cavan Road and the adjacent modern development (**Plate 23**). This lock house is well maintained and appears to be a dwelling in private ownership. The lock house will be retained under the proposed scheme and will remain in private ownership.

The line of the restoration diverges from the original line of the canal at Gortnacarrow with a new stretch of canal running northwest past the lock house, across the Cavan Road into the adjacent field and the River Finn (**Plate 24**). This new stretch of canal will entail a double lock being created to carry the canal over the hill while the adjacent stretch of the Cavan Road will be bridged over the canal. This bridge will include a pedestrian underpass to the north. A car park will be created on the east side of the Cavan Road adjacent to the new road bridge (**Plate 25**). This car park will sit on the former line of the canal though this area is overgrown with vegetation and there are no visible signs of the canal though these are possibly obscured by vegetation.

The former line of the canal appeared to sit at a higher level than the adjacent Cavan Road while a modern agricultural track is located adjacent to the east. This track may be set on the remains of the tow path. The lock, bridge and mooring post (IHR 00030:072:00) was located to the immediate north of this area. These features have been largely removed though the remains of the lock can still be discerned under thick vegetation adjacent to the road (**Plate 26**).

As mentioned, a new stretch of canal will run through the area adjacent to the west between the Cavan Road and the River Finn. Additionally, an amenity area will be created within this area to the south. This area currently consists of a field of level marginal pasture (**Plate 27**). Historic cartographic evidence suggested that this field is part of the floodplain of the River Finn.

The line of the proposed scheme now follows the River Finn curving round to the northwest to Lough Erne. The scheme will generally utilise the existing river with dredging required in places though additional groundworks will be required in places. The River Finn is crossed at Edergool by Wattle Bridge (IHR 01326:000:00) which is also a listed building (HB 12/02/084) and it is proposed that the line of the proposed scheme shall bypass the bridge by cutting around it to the south (**Plate 28**). This new cut will run through good quality pasture adjacent before rejoining the River Finn a short distance to the west of Wattle Bridge (IHR 01326:000:00). The river is bounded by County Cavan to the south at this location and the Castle Saunderson Demense (CV-27) (**Plate 29**).

The River Finn passes under another road bridge further to the north at Derrykerrib (**Plate 30**). This bridge is a modern concrete construction which dates to the 20th century and is not noted on either the Industrial Heritage Record or Historic Buildings Database. It is proposed that the bridge is by-passed by the scheme by a cut in the fields to the west (**Plate 30** and **Plate 31**). These fields are low lying and consist of marginal pasture. It is also proposed that the level of this bridge be raised by 1m to ensure that a minimum air draft is achieved.

The proposed scheme follows the River Finn as it flows northwest to Lough Erne with some dredging required in places. The only other feature of note within this area is the remains of the lock (IHR 00030:071:00) which is heavily overgrown though still visible at Edergool (**Plate 32**). This lock (IHR 00030:071:00) represents the western extent of the original Ulster Canal.

12.9 POTENTIAL IMPACTS

12.9.1 Direct Impacts

The proposed development concerns the restoration of the Ulster Canal between Clones and Lough Erne. Detailed descriptions of the scheme have already been given previously within this Environmental Impact Assessment and also briefly mentioned within this section however; works associated with this scheme will impact upon the remains of the Ulster Canal which is an Industrial site and therefore part of the Cultural Heritage resource of the area and Ireland in general. Additionally, the scheme will impact upon other Industrial Heritage sites within the area.

Given this, it is important that the exact nature of the scheme is known so that the potential impacts on Cultural Heritage can be accessed. The Ulster Canal operated until 1929 and was abandoned in 1931. Since then the canal has become derelict with large sections in-filled though the original route is still discernible in most places and many built features are still extant such as canal stores, aqueducts and bridges. The restoration, where possible, has sought to follow the original line of the canal though there are areas where this is not possible due to subsequent modern development. Additionally, many of the upstanding built features have been awarded statutory protection.

The original line of the canal has a bed width of 6m which, during the period of operation was found to be restrictive. Given this, the restoration will see the canal widened and deepened. The exact width of the new canal will vary in relation to local conditions however; it will entail removal of the existing stretches of canal. Additionally, the restoration will utilize the River Finn to access Lough Erne. The river will require dredging in places.

As mentioned, the original line of the canal has been in-filled and built over in places. The restoration will seek to avoid these areas with new stretches of canal created in adjacent terrain which consists of agricultural fields. These stretches will require groundworks in the form of excavation. Additional groundworks will be required for the construction of marina/lock facilities including car parking at Gortnacarrow and marina facilities including car parking at Clones.

Many original features associated with the canal are still extant. These mainly take the form of bridges, though an aqueduct/siphon (IHR 00030:058:00/HB 12/02/078), canal stores (HB 12/02/091) and a lock keeper's cottage (HB 12/02/090) also remain. Many of these features have been awarded statutory protection by NIEA:Built Heritage whilst others, such as the lock keeper's cottage (HB 12/02/090) are in private ownership. Given this, it is largely intended that only minimal disturbance will be created in relation to the majority of these features. However, it should be noted that the final treatment of the line of the proposed restoration at Clonfad has not yet been decided. The aqueduct/siphon (IHR 00030:058:00/HB 12/02/078) is set at this location and this structure is regarded as Historic Structure by NIEA:Built Heritage and is also noted on the Record of Protected Structures by Monaghan County Council. There are two options for this area. The first option would see the aqueduct/siphon (IHR 00030:058:00/HB 12/02/078) bypassed, while the second option would incorporate the structure into the scheme. Additionally, one archaeological site, tree ring (MO016-018) is also located along the line of the restoration. **Table 12.6** outlines the existing features along the restoration with any proposed works.

Table 12.6 Direct Impacts - Heritage Features

Site Number	Type	Statutory Protection	Location/Townland	Proposed Works
N/A	Canal Stores		Clones	Building retained in private ownership. Access towpath constructed to frontage
N/A	Access Bridge		Teehill House	Bridge to be retained and open to traffic. Under pass towpath to be removed with underpinning and reinstatement of stone as required
IHR 00030:058:00/HB 12/02/078	Aqueduct	Listed	Clonfad	Structure to be retained though two options available. Firstly structure bypassed. The second option would see the structure refurbished. This would require dismantling and rebuilding of structure.
IHR 01316:000:00	Road Bridge		Munnilly	Modern structure to be replaced

IHR 00030:061:00/HB 12/02/119	Canal Bridge	Listed	Munnilly	Bridge to be retained as feature for pedestrian/stock access {Steep approaches}. Under pass towpath to be removed with underpinning and reinstatement of stone as required
	Former Stables		Munnilly	Located at road junction. To be removed
IHR 00030:063:00	Canal Bridge		Clongowna	Original bridge since removed
IHR 00030:064:00	Canal Bridge		Tievegarrow	Original bridge since removed
IHR 00030:065:00/HB 12/02/079	Canal Bridge	Listed	Cloncorrick	Bridge to be retained and open to traffic. Under pass towpath to be removed with underpinning and reinstatement of stone as required
IHR 00030:066:00	Former Railway Bridge		Cloncorrick	Any remaining features to be retained with minor repairs as required.
	Road Bridge (Kelly's Bridge)		Clonlura	Bridge to be retained and open to traffic. Under pass towpath to be removed with underpinning and reinstatement of stone as required
	Former Swing Bridge		Drumsloe	No original features visible - now road culvert. Replace existing structure with new fixed bridge with approach roads re-profiled to modern standards.
MO 016-018	Tree Ring		Clonoony	Agricultural access road constructed across site.
HB 12/02/091	Gortnacarrow Canal Stores	Listed	Gortnacarrow	Buildings (Private ownership) to be retained and where possible incorporated into proposals. No intention to obtain ownership.
HB 12/02/090	Lock Keeper's Cottage	Not listed	Gortnacarrow	Building (Private Ownership) to be retained. No intention to obtain ownership. Access ramp and public services created adjacent
IHR 00030:072:00	Bridge and lock		Gortnacarrow	No plans
IHR 01327:000:00/HB 12/02/089	Road Bridge	Listed	Gortnacarrow	No plans. Outside development
IHR 01326:000:00/HB 12/02/084	Road Bridge (Wattle Bridge)	Listed	Edergool	Canal bypass section to be constructed around bridge. Road level of bridge to be raised 200mm approx and section of wall removed and reinstated on completion of new bridge over new canal section.
	Road Bridge		Derrykerrib	Modern bridge retained, raised by approximately 1m with earth embankments required both sides
IHR 00030:071:00	Mooring post/lock		Edergool	To be unaffected by proposals

Given the above information, it is likely that the main direct impacts to Cultural Heritage will be associated with the construction of the re-established canal. The requirement for wider and deeper bed width means that existing sections of the canal both extant and in-filled will be removed. These existing sections are part of the original Historic fabric of the canal as used until 1929.

The canal is located on low level ground with higher ground to the south. This level terrain would have assisted the construction and operation of the canal. The surrounding terrain appears to consist of marginal or improved pasture. The majority of recorded sites are located away from the canal and will not be impacted upon while recorded sites along the existing canal are related features which will be retained. However, there are five exceptions to this.

The first is the aqueduct/siphon (IHR 00030:058:00/HB 12/02/078) at Clonfad which is also regarded as a Historic Structure by NIEA:Built Heritage and is noted on the Record of Protected Structures by Monaghan County Council. The design of the scheme has not yet been finalised in relation to the area of this structure and two options have been proposed. The first of these would see the aqueduct/siphon (IHR 00030:058:00/HB 12/02/078) bypassed. The structure would remain undisturbed under this option. The second option proposes that the aqueduct/siphon (IHR 00030:058:00/HB12/02/078) is refurbished. However, the internal workings of the structure have collapsed since the Ulster Canal went out of use with the result that these require replacing. Given this, under this option, the aqueduct/siphon (IHR 00030:058:00/HB12/02/078) would be dismantled, new modern internal workings installed with the original structure rebuilt.

The second is the road bridge (IHR 01316:000:00) at Munnilly which carries the road over a local stream. Under the current proposals, this bridge will be replaced with the road system realigned. However, examination during the site visit revealed that the current bridge is a modern structure and not the feature shown from the First Edition Ordnance Survey map sheet (1835) onwards. Similarly, a swing bridge was located within the townland of Drumsloe. Under the current proposals this bridge will be replaced by a new fixed bridge with the approach roads re-profiled to modern standards. Examination during the site visit revealed that the original swing bridge has been replaced with the canal culverted at this location.

The fourth site is a tree ring (MO016-018) which is located in the townland of Clonoony towards the southwest of the re-established canal. This feature is located adjacent to an existing access lane adjacent to the canal and appears to have been truncated to the northwest by the construction of this lane. Despite this, the site remains relatively intact consisting of a small circular area surrounded by a stone and earth bank and a small ditch. This site was marked on the First Edition Ordnance Survey map sheet (1835) as a fort though has since been interpreted as a possible landscape feature. Under the current proposals, a new agricultural lane will be created running directly across the tree ring (MO 016-018). It is likely that all traces of this feature will be removed during the construction of this lane.

Also under the proposals, a row of former stables located adjacent to the road junction at Munnilly will be removed. These buildings are derelict and are not noted as Cultural Heritage features by NIEA:Built Heritage. However, these stables were associated with the canal when it was operational.

The construction of the restored canal and associated features both along the existing line of the canal and also along the new sections will require large scale groundworks. These groundworks could impact upon previously unrecorded Cultural Heritage features which would take the form of sub-surface archaeological features or deposits.

The majority of recorded archaeological sites within the area are located on higher ground to the south and north of the existing canal while the construction of the canal will have impacted upon any sub-surface archaeological features which may have existed. However, the restoration will see the footprint of the canal extended with the associated marina facilities, lock and realigned roads requiring large scale groundworks.

These groundworks will take place in areas not affected by the original construction of the canal and could, therefore, potentially impact upon sub-surface archaeological features, should they exist.

Additionally, the River Finn will be utilised to access Lough Erne. Recorded archaeological sites within the vicinity of the river include sites from all periods though the prehistoric is well represented. These include a possible cairn (FER 272:015, a possible court tomb (FER 272:006) and a group of five burnt mounds (FER 272:020). These sites represent a range of activities within the area which would have included using the local waterways for transportation.

While the River Finn will remain largely undisturbed by the scheme, areas will require dredging with the resultant spoil deposited on adjacent riverbanks. It is possible that this dredging could impact upon evidence of transportation such as log boats or the remains of other vessels.

As mentioned, there are a number of recorded sites located along the line of the scheme. These sites are generally bridges either associated with the former canal or carrying roads over the River Finn though, as mentioned, the aqueduct/siphon (IHR 00030:058:00) at Clonfad is also included. These will be retained under the current proposals. However, some modification and remedial works will be required to these sites such as the removal of existing tow paths and some underpinning and reinstatement of stonework. Retention of some of these sites will entail by-pass section of canal being created. In certain cases, these by-pass sections will see new bridges created alongside existing bridges with original stonework reinstated when the new bridges are completed while the existing road levels on existing bridges is raised. It has yet to be finalized if the aqueduct (IHR 00030:058:00/HB 12/02/078) at Clonfad will be retained. One option for this includes bypassing the structure. This option effectively leaves the structure as is, though some remedial work may be required. The second option would see the aqueduct/siphon (IHR 00030:058:00/HB 12/02/078) restored. This would require the complete replacement of the structure's inner workings which would entail the dismantling of the current structure and rebuilding the original stonework after the new inner workings were installed.

However, it should be noted that several of these sites including the siphon/aqueduct (HB 12/02/078) are regarded as Historic Structures and have been awarded statutory listed protected status. Indeed, the aqueduct (HB 12/02/078) spans the border between Northern Ireland and the Republic of Ireland. As such, it is subject to differing jurisdictions and legislation with the part within Northern Ireland afforded listed protected status while the part in the Republic of Ireland noted on the Record of Protected Structures held by Monaghan County Council. The Historic Structures associated with the scheme are given in **Table 12.7**.

Table 12.7 Direct Impacts - Historic Structures

Historic Buildings Number	Type	Grade of protection
HB 12/02/078	Aqueduct	B1
HB 12/02/119	Bridge	B2
HB 12/02/079	Bridge	B2
HB 12/02/084	Bridge	B2

Once a building is listed, consent is required for any works of alteration or extension which would affect its character as a structure of special architectural or historical interest (PPS 6, 1999). It is a criminal offence to alter a listed building without the appropriate listed building consent having first been sought and approved.

The Department of the Environment considers that inappropriate alteration can rob a structure of its architectural or historical merit as surely as demolition. As such, The Department operates a presumption in favour of historic structures and requires that applicants must be able to justify their proposals showing why these proposals are desirable and necessary. Given this, the Department requires full information regarding the proposed alterations/works to accompany each application so that a complete assessment of the likely impact of the proposals can be made (PPS 6, 1999).

In light of this, listed building consent must be sought and approved before any work may take place upon these structures. This listed building consent must be accompanied by full information regarding the level of underpinning, reinstatement of stone and other works proposed.

12.9.2 Indirect Impacts

While the majority of potential impact associated with Cultural Heritage will be direct there is also the potential for indirect impact. There are several recorded sites within the vicinity of the proposed scheme that have been awarded statutory protection by the Department of the Environment (Northern Ireland) and Monaghan County Council. The majority of the sites are located some distance from the restoration of the canal and will not be impacted upon. However, several sites are located either on the line of the restoration or directly adjacent. These sites are shown in **Table 12.8**.

Table 12.8 Indirect Impacts - Heritage Sites On or Adjacent to Restoration Works

SMR/Historic Buildings Number	Type	Location	Grade of protection
HB 12/02/078 & Record of Protected Structures	Aqueduct	Clonfad	B1
HB 12/02/119	Bridge	Clonfad	B2
HB 12/02/079	Bridge	Cloncorick	B2
HB 12/02/091	Canal Stores	Gortnacarrow	B1
HB 12/02/089	Bridge	Gortnacarrow	B1
HB 12/02/084	Bridge (Wattle Bridge)	Edergool	B2
FER 272:006	Cairn (passage grave?)	Annaghmore Glebe	Scheduled
FER 272:015	Mound	Derrykerrib	Scheduled

The statutory protection awarded to these sites extends to the integrity of their settings. The integrity of these settings could be indirectly impacted upon by the proposed restoration of the canal which could create a visual impact.

As mentioned, several of these sites are located along the line of the proposed restoration. The bridge (HB 12/02/119) and (HB 12/02/084) will be by-passed with the canal running around them. The original canal is either overgrown with vegetation or in-filled within the vicinity of these sites with the result that the original settings have been degraded. The restoration of the canal would, therefore, potentially benefit the settings of these sites.

Similarly, the aqueduct/siphon (HB 12/02/078) is located adjacent to a modern dwelling at Clonfad. The final treatment of the line of the proposed restoration has yet to be decided for this area with an option being that the structure will be by-passed. It is important that any bypass works, such as bank protection features, do not visually impact upon the setting of the aqueduct (HB 12/02/078). The second option involves the refurbishment of the aqueduct/siphon (HB 12/02/078) and its inclusion within the scheme. This option would see the structure fully restored. The structure is currently derelict and covered with vegetation. Given this, this option would be beneficial and it is unlikely that inclusion within the scheme would visually impact upon the setting of the aqueduct/siphon (HB 12/02/078).

Wattle Bridge (HB 12/02/084) will also be by-passed though the line of the bridge will be maintained with stonework reinstated. The River Finn will be utilised for navigation at this point with the setting remaining largely as is. It is unlikely that the by-pass section of canal skirting around Wattle Bridge (HB 12/02/084) will visually impact upon the setting. This is also the case for the mound/possible passage tomb (FER 272:006) which is located adjacent to the south of Wattle Bridge (HB 12/02/084).

The former canal stores (HB 12/02/091) are located directly adjacent to the former canal at Gortnacarrow. The original line of the canal has largely been removed at this location with the stores lying derelict and modern development evident to the immediate west. Given this, the original setting

of the canal stores (HB 12/02/091) has been removed. It is proposed that the original line of the canal is restored with a marina and lock at this location. These features would enhance the setting of the canal stores (HB 12/02/091) and are unlikely to create a visual impact.

Gortnacarrow Bridge (HB 12/02/089) is located to the southwest of the previous site on a sharp bend on the Cavan Road. Dense tree growth along the approach to the bridge means that it is only fully visible from the River Finn. Under the current proposal, the canal will be carried across the Cavan Road on a new bridge to the north of Gortnacarrow Bridge (HB 12/02/089) before entering the River Finn at a bend in the river. The River Finn is not navigable under the Gortnacarrow Bridge (HB 12/02/089) and it is unlikely that this new bridge and stretch of canal will be visible from the south side of Gortnacarrow Bridge (HB 12/02/089). Gortnacarrow Bridge (HB 12/02/089) will be clearly visible from the River Finn to the north with vessels on the proposed stretch of canal afforded very good views of the bridge. Given this, it is unlikely that the reestablished canal will create a visual impact upon the setting of Gortnacarrow Bridge (HB 12/02/089).

The last site with statutory protection within the immediate vicinity of the proposed restoration of the canal is a mound (FER 272:015). This site is set on damp, level pasture to the west of the River Finn. Under the proposals, the River Finn will be utilised for navigation into Lough Erne at this point. As such, the natural layout of the river will be maintained and the setting of the mound (FER 272:015) will not be affected.

Given these conditions, there is a low probability that the proposed restoration of the canal will cause any indirect impacts.

12.10 MITIGATION MEASURES

12.10.1 Mitigation Measures for Direct Impacts

As outlined above, the proposed restoration of the canal will involve different levels of direct impact. These vary with the nature of the work and the severity of the impact.

Potentially the most severe direct impacts will be associated with the groundworks carried out in relation to the construction of the new canal and associated features such as marina facilities, a new lock and road realignments. The majority of the restoration seeks to follow the existing line of canal which is either extant or in-filled. The proposed new canal will be wider and deeper than the original navigation with the result that the majority of the existing canal will be completely removed.

Given this, it is recommended that a section of the original canal is recorded to archaeological standards prior to construction works commencing. This recording will note the dimensions and constructional details of the canal and will be accompanied with a colour photographic record. It is

recommended that, for reasons of Health and Safety, the recording should take place within a dry stretch of canal, i.e. a section that has been in-filled.

The construction of the new canal will also impact upon four features within the immediate vicinity. Two of these are noted as Cultural Heritage sites while the other two, though canal related, are not. The sites are a tree ring (MO 016-018), Munnilly Bridge (IHR 01316:000:00) and a swing bridge at Drumsloe and former stables associated with the canal.

The tree ring (MO 016-018) is noted on the Record of Monuments and Places as maintained by DoE:HLG and has been classified as a modern landscape feature. The site is largely extant and will be impacted upon by the construction of a proposed agricultural access which will run across it. It is likely that the tree ring (MO 016-018) will be removed by groundworks associated with the construction of this agricultural access. Given this, it is recommended that the tree ring (MO 016-018) is recorded prior to groundworks commencing. It is recommended that this recording includes limited and targeted archaeological investigation within the tree ring (MO 016-018) to verify the nature of this site.

The aqueduct/siphon (IHR 00030:058:00/HB12/02/078) at Clonfad is currently derelict and covered in vegetation. The final treatment of the line of the proposed restoration has not yet been decided for this area and two options have been proposed for the treatment of the structure. The first would see the aqueduct/siphon (IHR 00030:058:00/HB12/02/078) bypassed and left undisturbed. This option would require no further mitigation. However, the second option would see the structure refurbished for use in the scheme. This would entail the dismantling of the current structure, the installation of new internal workings and the rebuilding of the original stonework around the new workings. Should this option proceed, it is recommended that the structure is photographically recorded prior to the current structure being dismantled.

The former stables are located adjacent to the Cavan Road and line of the former canal at the junction of the road to Munnilly Bridge (IHR 01316:000:00). These stables are currently derelict and will be removed under the current proposals. The stables were originally associated with the canal though are not noted on the Industrial Heritage Record. Given these conditions, it is recommended that the former stables are recorded by means of photographic survey prior to groundworks commencing.

The third site which will be severely impacted upon is Munnilly Bridge (IHR 01316:000:00) which carries a local road south over an unnamed stream. Under the current proposals, a new road junction will be created running north from the Cavan Road to the location of Munnilly Bridge (IHR 01316:000:00) which will be replaced. The site visit revealed that the current Munnilly Bridge is a modern structure and not the bridge marked at the spot from 1835 onwards. Given this, it is recommended that no further action is required in relation to this structure.

The last site to be severely impacted upon is the former swing bridge at Drumsloe which carried a local road over the canal. Under the current proposals, this feature will be replaced by a new fixed bridge with the approach roads re-profiled to modern standards. The site visit revealed that the former

swing bridge has been replaced with the canal culverted at this location. Given this, the former swing bridge no longer exists and, therefore, will not be impacted. Given this, it is recommended that no further action is required in relation to this structure.

As mentioned, the most severe direct impacts will potentially be associated with the construction of the new canal and its associated features. While it is intended that the line of the original canal will be followed as far as possible, the new canal will be much larger and will, through necessity, have to incorporate previously undeveloped. As such, groundworks associated with this have the potential to impact upon Cultural Heritage features which would take the form of previously unrecorded sub-surface archaeological features. Given this, it is recommended that mitigation should take the form of archaeological monitoring of topsoil stripping in areas where ground disturbance will take place.

The restoration of the canal will see the natural course of the River Finn used for access to Lough Erne from the canal facilities at Gortnacarrow. This will involve minimal disturbance though the river may require dredging at certain locations with the resultant spoil deposited at certain locations along the river bank. Such dredging has the potential to uncover archaeological evidence of riverine activity such as log boats or the remains of other vessels. Given this, it is recommended that dredging takes place under archaeological supervision with the resultant spoil examined for evidence of archaeological artefacts.

Under the current proposals, existing features associated with the canal such as bridges will require modification with tow paths removed while underpinning and reinstatement of stonework. Several of these features are considered Historic Structures and have been awarded statutory listed protection. As such, it is illegal to carry out works to these structures without listed building consent being first applied for and granted by the Department of the Environment (Northern Ireland).

The sites which have been awarded statutory protection have already been surveyed by the appropriate statutory bodies. However, other features which will be impacted upon have not been awarded statutory protection. These features are shown in **Table 12.9**.

Table 12.9 Protected Features for Alteration

Type of Site	Location	Proposed Works
Access Bridge	Teehill House, Clones	Bridge to be retained and open to traffic. Under pass towpath to be removed with underpinning and reinstatement of stone as required
Road Bridge (Kellys Bridge)	Clonlura	Bridge to be retained and open to traffic. Under pass towpath to be removed with underpinning and reinstatement of stone as required

It is recommended that these two structures are photographically recorded prior to their underpass tow paths being removed and remedial work commencing.

Given the above, the following **Table 12.10** can be used in relation to proposed mitigation for direct impacts.

Table 12.10 Proposed Mitigation for Direct Impacts

Nature of Direct Impact	Nature of Impact	Mitigation required
Groundworks associated with construction of new canal along existing line of Ulster Canal	Disturbance and removal of remains of existing canal and features- canal stables at Munnilly and tree ring (MO016-018) at Clonoony. Disturbance to ground levels adjacent to existing canal with possibility of disturbance to sub-surface archaeological features	Archaeological mitigation should be employed within these areas. A portion of the in-filled existing canal should be recorded prior to removal as should the canal stables at Munnilly and tree ring (MO 016-018) at Clonoony. Mitigation associated with areas of proposed ground disturbance adjacent to the existing canal should consist of archaeological monitoring of topsoil stripping
Groundworks associated with construction of new sections of canal and associated features such as marina complexes, new road junctions and lock in previously undisturbed ground	Disturbance to existing ground levels with possibility of disturbance to sub-surface archaeological features	Archaeological mitigation should be employed within these areas. Mitigation associated with areas of proposed ground disturbance should consist of archaeological monitoring of topsoil stripping
Dredging of sections of River Finn	Possible disturbance to archaeological artefacts on river bed	Archaeological mitigation required. Monitoring of dredging operations and examination of deposited spoil. All finds to be recovered, catalogues, described and where necessary conserved.
Refurbishment and inclusion of aqueduct/siphon (IHR 00030:058:00/HB 12/02/078) at Clonfad within scheme	Possible option proposed that would see structure included in scheme. Works would entail dismantling and rebuilding of structure which could lead to degrading of historic significance of structure. Works would also require statutory consent.	Mitigation required. Full details of proposed refurbishment should be prepared in advance of application for statutory consent to carry out works. Structure should be photographically recorded prior to works commencing.
Alteration and remedial work to existing structures including statutory protected structures and buildings	Alteration and remedial work to historic structures and buildings requiring statutory consent in many cases. Work possibly leading to degrading of historic significance of structure.	Mitigation required. Full details of proposed remedial work and alterations should be prepared in advance of application for statutory consent to carry out works. Non-statutory protected sites within scheme (Access bridge at Teehill and Kelly's Bridge Clonlura) should be recorded prior to alterations/remedial work taking place.
Removal of Munnilly Bridge (IHR 01316:000:00)	Original Munnilly Bridge (IHR 01316:000:00) has been replaced by a modern bridge which will be removed as part of road realignment	No mitigation required
Removal of former swing bridge at Drumsloe	The original swing bridge has been removed with the canal culverted at this location.	No mitigation required

It is recommended that mitigation should, where possible, take the form of archaeological monitoring of topsoil stripping in areas where ground disturbance will take place. These areas include the new canal, the associated marina facilities, lock and road junctions. The construction of the new canal will

effectively result in the removal of the existing canal. It is recommended that a section of the existing canal is recorded prior to removal.

This top soil stripping and investigation of the existing canal must be carried out by a backacting machine equipped with a toothless bucket which is under the constant supervision of a suitably qualified archaeologist under licence to NIEA: Built Heritage and DoEHLG (now DECLG).

An archaeological feature will be affected by the construction of the canal. This feature is a tree ring (MO016-018) and it is recommended that this feature is archaeologically recorded prior to removal. This recording should also take the form of limited archaeological investigation which should be carried out by a suitably qualified archaeologist under licence to DoEHLG (now DECLG).

Under the current proposals, sections of the River Finn will be dredged to facilitate navigation. This dredging could potentially impact upon archaeological artefacts on the river bed. Given this, it is recommended that dredging of the River Finn is carried out under archaeological supervision with deposited spoil also examined for evidence of archaeological artefacts. All finds will be retained, catalogued and described. Where necessary, finds will be conserved. This monitoring of dredging operations must be carried out by a suitably qualified archaeologist/s working under licence to NIEA: Built Heritage and DoEHLG (now DECLG).

Under the current proposals, existing built features along the route of the proposed restoration of the canal will be removed. The three built features which will be removed are former stables associated the canal at Munnilly, a modern road bridge which has replaced the former Munnilly Bridge (IHR 01316:000:00) and a culvert which has replaced the former swing bridge at Drumsloe. It is recommended that the former canal stables are photographically recorded and approved by NIEA:Built Heritage prior to the removal of the structure.

The modern road bridge which has replaced Munnilly Bridge (IHR 01316:000:00) is a modern structure and no further mitigation work is required in relation to its removal. Similarly, the culvert which has replaced the swing bridge at Drumsloe is a modern structure and no further mitigation works is required in relation to its replacement by a new fixed bridge.

The structure which may be refurbished is the aqueduct/siphon (IHR 00030:058:00/HB 12/02/078) at Clonfad. The final treatment of this area of the line of the proposed restoration has to be decided with one option being the refurbishment of this structure for use in the scheme. This refurbishment would see the structure dismantled and rebuilt around new internal workings. This work could lead to degrading of historic significance of the structure. Given this, it is recommended that the structure is photographically recorded prior to works commencing. Additionally the structure has been awarded statutory protection by both NIEA:Built Heritage and Monaghan County Council. As such, statutory consent must be applied for and received before any works take place.

Other built features along the route of the proposed restoration of the canal will be altered with remedial work carried out. Many of these structures have been awarded statutory protection and statutory consent must be applied for and received before any works take place.

Two further built features along the route of the proposed restoration of the canal do not have statutory protection. These built features are also proposed for alteration and remedial work. These built features are the access bridge at Teehill and Kelly's Bridge at Clonlura. It is recommended that these structures should be photographically recorded with the record approved by DoEHLG (now DECLG) prior to alterations/remedial work taking place.

Should archaeological deposits or artefacts be present, the licensed archaeologist will be responsible for communicating this to the client or appointed representative, as well as to the NIEA: Built Heritage and DoEHLG (now DECLG). A sample of the archaeological deposits identified at this stage may need to be further investigated by manual excavation and recording, discussed and agreed with the relevant representatives of NIEA: Built Heritage/DoEHLG (now DECLG) and may be subject to a separate archaeological methodology.

It is recommended that enough time is allowed in the development programme for a possible archaeological excavation. It should be noted that the results of all excavation including site evaluation and monitoring, must be compiled into a fully illustrated report.

12.10.2 Mitigation Measures for Indirect Impacts

It is likely that there will be no indirect impacts associated with the proposed restoration of the canal. Given this, no mitigation measures are required in relation to indirect impacts.

12.11 RESIDUAL IMPACTS

All direct impacts will occur during the construction phase when the original ground surface is disturbed and existing features either removed or altered. Any previously unrecorded sub-surface archaeological features that may exist will be uncovered during this phase. These features and the disturbance to the existing features will be resolved through appropriate mitigation agreed with client and the appropriate heritage authorities.

Given this, it is unlikely that there will be any residual impacts associated with the proposed restoration of the canal.

13 NOISE AND VIBRATION

13.1 INTRODUCTION

This section of the EIS assesses the potential noise and vibration impact associated with the proposal to reopen the section of the Ulster Canal between Upper Lough Erne and the town of Clones, for navigation and waterside recreation. The proposed design will principally follow the route of the original canal for 14km. The proposed development crosses three county borders (Fermanagh, Cavan and Monaghan) and is partly in Northern Ireland and partly in Ireland. The noise and vibration assessment reflects the different noise guidance documentation relevant to each jurisdiction.

Potential noise and vibration impacts that may be associated with the proposed development and that have been included in the noise and vibration assessment include:

- Noise and vibration impact associated with noise generated during the construction phase;
- The noise impact at the nearest noise sensitive receptors from noise generated by the operation of the plant/equipment associated with the proposed development;
- The noise impact at the nearest noise sensitive receptors from boats using the proposed canal;
- The noise impact from alterations to the traffic flows in the study area as a result of the proposed development.

This section should be read in conjunction with **Appendix G Figures 1.1a – 1.1g**.

13.2 METHODOLOGY

13.2.1 Relevant Noise Guidance Documents

Guidance Note for Noise in Relation to Scheduled Activities, 2nd Edition (EPA, 2006)

This EPA noise guidance document is intended to provide information, advice and guidance on noise from activities licensed by the EPA under the Integrated Pollution Prevention Control (IPPC) and waste licensing systems in Ireland.

The guidance document sets out basic noise and vibration concepts and provides a variety of practical techniques and measures for controlling noise. The document has been used as a reference document for completing the noise and vibration assessment for the proposed development.

Environmental Noise Survey Guidance Document (EPA, 2003)

This guidance document was created to provide acoustic guidelines to the operators of activities which are listed in the First Schedule of the EPA Act 1992, activities which are normally subject to IPC regime. The guidelines relate to conducting and completing Annual Noise Surveys.

While not specifically related to the completion of noise surveys for the planning process, the guidelines provide useful reference material for general noise surveys. It is in this context that these guidelines have been used as reference guidelines for the noise surveys completed as part of the proposed development.

Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements) (EPA, 2003)

This guidance document along with the EPA *Guidelines on the Information to be Contained in Environmental Impact Statements (2002)* provides the guidelines on current practice for the structure and content of Environmental Impact Statements in Ireland.

While the guidelines relate to all of the significant environmental issues that generally are of interest for EIA projects, it also gives specific guidance relating to noise and vibration.

Guidelines for the Treatment of Noise and Vibration in National Road Schemes (NRA, 2004)

These guidelines provide specific and detailed guidance on all aspects of the survey and assessment of noise and vibration for road schemes in Ireland. While the guidance document relates specifically to noise and vibration from road schemes, it provides useful reference material (e.g. regarding construction phase noise and vibration) that can be used for noise and vibration assessments such as the proposed Ulster Canal development.

World Health Organisation (WHO) – Guidelines for Community Noise (1999)

In 1999, the World Health Organisation (WHO) proposed guidelines for community noise. In this guidance, a L_{Aeq} threshold daytime noise limit of 55 dB is suggested for outdoor living areas in order to protect the majority of people from being seriously annoyed. A second daytime limit of 50 dB is also given as a threshold limit for moderate annoyance.

The guidelines suggest that an internal L_{Aeq} not greater than 30 dB for continuous noise is needed to prevent negative effects on sleep. This is equivalent to a façade level of 45 dB L_{Aeq} , assuming open windows or a free-field level of about 42 dB L_{Aeq} . If the noise is not continuous, then the internal level required to prevent negative effects on sleep is an $L_{Amax,fast}$ of 45 dB. Therefore, for sleep disturbance, the continuous level as well as the number of noisy events should be considered.

British Standard 8233: 1999 Sound Insulation and Noise Reduction for Buildings – Code of Practice

BS8233:1999 provides guidance values for a range of ambient noise levels within residential properties as shown in **Table 13.1** below.

Table 13.1: Internal Ambient Noise Levels for Bedrooms and Living Rooms

Citation	Typical Situation	Design Range dB L _{Aeq,t}	
		Good	Reasonable
Reasonable resting/ sleeping conditions	Living rooms	30	40
	Bedrooms	30	35

British Standard BS4142: 1997 – Method for rating industrial noise affecting mixed residential and industrial areas

BS4142: 1997 describes a method of determining the level of a noise of an industrial nature, together with procedures for assessing whether the noise in question is likely to give rise to complaints from persons living in the vicinity. In general, the likelihood of complaint in response to a noise depends on factors including the margin by which it exceeds the background noise level, its absolute level, time of day, change in noise environment etc., as well as local attitudes to the premises and the nature of the neighbourhood.

The standard has been used in this assessment in order to characterise suitable noise threshold limits that will ensure that the proposed leachate treatment system will not give rise to complaints at the nearest noise sensitive properties.

Calculation of Road Traffic Noise (CRTN) – Department of Transport (Welsh Office)

This Calculation of Road Traffic Noise (CRTN) guidance document outlines the procedures to be applied for calculating noise from road traffic. These procedures are necessary to enable entitlement under the Noise Insulation Regulations (NI) 1995 to be determined but they also provide guidance appropriate to the calculation of traffic noise for more general applications e.g. environmental appraisal of road schemes, highway design and land use planning.

The document consists of three different sections, covering a general method for predicting noise levels at a distance from a highway, additional procedures for more specific situations and a measurement method for situations where the prediction method is not suitable. The prediction method constitutes the preferred calculation technique but in a small number of cases, traffic conditions may fall outside the scope of the prediction method and it will then be necessary to resort to measurement. The prediction method has been used in this instance to determine the likely noise impact from traffic flow increases as a result of the proposed development.

British Standard BS 5228:2009 Noise and Vibration Control on Construction and Open Sites

This British standard consists of two parts and covers the need for protection against noise and vibration of persons living and working in the vicinity of construction and open sites. The standard recommends procedures for noise and vibration control in respect of construction operations and aims to assist architects, contractors and site operatives, designers, developers, engineers, local authority environmental health officers and planners.

Part 1 of the standard provides a method of calculating noise from construction plant, including:

- Tables of source noise levels
- Methods for summing up contributions from intermittently operating plant
- A procedure for calculating noise propagation
- A method for calculating noise screening effects
- A way of predicting noise from mobile plant, such as haul roads.

The standard also provides guidance on legislative background, community relations, training, nuisance, project supervision and control of noise and vibration.

13.2.2 Consultation

A detailed consultation exercise was undertaken as part of the proposed development. This commenced when consultation packs were sent to all of the relevant statutory and non-statutory consultees in early December 2010. In terms of noise and vibration issues associated with the proposed development, the key consultees were Fermanagh District Council, Cavan County Council and Monaghan County Council.

There were no responses from the above consultees that made specific comments or requests in terms of the methodology for the noise and vibration assessment. The National Roads Authority made reference to noise in its response, requesting that consideration be given to the Environmental Noise Regulations 2006 and how the proposed development may impact on future action plans. Similarly, the NRA response indicated that noise barriers may be required and that the NRA *Guidelines for the Treatment of Noise and Vibration in National Road Schemes (2004)* should be consulted as a reference for determining such a need.

Public Information Days were held in Clones (18th April 2011) and Newtownbutler (19th April 2011) in order to gather public feedback on issues relating to the proposed development. The public were afforded an opportunity to raise any concerns relating to potential noise and vibration issues at these events.

13.2.3 Vibration

There is no published Irish guidance relating to the assessment of vibration impacts associated with development. When assessing potential vibration impacts proposed in Ireland, it has been common

practice to use guidance from internationally recognised standards. The reference to guidance documents on vibration in this section should be taken as a reference to the entire proposal, both in Northern Ireland and Ireland.

Limits of transient vibration, above which cosmetic damage could occur, are given numerically in **Table 13.2** (Ref: BS5228-2:2009). Minor damage is possible at vibration magnitudes which are greater than twice those given in **Table 13.2**, and major damage to a building structure can occur at values greater than four times the tabulated values (definitions of the damage categories are presented in BS7385-1:1990, 9.9).

Table 13.2: Transient Vibration Guide Values for Cosmetic Damage (Ref BS5228-2:2009)

Type of Building	Peak Particle Velocity (PPV) (mm/s) in Frequency Range of Predominant Pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures. Industrial and heavy commercial buildings.	50 mm/s at 4 Hz and above	50 mm/s at 4 Hz and above
Unreinforced or light framed structures. Residential or light commercial buildings.	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above.

British Standard BS 7385 (1993) *Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration* indicates that cosmetic damage should not occur to property if transient vibration does not exceed 15mm/s at low frequencies rising to 20mm/s at 15Hz and 50mm/s at 40Hz. These guidelines refer to relatively modern buildings and therefore, these values should be reduced to 50% or less for more sensitive buildings.

The NRA Guidelines for the Treatment of Noise & Vibration in National Road Schemes recommends that vibration is limited to the values set out in **Table 13.3** in order to ensure that there is little or no risk of even cosmetic damage to buildings. These values and the values indicated in **Table 13.2** should be used as guidance for monitoring vibration levels from the construction phase of the proposed scheme.

Table 13.3: Recommended Vibration Level Thresholds for NRA Schemes

Allowable Vibration Velocity (Peak Particle Velocity) at the Closest Part of Any Sensitive Property to the Source of Vibration, at a Frequency of:		
Less than 10Hz	10 to 50 Hz	50 to 100 Hz (and above)
8mm/s	12.5mm/s	20mm/s

The human body is an excellent detector of vibration, which can become perceptible at levels which are substantially lower than those required to cause building damage. The human body is most sensitive to vibration in the vertical direction (foot to head). The effect of vibration on humans is guided by British Standard 6472:1992. This standard does not give guidance on the limit of perceptibility, but it is generally accepted that vibration becomes perceptible at levels of approximately 0.15 to 0.3 mm/s.

BS 6472 defines base curves, in terms of rms acceleration, which are used to assess continuous vibration. Table 5 of the Standard states that in residential buildings, the base curve should be multiplied by 1.4 at night and by 2 to 4 during the daytime to provide magnitudes at which the probability of adverse comment is low.

In order to assess human exposure to vibration, ideally, measurements need to be undertaken at the point at which the vibration enters the body, i.e. measurements would need to be taken inside properties. However, various conversion factors have been established to convert vibration levels measured at a foundation to levels inside buildings, depending on the structure of the building.

Where vibration is intermittent or occurs as a series of events, the use of Vibration Dose Values (VDVs) is recommended in BS 6472 for the assessment of subjective response to vibration. The VDVs at which it is considered there will be a low probability of adverse comment are drawn from BS 6472 and presented in **Table 13.4**.

Table 13.4: Threshold Values for the Evaluation of Disturbance due to Vibration

Place	Daytime 16 Hour VDV ($\text{ms}^{-1.75}$)	Night-time 8 Hour VDV ($\text{ms}^{-1.75}$)
Critical working Area	0.11	0.09
Residential	0.22 – 0.43	0.13
Office	0.43	0.36 ¹
Workshops	0.87	0.73

These VDV thresholds do not apply unless night-time work was a regular activity at these premises.

13.2.4 Methodology for Noise Monitoring

Baseline noise monitoring was conducted in the vicinity of the proposed development site in order to characterise the noise environment in the study area.

A total of 15 locations were selected to represent the nearest sensitive receptors to various portions of the proposed canal. The noise monitoring locations are illustrated in **Appendix G Figures 1.1a – 1.1g**.

Daytime monitoring was carried out for 30 minutes at each location. Night-time monitoring was not undertaken as there will be no night-time noise impacts associated with the proposed development. Subjective noisy events were recorded during each logging period.

Noise monitoring was carried out on-site using a Brüel & Kjær 2250 Hand Held Analyzer and a Brüel & Kjær Type 4231 Sound Level Calibrator. This instrumentation conforms to the requirements for integrating averaging sound level meters (Type 1) as specified in BS EN 60804. The sound level meter was accurately calibrated before use.

Measurements were made at a height of 1.2 – 1.5m above ground level. The weather conditions were in accordance with the requirements of BS7445: Description and Measurement of Environmental Noise.

The following parameters were recorded during each monitoring period:

- L_{Aeq}** The continuous equivalent A-weighted sound pressure level. This is an “average” of the sound pressure level.
- L_{Amax}** This is the maximum A-weighted sound level measured during the sample period.
- L_{Amin}** This is the minimum A-weighted sound level measured during the sample period.
- L_{A10}** This is the A-weighted sound level that is exceeded for noise for 10% of the sample period.
- L_{A90}** This is the A-weighted sound level that is exceeded for 90% of the sample period.

13.3 EXISTING ENVIRONMENT

Noise monitoring was carried out at the proposed development site on 27/10/10 and 19/01/11. The noise monitoring locations are illustrated in **Appendix G Figures 1.1a – 1.1g**. The noise measurements attained during the monitoring surveys are displayed in **Table 13.5** below.

Table 13.5: Summary of Noise Monitoring Results

Monitoring Time Period	Measured L_{Aeq} dB(A)	Measured L_{Amax} dB(A)	Measured L_{Amin} dB(A)	Measured L_{A10} dB(A)	Measured L_{A90} dB(A)
Daytime					
Noise Monitoring Location 1 (L1) 11:09 – 11:39 (27/10/10)	60.0	81.3	36.0	61.3	41.4
Noise Monitoring Location 2 (L2) 10:32 – 11:02 (27/10/10)	65.4	83.3	33.0	68.0	36.2
Noise Monitoring Location 3 (L3) 11:46 – 12:16 (27/10/10)	59.3	86.5	36.5	55.2	40.0
Noise Monitoring Location 4 (L4) 12:25 – 12:55 (27/10/10)	69.5	92.1	33.7	71.5	39.6
Noise Monitoring Location 5 (L5) 13:03 – 13:33 (27/10/10)	42.3	73.4	31.6	44.0	35.2
Noise Monitoring Location 6 (L6) 15:56 – 16:26 (19/01/11)	48.8	75.6	37.5	48.5	42.6
Noise Monitoring Location 7 (L7) 10:09 – 10:39 (19/01/11)	53.4	79.4	65.4	55.6	41.3
Noise Monitoring Location 8 (L8) 10:49 – 11:19 (19/01/11)	53.9	67.5	31.7	58.6	41.3
Noise Monitoring Location 9 (L9) 11:29 – 11:59 (19/01/11)	68.6	92.2	31.6	70.5	37.0
Noise Monitoring Location 10 (L10) – 12:06 – 12:36 (19/01/11)	57.6	85.1	35.2	54.6	40.4
Noise Monitoring Location 11 (L11) – 12:45 – 13:15 (19/01/11)	66.1	86.1	28.9	70.3	36.5
Noise Monitoring Location 12 (L12) – 13:18 – 13:48 (19/01/11)	53.8	70.5	30.3	58.5	36.7
Noise Monitoring Location 13 (L13) – 13:54 – 14:24 (19/01/11)	67.3	89.9	34.4	70.8	44.2
Noise Monitoring Location 14 (L14) – 14:40 – 15:10 (19/01/11)	68.0	85.3	31.8	72.1	39.1
Noise Monitoring Location 15 (L15) – 15:18 – 15:48 (19/01/11)	63.2	86.9	37.3	67.2	43.7

Subjective observations were recorded during each measurement period. It was observed that the dominant noise sources at each of the noise monitoring locations was a mixture of road traffic noise, human activities, dogs barking and birdsong.

13.4 IMPACT ASSESSMENT

13.4.1 Construction Phase

13.4.1.1 Construction Noise - General

Typical noise levels from various construction plant are displayed in **Table 13.6** and typical combined construction noise levels for various construction phase activities are illustrated in **Table 13.7**. The plant shown in **Table 13.6** is generally representative of the type of plant that will be in use for the construction phase of the proposed development.

Table 13.6: Noise Levels for Construction Plant (Ref: BS 5228:2009)

Activity / Plant (Reference from Table C2, Annex C, BS5228:2009)	Power Rating (kW)	Equipment Size, Weight (Mass), Capacity	Activity Equivalent Continuous Sound Pressure Level L_{Aeq} at 10m (dB)
Clearing Site: Dozer (Ref 1)	142	20t	75
Clearing Site: Tracked excavator (Ref 3)	102	22t	78
Clearing Site: Wheeled backhoe loader (Ref 8)	62	8t	68
Ground Excavation: Dozer (Ref 12)	142	20t	81
Ground Excavation: Tracked excavator (Ref 14)	226	40t	79
Ground Excavation: Wheeled loader (Ref 27)	193	-	80
Distribution of Material: Dump Truck (tipping fill) (Ref 30)	306	29t	79
Distribution of Material: Dump Truck (empty) (Ref 30)	306	29t	87
Rolling & Compaction: Dozer (towing roller) (Ref 36)	142	20t	81
Directional Drilling: Directional drill (generator) (Ref 44)	106	-	77
Digging out riverbed (Table D12, Ref 2)* Tracked excavator & water pump	(46, 6)		85
Sheet Steel Piling [Table D4, Ref 13]	220,00k g/pile		78
Combined			92

* Most relevant reference to restoration existing canal bed

It is likely that there will be a requirement for some piling at a number of particular locations along the proposed Ulster Canal route. The most notable locations are at Derrykerrib Bridge, Wattle Bridge, Gortnacarrow and the marina at Clones. In all of these cases, the piling will be sheet piling. The reference to sheet piling in **Table 13.6** above covers this requirement. The overall cumulative worst-case noise level (i.e. 92dB) is the same with or without the input of the sheet piling (i.e. 78dB) and therefore the cumulative worst-case noise level is used at all properties irrespective of whether sheet piling will be used or not.

There is likely to be a requirement for some form of piling for bridge foundations, however this will depend on the contractors design and the existing ground conditions at each location. It is not possible to adequately assess the potential noise and vibration impacts associated with such works and therefore, there will be a requirement for this to be assessed at the detailed design stage.

Table 13.7: Typical Combined Construction Noise Levels

Activity	L _{Aeq} @ 10 m	L _{Aeq} @ 40 m	L _{Aeq} @ 80 m	L _{Aeq} @ 160 m	L _{Aeq} @ 320 m
Clearing Site	80	68	62	56	50
Ground Excavation	85	73	67	61	55
Distribution of Materials	87	75	69	63	57
Rolling & Compaction	81	69	63	57	51
Directional Drilling	77	65	59	53	47
Digging out river bed (i.e. canal bed)	85	73	67	61	55
Piling	78	66	60	54	48
Combined Total for All Activities	92	80	74	68	62

The combined noise levels in this table have been calculated by combining the various noise levels for the various plant listed in Table 13.6

The above tables serve as typical examples of the noise levels likely to be experienced for various parts of the construction process.

13.4.1.2 Predicted Impact of Construction Noise from Proposed Development

Construction activity for the proposed development will operate between the hours of 08:00 and 18:00 on Monday to Fridays, between 08:00 and 13:00 on Saturdays and there will be no activity on Sundays or Bank Holidays.

The precise construction strategy to be adopted will be a matter for the contractor, but it is likely that construction noise levels experienced during the construction phase will be similar to the typical construction noise levels indicated in **Table 13.6** for the various plant. In order to assess the worst-case construction noise level from the proposed development, a noise level of 92 dB(A) at 10m has been used for the purposes of the construction noise assessment. This noise level was arrived at as a combination of the all of the activity noise levels specified in **Table 13.7**.

Table 13.8 includes worst-case construction noise level predictions at a selection of the nearest noise sensitive properties to the proposed development. The hard ground distance attenuation equation from BS5228:2009 (Equation F1, Annex F) has been assumed for all of the noise level predictions included in this table in order to ensure a worst-case scenario is assessed. The locations of these properties are illustrated in **Appendix G Figures 1.1a – 1.1g**.

Table 13.8: Worst-Case Predicted Construction Noise Levels at Nearest Noise Sensitive Properties

Property Reference (Appendix G)	Worst-Case L _{Aeq} @ 10m (dBA)	Distance from Construction Boundary (m)	Distance Attenuation (dBA)	Predicted Worst-Case Construction Noise (dBA)
1	92	240	-28	64
2	92	226	-27	65
3	92	168	-25	67
4	92	56	-15	77
5	92	232	-27	65
6	92	347	-31	61

6a	92	63	-16	76
7	92	109	-21	71
8	92	44	-13	79
9	92	12	-2	90
10	92	168	-25	67
11	92	170	-25	67
12	92	59	-15	77
13	92	139	-23	69
14	92	80	-18	74
15	92	79	-18	74
16	92	241	-28	64
17	92	83	-18	74
18	92	46	-13	79
19	92	76	-18	74
20	92	96	-20	72
21	92	41	-12	80
22	92	85	-19	73
23	92	25	-8	84
24	92	<10	-	>92
25	92	12	-2	90
26	92	198	-26	66
27	92	92	-19	73
28	92	144	-23	69
29	92	<10	-	>92
30	92	46	-13	79
31	92	197	-26	66
32	92	85	-19	73
33	92	199	-26	66
34	92	41	-12	80
35	92	<10	-	>92
36	92	<10	-	>92
37	92	203	-26	66
38	92	277	-29	63
39	92	13	-2	90
40	92	24	-8	84
41	92	151	-24	68
42	92	115	-21	71
43	92	202	-26	66
44	92	276	-29	63
45	92	31	-10	82
46	92	26	-8	84
47	92	78	-18	74
48	92	54	-15	77
49	92	137	-23	69
50	92	318	-30	62
51	92	30	-10	82
52	92	109	-21	71
53	92	31	-10	82
54	92	<10	-	>92
55	92	43	-13	79
56	92	39	-12	80
57	92	<10	-	>92
58	92	<10	-	>92
59	92	<10	-	>92
60	92	301	-30	62
61	92	308	-30	62
62	92	256	-28	64
63	92	77	-18	74
64	92	52	-14	78
65	92	254	-28	64
66	92	20	-6	86
67	92	69	-17	75
68	92	23	-7	85
69	92	14	-3	89
70	92	15	-4	88
71	92	40	-12	80
72	92	60	-16	76

73	92	<10	-	>92
74	92	20	-6	86
75	92	15	-4	88
76	92	23	-7	85
77	92	42	-12	80
78	92	<10	-	>92
79	92	320	-30	62

Table 13.8 demonstrates that there is potential for significant construction noise impacts at the nearest noise sensitive properties if worst-case construction activities take place at the boundary of the proposed development site. There is potential for worst-case construction noise levels in the 80s and 90s dB(A) at a number of the nearest properties if the combined construction phase activities were undertaken at the boundary of the proposed development site with the nearest properties.

On the basis of the predicted worst-case construction noise levels from the proposed development, there will be a requirement for mitigation measures to be put in place in order to ensure that construction noise levels are reduced as much as practicable. Noise mitigation measures for construction activities are outlined in **section 13.5** below.

13.4.2 Operational Phase

The potential noise impact resulting from the operational phase of the proposed development has been assessed to determine effects on the nearest sensitive receptors.

13.4.2.1 Calculation of Road Traffic Noise (CRTN) Assessment

In terms of assessing the noise impact associated with changes in traffic flows, the Highways Agency guidance document the *Design Manual for Roads and Bridges (DMRB)* defines the study area as the area where there are roads that are predicted to be subject to a change in noise level of more than 1dB(A) as a result of the project on opening. Such a change in noise levels equates to a 25% increase in traffic flows along the relevant route.

A full Transport Assessment (TA) has been undertaken for the proposed development and is included as part of the planning application. The main traffic generators associated with the proposed development will be the jetty locations at either end of the canal upgrade. The proposals for the Gortnacarrow jetty include parking facilities for 39 cars and 2 buses while the proposals for the Clones jetty include parking facilities for 50 cars and 2 buses.

The completed TA gives an estimation of the number of journeys that will be made on the roads in the vicinity of each jetty complex each day and gives peak hour generations associated with the proposed development. The TA data shows that there will be AM and PM peak generation of no more than 15 vehicles on all of the roads in the vicinity of the proposed jetties as a result of the proposed development.

The peak generations presented in the TA are sufficiently low for one to confirm that the changes to the traffic flows on the existing road network will be significantly less than 25%. This would suggest that noise level increases on the local road network as a result of the proposed development will be significantly less than 1dB(A). Noise level increase of approximately 1dB(A) would be imperceptible to the majority of people and therefore, the road traffic increases from the proposed development will result in a negligible impact at the properties in the vicinity of the proposed development.

13.4.2.2 Assessment of Boat Traffic Noise on Canal

Table 13.9 includes a list of the proposed numbers of boats and canoes predicted to use the upgraded canal when opened (Waterways Ireland estimates based on PWC 2006 report). The boat numbers have been categorised as permanent boats on this stretch of the canal (i.e. moored boats, hire boats, day boats for hire etc.) and visiting boats just passing through.

Table 13.9: Predicted Numbers of Boats & Canoes Using Canal

Activity	Numbers	Description
Moored Boats	30	Number of boats to be permanently moored on the canal
Hire Boats	3	Number of hire boats to be permanently moored/operating on the canal section
Visiting Boats	600	Number of 2-way boat trips per year on the canal section.
Trip Boats in Canal	1	Boat based on the canal section for taking people on trips up and down the canal
Day Boats for Hire	3	Number of day hire boats to be permanently moored/operating on the canal section
Canoeing for Hire	10	Number of canoes for hire to be permanently moored/operating on the canal section

From the information presented in **Table 13.9**, it is clear that the largest number of boat users will be boats passing visiting the stretch of canal. The number of permanently moored boats is relatively low (i.e. 30), while the number of hire boats, trip boats in canal and day boats for hire is negligible in terms of looking at potential noise impacts.

The number of visiting boats is the most significant source of usage of the proposed canal but still constitutes a relatively low use of the canal (i.e. less than 2 boats a day based on averaging out over the year). It is expected that canal usage will be seasonal with a far great proportion of visits taking place during the summer months. Even assuming a greater proportional usage during summer months, the number of boats per day will be relatively low and would certainly be less than 10 per day based on the yearly figures given in **Table 13.9**. Even considering the additional usage of the permanently moored boats and the various hire and day trip boats, it is difficult to envisage that there would be more than 1 boat trip (2-way) per hour passing through the canal at busy times (based on the figures presented in **Table 13.9**).

In terms of the noise associated with canal boats, there is a huge range of boat types that generally use canals with single engine, twin engine, petrol, diesel, small motorboat varieties all producing different noise levels. A large portion of the boats using the canal will not be significant noise emitters (e.g. small motorboat, petrol, single engine etc.). Considering the predicted low numbers of boats using the canal and the smaller portion of boats that are likely to be significant noise emitters (e.g. twin engine diesel etc.), it is not predicted that there will be significant operational phase noise impacts associated with the boat use of the canal. While the canal will be located predominantly in rural areas, the occasional noisy boat passing through is not likely to be dissimilar to occasional noise sources that are already experienced in such rural areas (e.g. passing tractors etc.).

13.4.2.3 Assessment of Plant/Equipment Noise

There are a number of locations throughout the canal that have some form of plant/equipment associated with them and these have been assessed to determine if there is likely to be any noise impact associated with them.

At Gortnacarrow, there will be a water extraction pump house which will contain mechanical pumps for pumping water. This equipment will be housed inside a building and assuming that the appropriate design considerations are in place, this would not be expected to create any significant noise impacts at the nearest noise sensitive receptors. There will be an onus on the developer to ensure that this is the case at the detailed design stage. Also at Gortnacarrow, there will be a collection of water pumps to be located on the eastern side of the A3 Cavan Road with inlets submerged in the River Finn. On account of these pumps being submerged and the relative distance to the nearest noise sensitive properties, there will be no noise impact at these properties.

There will be a boat pump out connect to the realigned main sewer outflow at the Clones marina but on account of the relative distance to the nearest noise sensitive receptors, this should not present a significant noise source assuming it is suitably designed and positioned.

A new lift bridge is proposed at Munnilly Bridge (chainage 9,200), which will involve a power source, moving parts and potentially a beeper warning system. It is not envisaged that the power source or moving parts will create a significant noise impact at the properties that are in the vicinity of the bridge as the power source will be screened by the approaching road to the bridge on both sides (i.e. it is on embankment) and the power source itself will be enclosed in a suitable casing for protection and to limit the noise levels emitted from it. There is potential for any warning system to create a tonal noise capable of being a nuisance at the properties in the vicinity of the bridge. Careful consideration of noise issues should go into the design of such a system if it is decided that it is required.

13.5 MITIGATION

13.5.1 Construction Phase

There is no detailed plan as yet with regard to the construction phase of the proposed development. It has been proposed at the outset that the hours of operation for construction works will be between 08:00 and 18:00 from Monday to Friday, between 08:00 and 13:00 on Saturdays and no activities on Sundays and Bank Holidays. A detailed programme for the construction phase will be prepared as part of the detailed design phase and will include information such as notifications, contact numbers, method of appointing contractor, monitoring, contractual conditions and timescales. The programme of works will be agreed with Fermanagh District Council, Cavan County Council and Monaghan County Council and the successful contractor will be obliged to comply with the information therein.

There is no published Irish guidance relating to maximum permissible noise levels that may be generated during the construction phase of a project, however the NRA *Guidelines for the Treatment of Noise and Vibration in National Road Schemes (2004)* does indicate noise levels typically deemed to be acceptable for similar schemes (See **Table 13.10**). These values are indicative only and more stringent limits may be applied where pre-existing noise levels are low.

Table 13.10: Maximum Permissible Noise Levels at the Façade of Dwellings during Construction

Days & Times	$L_{Aeq} (1 \text{ hr}) \text{ dB}$	$L_{pA(max)slow} \text{ dB}$
Monday to Friday 07:00 – 19:00hrs	70	80
Monday to Friday 19:00 – 22:00hrs	60*	65*
Saturday 08:00 – 16:30hrs	65	75
Sunday Bank Holidays 08:00 – 16:30hrs	60*	65*

* Construction activity at these times. Other than that required in respect of emergency works, will normally require explicit permission of the relevant local authority.

BS5228:2009 also gives guidance on indicative noise limits that may be applied for construction activities based on two different approaches, namely a fixed limit approach or alternatively significance based on noise change.

The fixed limit approach is the older and more simplistic approach and originally emerged following the findings of the Wilson Committee whose report was presented to the UK parliament in 1963. The basic outline of the findings was that between the hours of 07:00 and 19:00, noise levels outside the nearest window to the site boundary of the proposed activity should not exceed 70dB(A) in rural/suburban/urban area away from main road traffic and industrial noise and 75dB(A) in urban areas near main roads in heavy industrial areas.

The significance based on noise change approach takes two forms generally. The first, known as the ABC method, compares the ambient noise level with the total noise level (including construction). Where the total noise level exceeds the appropriate category value specifying threshold limits, a significant effect is deemed to occur. The second method deems noise levels generated by construction activities to be significant if total noise (pre-construction ambient plus construction noise) exceeds pre-construction ambient noise by 5dB or more.

Piling

Piling will be used to drive sheet steel piles for coffer dams at Derrykerrib Bridge and Wattle Bridge bypass channels. A coffer dam will be required at Gortnacarrow where the canal will join the River Finn. Sheet piling may also be used during the construction of the marina in Clones.

Piling for the bridge foundations will depend on the contractors design and the existing ground conditions at each location. As it is not possible to adequately assess the requirements for piling at these particular locations at this stage, the potential noise and vibration impact associated with the bridge piling must be assessed in detail at the detailed design stage when the method and conditions of piling are known.

The standard to be achieved during piling operations and the selection criteria for contractors will be agreed with Fermanagh District Council, Cavan County Council and Monaghan County Council prior to works commencing. This operation should be carried out using recognised noise reducing systems and only during specified working hours. In addition, the piling activities will be confined to specific locations and will be of limited duration. Measures shall be taken to minimise vibration due to plant and machinery on the site.

Vibration

Subject to vibration at sensitive locations not exceeding 5mm/s during general construction works and 10mm/s during piling / blasting, structural damage to buildings is highly unlikely.

Monitoring

It may be necessary to conduct noise monitoring of construction works during noisy or extensive works at locations close to the nearest residential properties. Noise levels limits set down by Fermanagh District Council, Cavan County Council and Monaghan County Council should be adhered to.

Specific Mitigating Measures for Construction Phase

Due to the proximity of the proposed development site to the surrounding noise-sensitive receptors, there is potential for construction noise levels from the proposed development site to reach up to the

80s and 90s dBA at some properties if worst-case noise levels are emitted at the boundary of the proposed site and if no mitigating measures are put in place.

It is recommended that a robust temporary barrier (minimum of 2m height) is put up around the proposed development site and particularly between the proposed development and the nearest residential properties during the construction phase. Such a barrier, if constructed in accordance with sound acoustic principles, should offer a minimum of 10dBA attenuation on ground based activities in close proximity to the boundary barrier.

In addition to this, a detailed construction plan should be prepared and should include a range of measures aimed at reducing the potential construction noise impact on the nearest properties to the proposed development site. On account of the proximity of the proposed site boundary to a number of properties (i.e. <5m), this plan should address the mode and timing of construction activity in close proximity to the site boundary with these properties, aiming to reduce the noisiest activities in the vicinity of the boundary of the proposed site. This plan should also address the issues relating to collaboration with the local community in order to reduce as much as possible the potential impact from construction noise.

A range of measures should be taken to ensure that the quietest machinery is used or that the use of machinery is such as to be sensitive to the residents at the nearest properties. This should be detailed in the construction plan mentioned above.

British Standard *BS5228:2009 – Noise and vibration control on construction and open sites* outlines a range of measures that can be used to reduce the impact of construction phase noise on the nearest noise sensitive receptors. These measures should be applied by the contractor where appropriate during the construction phase of the proposed development. Examples of some of the best practice measures included in BS5228 are listed below:

- Ensuring that mechanical plant and equipment used for the purpose of the works are fitted with effective exhaust silencers and are maintained in good working order;
- Careful selection of quiet plant and machinery to undertake the required work where available;
- All major compressors should be 'sound reduced' models fitted with properly lined and sealed acoustic covers which should be kept closed whenever the machines are in use;
- Any ancillary pneumatic percussive tools should be fitted with mufflers or silencers of the type recommended by the manufacturers;
- Machines in intermittent use should be shut down in the intervening periods between work;
- Ancillary plant such as generators, compressors and pumps should be placed behind existing physical barriers, and the direction of noise emissions from plant including exhausts or engines should be placed away from sensitive locations, in order to cause

minimum noise disturbance. Where possible, in potentially sensitive areas, acoustic barriers or enclosures should be utilised around noisy plant and equipment.

- Handling of all materials should take place in a manner which minimises noise emissions;
- Audible warning systems should be switched to the minimum setting required by the Health & Safety Executive;

In order to minimise the likelihood of complaints, Fermanagh District Council, Cavan County Council, Monaghan County Council and affected residents should be kept informed of the works to be carried out and of any proposals for work outside normal hours. A complaints procedure should be operated by the Contractor throughout the construction phase.

13.5.2 Operational Phase

All plant and equipment associated with the proposed development should be designed with careful consideration of the potential noise impacts at the nearest noise sensitive properties.

If it is determined that there will be a requirement for some form of audible warning system for the proposed lift bridge at Munnilly Bridge, this should be subject to a detailed noise assessment at the detailed design stage to ensure that no noise nuisance impacts are caused by such a system at the nearest noise sensitive receptors.

13.6 RESIDUAL IMPACT

During the construction phase, there will be minor to moderate noise impacts at the nearest noise sensitive properties on account of the construction activities but these should be relatively short-term in nature.

Assuming that all plant and equipment associated with the proposed development are designed to a suitable standard, it is not envisaged that there will be any significant noise impact associated with the operation of this plant/equipment.

During the operation of the proposed canal, there is likely to be occasional noisy boat movements passing through, but these are not likely to be dissimilar to existing sporadic movements in rural areas (e.g. tractor movements etc) and are not likely to create a significant noise impact at the nearest noise sensitive properties.

14 POPULATION AND HUMAN BEINGS

14.1 INTRODUCTION

Human beings form one of the most important aspects of the environment to be considered. Any likely significant effects on the character of human beings must therefore be addressed. This section of the EIS considers the socio-economic characteristics, as well as the economic activity and employment, within the area. Consideration is also afforded to tourism within the area and the impact of the proposed development on this.

14.2 THE SOCIO-ECONOMIC ENVIRONMENT

A section of the proposed canal route falls within Northern Ireland with the remaining part of the canal falling within Ireland. The economy of the Ulster Canal corridor, from Lough Erne to Clones, relies mainly on agriculture and agri-related manufacturing businesses. Both of these sectors are declining as a source of employment. The tourism industry in the area is also relatively underdeveloped, especially compared to the nearby areas of Upper and Lower Lough Erne.

14.2.1 Demography

The Northern Ireland section of the Ulster Canal is within the Newtownbutler census output area. In 2001 this area had a population of 2,426 and a population density of 27 people per km².

The Irish section of the Ulster Canal includes areas of County Cavan and Monaghan. County Cavan has a relatively small population relative to all the counties of Ireland. The 2006 Census found the total population of County Cavan to be 64,003 which was up by over 13% from the 2002 population of 56,546. It is estimated that just over 26% of the population of County Cavan is located within town areas, while the remainder live in rural areas. The county has an overall population density of approximately 33 people per km². The largest population centres within the County are Cavan Town and Bailieborough with populations of 3,934 and 1,966 respectively. The nearest County Cavan town to the canal section is Belturbet, which has a population of 1,395 people.

County Monaghan has a smaller population than County Cavan, with the 2006 census showing the County's total population to be 55,997, which was up by over 6% from the 2002 population of 52,593. It is estimated that just over 28% of the population of County Monaghan is located within town areas, while the remainder live in rural areas. The county has an overall population density of approximately 43 people per km². The largest population centre in the study area within County Monaghan is Clones town. In 2006, Clones town had a population of 1,517 which is down by almost 12% from the 2002

population. The Clones environs have however seen a 10% increase in population from 2002 to 2006¹.

A summary of the population statistics for the region are set out in **Table 14.1**.

Table 14.1 Population Statistics

Area	Population
Proposed restored Ulster Canal Region	
Newtownbutler	2,426
County Cavan:	64,003
Cavan Town	3,934
Bailieborough	1,966
Belturbet	1,395
County Monaghan:	55,997
Clones Town	1,517

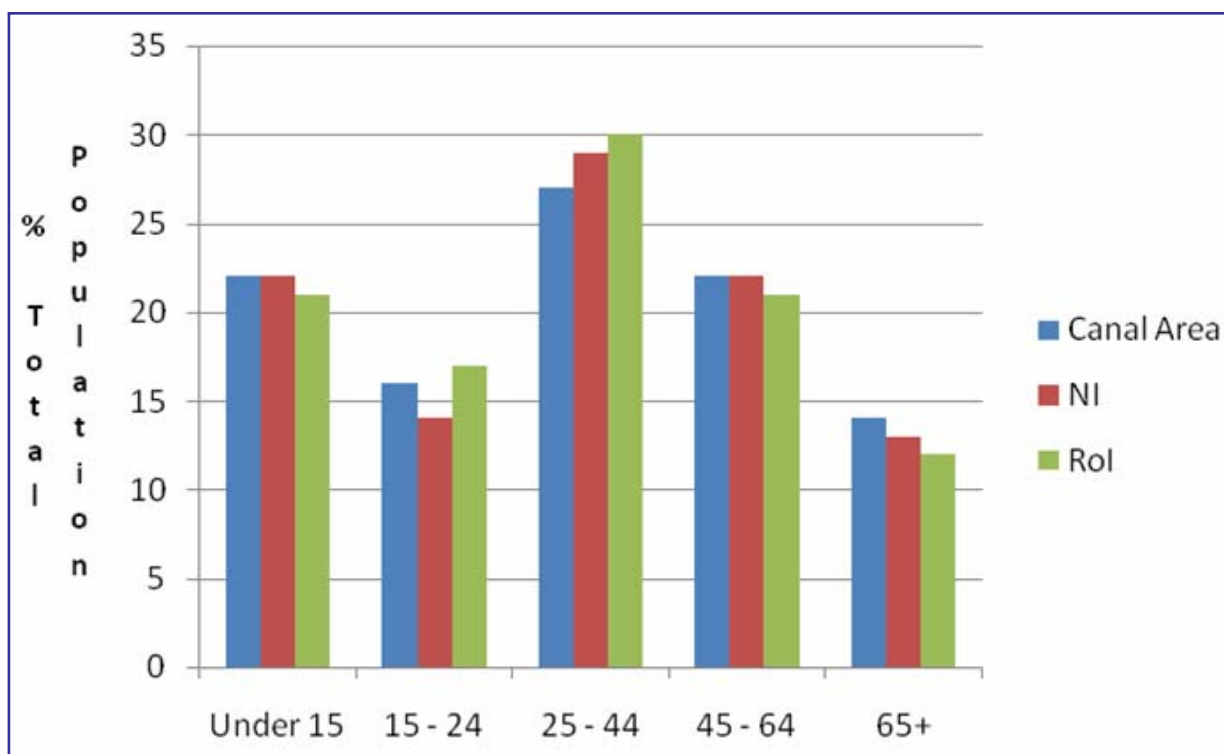
Source: Northern Ireland Statistics Research Agency (NISRA) - 2001 Census and Central Statistics Office (CSO) – 2006 Census

14.2.2 Age Structure

The average age of Northern Ireland's population is increasing. In 1991, there were 417,000 children aged under 16, accounting for 26% of the population. In 2001, the number of children had decreased by 5% to 397,000. There was a further decrease observed in 2010 of 3.9% to 381,388 from the 2001 estimation.. In contrast, the number of people of pensionable age has increased from 246,000 to 307,629 and accounted for 17% of the population when compared to 15% in 1991.

Analysis of the population by age is shown in **Figure 14.1**. These results from the 2001/02 Census in Northern Ireland and Ireland show that the age structure of the proposed canal area is generally similar to that of both Northern Ireland and Ireland.

¹ Central Statistics Office (CSO), 2009. <http://www.cso.ie/>

Figure 14.1 Population by Age Structure (2001/02)

Source: NISRA (2001 Census) and CSO (2002)

There are just over 1,300 properties within 1 km of the restored canal route between Upper Lough Erne and Clones. The majority of these properties are within Clones town itself. A breakdown of the building use is as follows:

- 840 residential use;
- 118 commercial use;
- 70 both residential and commercial use; and
- 278 of unknown use.

14.2.3 Economic Activity Employment

Statistics from the 2001 Northern Ireland Census show that out of the population of Newtownbutler there were 1,668 persons of working age, with an unemployment rate of 8%, which is slightly above the national average².

² Northern Ireland Statistics Research Agency (NISRA), 2009. <http://www.nisra.gov.uk/>

Results from the 2006 Census in Ireland show that in County Cavan there are 28,319 persons who are currently employed and in County Monaghan there are 25,378 who are currently employed. Based on the results from the 2006 Census it was estimated that 4.2% of the total population in County Cavan and 3.89% of the total population in County Monaghan was unemployed.

In 2010 there were 4,135 VAT and PAYE Registered businesses in the Fermanagh District Council area. The three sectors with the largest number of companies registered were:

- Agriculture, Fishing and Forestry accounting for 46%;
- Construction accounting for 14%; and
- Retail accounting for 9%.

14.3 IMPACT OF PROPOSAL ON SOCIO-ECONOMIC FABRIC OF AREA

The restoration of the Ulster Canal will be located in a mainly rural area and will only impact locally along the proposed / former canal route. It is anticipated that the restoration will potentially cause minimal disturbance, in terms of noise, vibration, dust and road works, confined to the construction phase with no significant operational impacts. However, due to the rural location these potential nuisances will be both minimal and temporary and will be mitigated by control measures and good site management and operational practices. The impact on the closest receptors is considered further in the following sections of this Environmental Impact Statement.

In the medium and long term there may be significant benefits to the local population. The reinstatement of the canal would provide an economic boost to the region, which has had historically low investment. Secondary and tertiary businesses have the potential to benefit as a result of the expansion of tourism developed from navigation.

In addition to this, the increase in tourism and business activity will increase employment opportunities within the area and, in particular, will offer alternative employment to agriculture and agri-related businesses in the region.

The restoration of the canal will also provide an improved recreational environment, for example for boating, cycling, angling or walking, which will be of benefit to both the local population and also visitors to the area.

14.4 MITIGATION MEASURES

Any potential disruption caused by construction activities associated with the restoration of the canal will be temporary and will be conducted using good site management and operational practices to minimise any potential negative impacts. Appropriate control measures, set out in further sections of this Environmental Impact Statement, will also be implemented to minimise any potential nuisances.

14.5 IMPACT OF PROPOSAL ON THE TOURISM INDUSTRY

Fáilte Ireland and the Northern Ireland Tourist Board (NITB) were consulted regarding the proposed restoration of the Ulster Canal. The Fáilte Ireland response included guidelines on how tourism is to be considered within an Environmental Impact Statement.

In general it is considered that the proposed restoration of the Ulster Canal will:

- Be a tourism asset in its own right;
- Provide a link between existing and new attractions;
- Support the holiday industry through water based activities; and
- Enhance the environment and attract increased visitor activity.

There has been a substantial growth in tourism in Ireland, the local areas surrounding the Ulster Canal are not performing well in tourism terms and therefore have the potential to benefit from the increase in tourism resulting from the canal restoration both through water and land based activities. The proposed restoration of the canal will also provide visitors to the area with the opportunity to visit existing heritage, such as Clones Round Tower.

The restoration of the canal will, in particular, provide opportunities for increased tourism through recreational activities. The anticipated increased numbers of users of the canal following its restoration are set out in **Table 14.2**.

Table 14.2 Canal User Numbers

Activity	User Numbers
Moored Boats	30
Hire Boats	3
Visiting Boats	600 visiting boat trips
Trip boats in canal	1
Day boats for hire	3
Canoeing for hire	10
Angling	195 persons/annum
Cycling	165 persons/annum
Hikers/walkers	572 persons/annum
Special Interests	606 persons/annum

Source: PWC 2006

The restoration of the canal may also have a significant beneficial impact on the social and economic regeneration of the areas adjoining the canal. These benefits should outweigh the immediate disturbance impacts of the proposed construction activities on the canal, and are likely to include:

- Increased economic activity in terms of regeneration of towns and villages in tourism and business development;
- Job creation in the local area during the construction period; and
- Wider employment creation resulting from increased economic activity.

As the proposed restoration of the canal will improve both the physical environment and recreational opportunities of the area the development is anticipated to have a positive impact on the tourism potential of the region. It should also be noted that the increase in visitor numbers in the area may lead to an increase in traffic however it is considered that the existing road network will be able to accommodate this proposed increase in vehicle numbers. Further detail on the impact of traffic is included in **section 16** of this Environmental Impact Statement.

14.6 HUMAN HEALTH

It is anticipated that on completion, the proposed restoration of the canal will have no major health impacts. In particular, the operation of the canal may actually have a positive impact on human health by providing additional opportunities for leisure and exercise for both the local population and visitors.

There may be potential temporary impacts on the local environment during the construction phase of this project, which is anticipated to last approximately 30 months. During this construction phase there is potential for an increase in dust, noise and vibration, however control measures to mitigate these potential impacts have been proposed and are set out in detail in **section 8** Air Quality and **section 13** Noise and Vibration of this Environmental Impact Statement. The implementation of these proposed control measures and good site management and operational practices will mitigate any potential negative impacts on human health from the construction phase.

14.7 CONCLUSIONS

The economy of the Ulster Canal corridor, from Lough Erne to Clones, relies mainly on agriculture and agri-related manufacturing businesses. Both of these sectors are declining as a source of employment. The tourism industry in the area is also relatively underdeveloped.

The Northern Ireland section of the Ulster Canal is within the Newtownbutler census output area. Based on the 2001 census the population of the area was 2,426. The Ireland section of the Ulster Canal includes areas of Counties Cavan and Monaghan. The 2006 census found that the total population for Counties Cavan and Monaghan was 64,003 and 55,997 respectively. It is estimated that just over 26% of the population of County Cavan and 28% of the population of County Monaghan is located within town areas, while the remainder live in rural areas.

There are just over 1,300 properties within 1km of the old canal route and potential canal routings between Upper Lough Erne and Clones. The majority of these properties are located within Clones Town.

During construction, minor short term dust, noise and vibration impacts are expected at local receptors, however these can be easily minimised following the implementation of appropriate mitigation measures.

It is anticipated that the restoration of the Ulster Canal will have a positive impact on the land use and development potential for the area. The Ulster Canal Restoration offers opportunities for regeneration and leisure-related activities for the entire region. The proposed restoration of the canal has huge potential for attracting tourists, increasing employment and becoming a significant contributor to the local economy.

15 GEOLOGY & SOILS

15.1 INTRODUCTION

This section of the EIS describes the geology, soils and groundwater conditions in the area for development, and gives the potential impacts that the construction and operation of the Ulster Canal from Upper Lough Erne to Clones may have.

15.2 GEOLOGY

15.2.1 Bedrock Geology

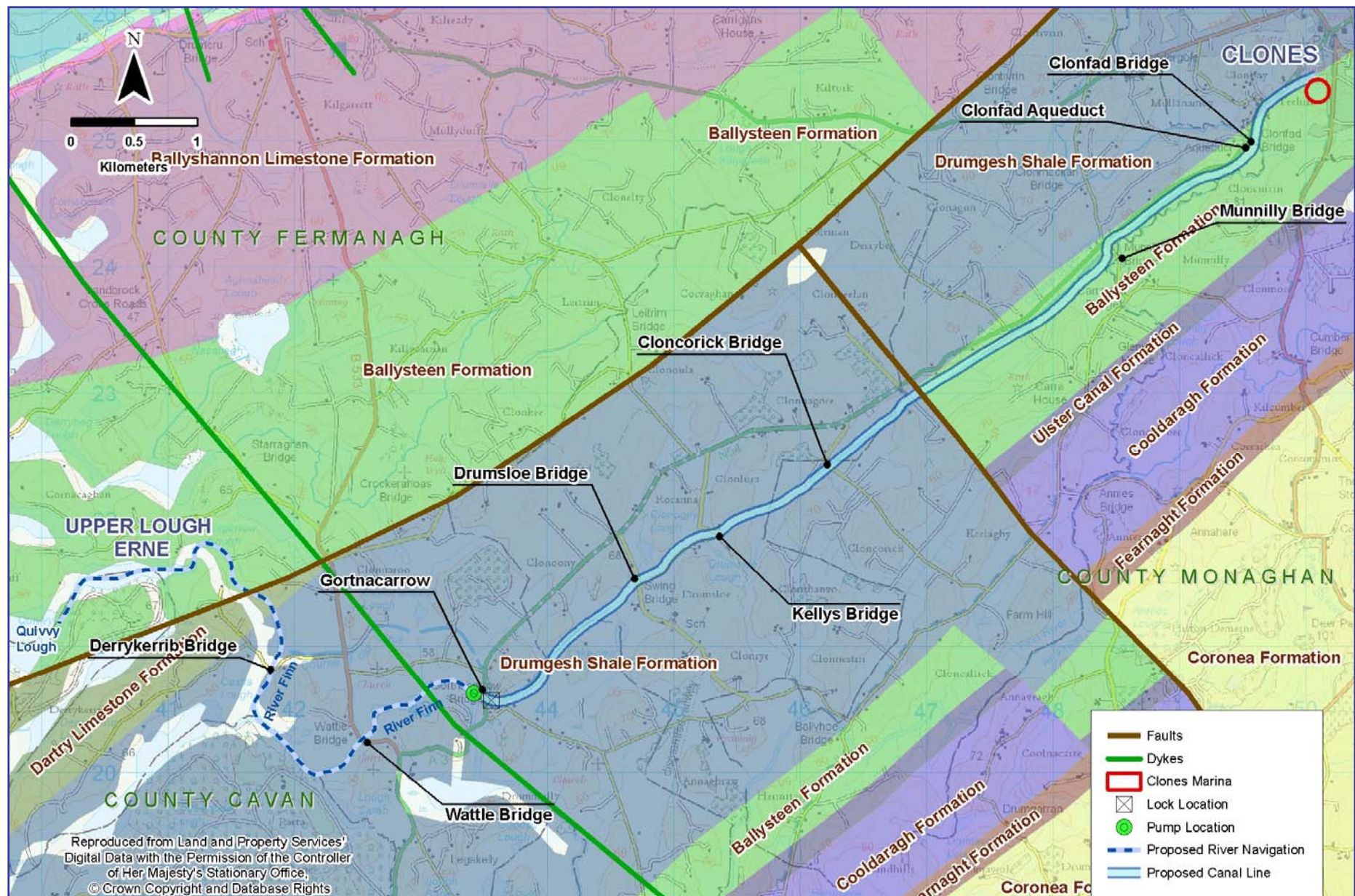
The Bedrock geology underlying the proposed navigation location is mainly Drumgesh Shale Formation which is dark shale and fine grained limestone, and Ballysteen Formation, dark muddy, limestone and shale. **Figure 15.1** shows the bedrock geology of the area while **Table 15.1** gives a summary of these bedrock layers. There can be seen to be two mapped fault lines within the vicinity of the navigation, with one transecting the canal line at Clonnagore. There is also one mapped dyke in the area, which is an igneous intrusion, to the south west of Gortnacarrow, travelling on a north west to south east axis.

Table 15.1 Bedrock Geology Summary

Unit Name	Description
Ballyshannon Limestone Formation	Pale grey calcarenite limestone
Ballysteen Formation	Dark muddy limestone, shale
Bundoran Shale Formation	Dark shale, minor fine-grained limestone
Carrickateane Formation	Greywacke with argillite & black shale
Cooldaragh Formation	Pale brown-grey flaggy, silty mudstone
Coronea Formation	Turbidite, red shale, minor volcanic
Dartry Limestone Formation	Dark fine-grained cherty limestone
Drumgesh Shale Formation	Dark shale, fine-grained limestone
Fearnaght Formation	Pale conglomerate & red sandstone
Mullynagowan Sandstone Member	Two metre thick pale grey sandstone
Newtownbutler Limestone Member	Pale grey grainstone
Red Island Formation	Greywacke, microconglomerate & argillite
Ulster Canal Formation	Calcareous sandstone, shale, micrite

On initial consultation with Geological Survey of Ireland (GSI) the Geological Heritage audits of County Cavan and County Monaghan were incomplete, however it was reported that the nearest Geological Heritage site to the proposed development area is Redhills (Claragh) in County Cavan, which is approximately 5km to the south of the development area. This is an area of ferruginous shales that were extensively mined in the 19th century. This Geological Heritage site is being recommended for NHA designation. GSI commented that the site is unlikely to be impacted upon by the proposed navigation development due to its distant location.

Figure 15.1 Bedrock Geology

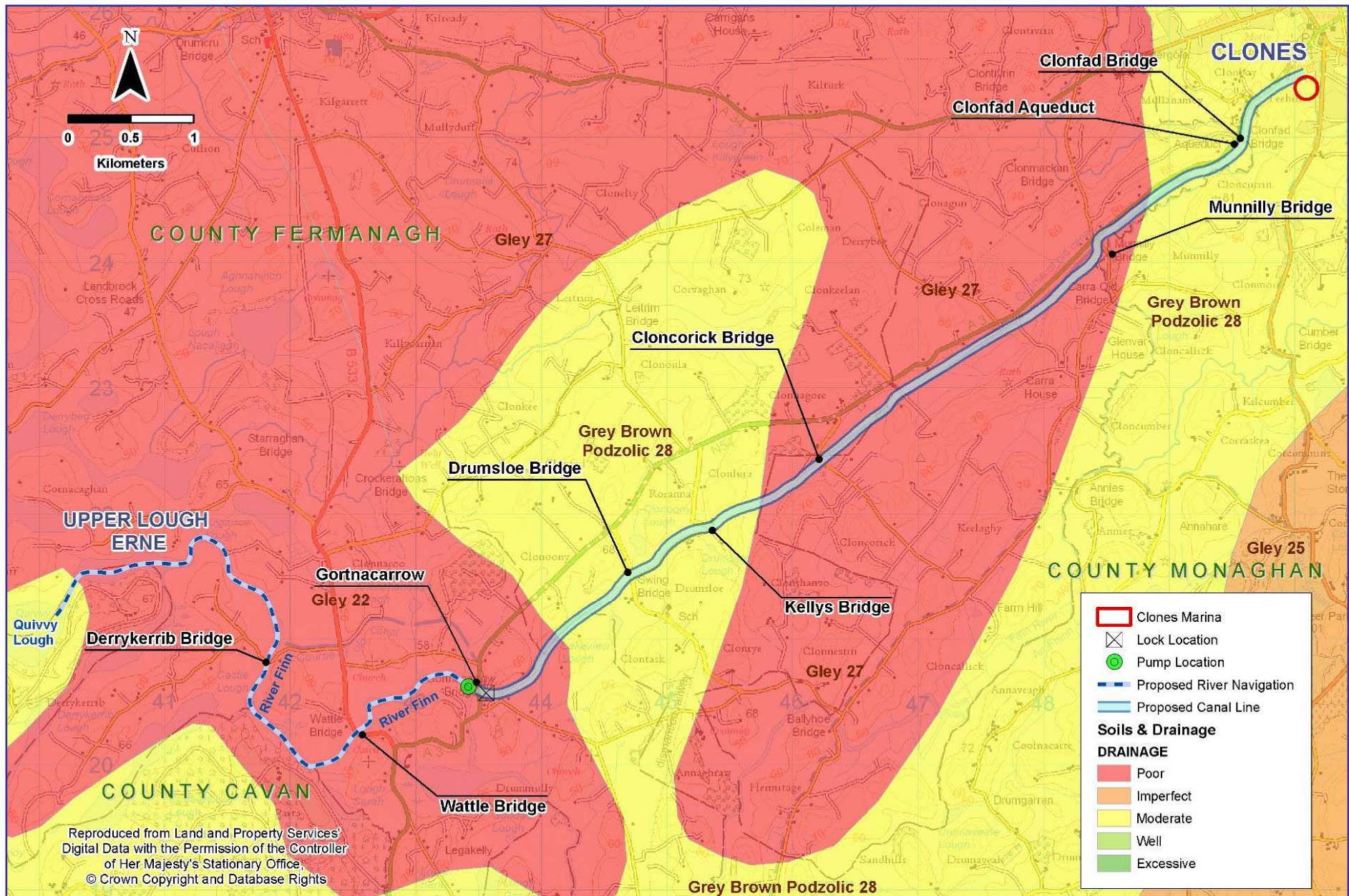


15.3 SOILS

Soils in the south western rolling lowland area of the canal are mainly poorly draining gleys of low hydraulic conductivity over Upper Carboniferous shale glacial till. Travelling north east from Clonooney to Clonnagore the soils are mainly moderately draining grey brown podzols over limestone glacial till. There are also gleys and interdrumlin peat and peaty gleys present in this area. From Clonnagore to Munnilly the soils are generally poorly draining gleys of very low hydraulic conductivity over Upper Carboniferous limestone and shale sandstone glacial till. From Munnilly to Clones the soils are generally moderately draining grey brown podzols of moderate hydraulic conductivity over limestone glacial till. **Figure 15.2** demonstrates the main soil units in the area and their drainage characteristics.

No known issues with regards to contaminated land along the proposed route of the canal have been raised in any consultations. Following closure of the Ulster Canal there was large amounts of fill material used to reclaim the land for agriculture, the source and composition of this material was unknown, however was subject to detailed site investigations. Soil sampling and analysis was undertaken by Glovers Site Investigation Ltd along the proposed route of the canal and river navigation in 2010. None of the samples analysed were found to contain chemicals at hazardous levels. This is discussed further in **section 18**.

Figure 15.2 Soils and Drainage Characteristics



15.4 GROUNDWATER

All works associated with the Ulster Canal from Upper Lough Erne to Clones will occur within the boundaries of the Clones groundwater waterbody (IEGBNI_NW_G_063). Under the WFD the Clones groundwater waterbody is currently of Good Status, with an overall objective of Protect.

Most of the wells in the vicinity of the canal line are poor yielding dug wells, boreholes, or low springs. Two excellent yielding public supply boreholes are present to the north of the canal at Clonlura (230m north) and Clonnagore (365m north). Three good to excellent yielding industrial water supply wells are also present at Teehill on the eastern side of Curtain Street, approximately 350m to the south east of the proposed marina at Clones.

The nearest groundwater source protection area is 2.3km to the south east at Scotshouse, which contains 16 wells, of which 5 are public supply boreholes of good to excellent yields.

15.5 TOPOGRAPHY

15.5.1 Regional Topography

As detailed in **section 8**, the landscape in the close proximity of the proposed navigation from Upper Lough Erne to Clones is made up mainly of waterways and lowland drumlins. The proposed canal length between Gortnacarrow and Clones is generally the same at an elevation of about 49m OD, while drumlin tops in the area are generally around 70m elevation. Further afield the entire navigation length is surrounded on all sides by higher ground, to the west the Cuilcagh Mountains (666m), to the north Slieve Beagh (370m), to the east the higher ground at Cavanagarvan (200m), and to the south Slieve Glah (319m). The lowest lying area near to the canal is Upper and Lower Lough Erne to the north west of Gortnacarrow.

Geological Survey of Ireland has recorded no landslides within the vicinity of the proposed development area within their Geohazards database.

15.6 SITE INVESTIGATIONS

Glovers Site Investigations Ltd undertook a series of site investigations along the proposed route of the navigation. A summary of these findings at each of the proposed area of works is provided below, giving a site description, a general description of the site geology from the 1:50,000 Geological Survey Northern Ireland mapping, a summary of the results from the borehole testing (in stratigraphical order), and the groundwater levels encountered. **Figure 15.3** shows the site investigation locations. Engineering appraisals of the substrate suitability have been supplied by Glovers Site investigations Ltd for the appointed contractor to adopt in their detailed design.

15.6.1 Derrykerrib Bridge

Exploratory holes were located in the agricultural land to both sides of the western approach embankment to the bridge. Geological maps show the site to be underlain by bedrock of the Drumgesh Shale Formation, of the Carboniferous period, described as mudstone, dark grey, and limestone, fossiliferous. The drift cover on the west bank of the river is shown as Alluvium, close to the channel, and Lacustrine Alluvium, with Glacial Till further west beyond the floodplain.

- Topsoil: 200-300mm thickness.
- Glacial Till: Penetrated to 1.1m in the percussion borehole as firm brown slightly sandy slightly gravelly clay terminating on a boulder at 1.1m. Rotary drilling at two locations encountered grey sandy gravelly clay with cobbles and boulders, identified as being of variable consistency.
- Limestone: Medium strong to strong, in places weak, dark grey thinly to medium bedded fine grained fossiliferous limestone interbedded with thin lenses of mudstone. Fresh, locally slightly weathered adjacent to discontinuity surfaces with some clay smearing.

There was a groundwater strike at 0.9m, rising to 0.50m, in the percussion borehole (BH02); groundwater was not detected in the two rotary drilled boreholes. However, the use of drilling flush would have masked small water entries. A standing water level near the water level in the River Erne would be expected in the area.

15.6.2 Wattle Bridge

The exploratory holes were located in the agricultural land to both sides of the road on the south east side of the river. Geological maps show the site to be underlain by bedrock of the Drumgesh Shale Formation, of the Carboniferous period described as mudstone, dark grey, and limestone, fossiliferous. The drift cover is shown as Lacustrine Alluvium in the area close to the river upstream of the bridge with Glacial Till in the downstream area and on progression away from the river.

- Topsoil: 300mm thickness.
- Glacial Till: Penetrated to the base of the 1.3-1.7m deep percussion borehole as firm, becoming stiff and very stiff sandy gravelly clay with low cobble content. Both boreholes terminated on boulders; rotary drilling showed the continuance of Glacial Till to approximately 4.5m depth.
- Limestone: Dark grey / grey thinly to medium bedded fine grained fossiliferous limestone interbedded with thin layers of mudstone. Fresh, locally slightly weathered and of compressive strength varying weak to strong, locally very strong.
- Groundwater: Groundwater was not encountered during exploration; however, the use of drilling flush would have masked small water entries to the rotary drilled boreholes. A standing water level near the water level in the River Finn would be expected in the area.

15.6.3 Gortnacarrow

Ground investigation works at Gortnacarrow were conducted in the area alongside the A3 Cavan Road directly to the north east of the Gortnacarrow Bridge and close to the junction with Drumgramph Road. The area of the investigation included:

- The low-lying, occasionally waterlogged, area immediately adjacent to the River Finn to the south west of the junction of the A3 and the Druncrin Road.
- The area to the north of the “First Stop” tyre depot where the ground rises steadily northwards on a glacial drumlin.
- The former course of the Ulster Canal, which has now been largely infilled.

The majority of the exploratory holes were located in land used for agriculture. Geology maps of the area show the site to be underlain by bedrock of the Drumgesh Shale Formation of the Carboniferous period, described as mudstone, dark grey, and limestone, fossiliferous. Drift cover of Lacustrine Alluvium (first level) in the area to the west of the A3; Glacial Till within the higher level ground forming the glacial drum; with bedrock at or near the surface near the Drumgramph Road.

- Topsoil: 100-400mm thickness in the exploratory holes in road verges and fields.
- Fill/Made Ground: within the road construction layers and farm access tracks and identified to 1.1m (BH12), 1.3m (BH16A), 0.9m (BH18), 2.0m (TP02) and 1.2m (TP03), predominantly as fine-grained soils of variable consistency.
- Peat: penetrated in BH07, located close to the River Finn as spongy brown fibrous peat to 1.9m underlain by spongy dark grey silty fibrous peat to 5.4m.
- Lacustrine Alluvium: encountered underlying the peat to 7.2m in BH07 and to the base of TP01 and TP02, 2.0m and 4.0m deep, respectively. The soils are very soft slightly sandy organic silt and silty clay.
- Glacial Till, mainly fine-grained soils: sandy gravelly clay with variable cobble and boulder content, firm in upper horizons becoming stiff and very stiff with depth.
- Limestone: recovered in five boreholes below 1.4-9.5m depth by rotary coring over 3.0-5.1m length of borehole. The rock was typically medium strong dark grey to black fine grained fossiliferous limestone.

Groundwater was encountered during the exploration works as follows:

Exploratory Hole	Depth of water entry (m)	Depth to water after 20 minutes (m)	Comments
BH07	1.7	0.3	Water Strike
BH09	1.85	1.1	Water Strike
BH16A	1.3	0.4	Water Strike
BH18R	2.5	1.7	Water Strike
TP01	1.1		Water struck
TP02	1.3		Seepages
TP03	1.5		Steady flows

A standpipe was installed in BH18R for monitoring the seasonal variation of groundwater.

15.6.4 Gortnacarrow Access Bridge

Ground investigation works were conducted at the site of a proposed access bridge over the canal at Gortnacarrow: approximate canal chainage of 3,300m. Geology maps of the area show the site to be underlain by bedrock of the Drumgesh Shale Formation, of the Carboniferous period described as mudstone, dark grey, and limestone, fossiliferous. The site is close to the boundary of an area underlain by Glacial Till (within a drumlin to the north), and an extensive area of peat to the south.

- Topsoil: 200mm thickness in BH19.
- Peat: penetrated in 0.4m surface layer in BH20 and identified to 5.5m in rotary drilled BH20R. The variation between the two boreholes is indicative of the marked variation in peat thickness in the area.
- Lacustrine Alluvium: penetrated in the two percussion boreholes to 0.9m and 1.6m as very soft /soft slightly sandy clay and organic clay.
- Glacial Till: penetrated to 2.5m depth in the location of BH19/BH19R and to 2.7m in BH20, as variable fine-grained soils with a 0.6m layer of clayey sandy gravel. The increasing strength and increase in coarse-grained content lead to refusal of the two percussion boreholes at 1.3m and 2.7m depth.
- Limestone: weak to medium strong, in places to strong/weak, dark grey fine-grained limestone with occasional calcite veining and fossilisation.

Groundwater was encountered as a water strike at 1.6m in BH20. The use of drilling flush would have masked small water entries to the rotary drilled boreholes. A high standing water level would be expected in the low-lying frequently waterlogged area.

15.6.5 Drumsloe Bridge

Ground investigation works were conducted in the area of the Swing Bridge in the townland of Drumsloe at an approximate canal chainage of 4,650m. An existing bridge carries a minor road over the former canal at approximately 450m to the south of the N54. Geology maps of the area show the site to be underlain by bedrock of the Drumgesh Shale Formation, of the Carboniferous period described as mudstone, dark grey, and limestone, fossiliferous. The drift cover is shown as peat with Glacial Till in the area to the north west and with rock shown at or near the surface in adjacent areas.

- Topsoil: 100mm thickness.
- Peat: generally spongy brown pseudo-fibrous – fibrous peat penetrated to 2.2m in BH23 with the strata in the two rotary drilled boreholes described as peat to approximately 7m and 8m.
- Lacustrine Alluvium: identified in BH23 below 2.2m as very soft slightly sandy clay.
- Glacial Till: recovered below roughly 7m and 8m in the two rotary boreholes as arisings from Symmetrix drilling, and described as stiff sandy gravelly clay with cobbles and boulders.

Groundwater was not encountered during exploration; however, the use of drilling flush would have masked small water entries to the rotary drilled boreholes. A high standing water level would be expected in the area.

15.6.6 Derrynure Access Bridge

Ground investigation works were conducted at the site of a proposed access bridge over the canal at Derrynure: approximate canal chainage of 7,300m. Geology maps of the area show the site to be underlain by bedrock of the Drumgesh Shale Formation, of the Carboniferous period described as mudstone, dark grey, and limestone, fossiliferous. The site is close to the boundary of areas underlain by Glacial Till and peat.

- Topsoil: 600mm thickness in BH27.
- Peat, penetrated to 1m in BH26 as spongy dark brown/black fibrous peat containing roots and pieces of bark.
- Lacustrine Alluvium: penetrated in the two boreholes to 2.7m and 2.95m as very soft /soft
- Slightly Sandy Clay, with organics in places
- Glacial Till: medium dense – dense slightly clayey sandy gravel penetrated by 0.6-0.65m depth before refusal encountered on probable boulders.

Groundwater was encountered during exploration as follows:

Exploratory Hole	Depth to Water (m)	Depth to Water Rise (m)	Form of water Entry
BH26	2.7	0.6	Water strike
BH27	3.6	1.4	Moderate seepage

15.6.7 Clongowna Access Bridge

Ground investigation works were conducted at the site of a proposed access bridge over the canal at Clongowna at an approximate canal chainage of 8,400m. Geology maps of the area show the site to be underlain by bedrock of the Ballysteen Formation, of the Carboniferous period, described as limestone, argillaceous and mudstone, calcareous fossiliferous. The site is shown as underlain by Glacial Till with peat in the immediate areas to the south west and north east.

- Topsoil: 300mm thickness.
- Glacial Till: sandy gravelly clay with low cobble and boulder content. The soils are of variable consistency ranging soft to firm to very stiff. The presence of cobbles and boulders led to refusal of the two boreholes at 1.35m and 2.8m depth.

Groundwater was encountered as a water strike at 1.9m in BH29.

15.6.8 Munnilly Road Bridge

Ground investigation works were conducted near the junction of a minor road with the A3 Cavan Road in the townland of Munnilly, approximately 2.5km south west of Clones: approximate canal chainage of 9250m. Geology maps of the area show the site to be underlain by bedrock of the Ballysteen Formation, of the Carboniferous period, described as limestone, argillaceous and mudstone, calcareous fossiliferous. The drift cover in the area of the road junction is shown as Glacial Till with Lacustrine Alluvium (third level) in the area to the south.

- Topsoil: 200-300mm thickness.
- Made Ground: identified to 1.9m in BH33, to the north east of the minor road, as soft/firm, occasional organic, clay with fragments of red brick and wood. The 0.5m thick probable former topsoil layer was penetrated below 1.9m.
- Lacustrine Alluvium: penetrated as soft silty clay in a 0.6m layer below the former topsoil in BH33.
- Glacial Till (coarse-grained): medium dense sandy gravel penetrated by 0.5m at the base of the 3.5m deep BH33.
- Glacial Till (fine-grained): encountered in BH32 as firm to stiff sandy gravelly clay, with occasional cobbles below 1.0m. The borehole terminated at 1.7m on probable obstructions within the Till.

Groundwater was encountered during exploration as follows:

Borehole	Depth to Water Strike (m)	Depth to Water Rise (m)	Nature of Water Entry
BH32	1.0	0.8	Water Strike
BH33	2.4	1.7	Water Strike
P21A	2.0	0.3	Water Strike

15.6.9 Clonfad Siphon and Access Bridge

Ground investigation works were conducted in the area of Clonfad Bridge located at the border on the A3/N54, approximately 1km south west of Clones, at a canal chainage of 10,800m. Geology maps of the area show the site to be underlain by bedrock of the Ballysteen Formation, of the Carboniferous period, described as limestone, argillaceous and mudstone, calcareous fossiliferous. The site is near the limit of an area shown to be underlain by Lacustrine Alluvium (third level) with Glacial Till in the surrounding areas.

- Topsoil: 200mm thickness.
- Made Ground: Firm, slightly gravelly silty clay penetrated to 1.4m, underlain by 200mm thick former topsoil layer.
- Lacustrine Alluvium: very soft grey slightly organic silty clay to 4.4m depth.
- Glacial Till: penetrated to 5.8m as firm to stiff, slightly sandy slightly gravelly silty clay.
- Limestone: possible bedrock penetrated by 0.3m at the base of the borehole.

Groundwater was encountered in BH77 at 4.2 – 4.4m, near the base of the alluvium, and on entering the possible bedrock, rising to 2.7m in 5 minutes. There were water entries to TP37 and TP38 at 3.5m and 1.8m respectively.

15.6.10 Teehill Farm Accommodation Bridge

Ground investigation works were conducted in the Teehill area, alongside the N54, approximately 350m south west of the Canal Stores in Clones, at an approximate canal chainage of 11,225m. Geology maps of the area show the site to be underlain by bedrock of the Drumgesh Shale Formation, of the Carboniferous period, described as mudstone, dark grey, and limestone, fossiliferous. The site is near the limit of an area shown to be underlain by Lacustrine Alluvium (third level) with Glacial Till in the area to the north.

- Topsoil: 100-200mm thickness.
- Lacustrine Alluvium: grey slightly organic silty clay and clayey silt, penetrated to the base of the two pits, of maximum 4m depth. The soils were very soft, under a 0.6m thick firm layer below topsoil in TP41.

Groundwater was encountered as seepage at 2.3m depth in TP41. A standing groundwater level near the ground surface would be expected in the area.

15.6.11 Clones Marina

Ground investigation works were undertaken in the area of the proposed Clones Marina and Amenity Area. Geology maps of the area show the site to be underlain by bedrock of the Drumgesh Shale Formation, of the Carboniferous period, described as mudstone, dark grey, and limestone, fossiliferous. However, the nearby area to the south is shown as underlain by the Ballysteen Formation, of the Carboniferous period, described as limestone, argillaceous and mudstone, calcareous fossiliferous. The at-surface drift cover is shown as Peat with Glacial Till in the immediate area to the north.

- Topsoil: 300mm thickness.
- Peat: penetrated to 7m.
- Glacial Till: grey sandy gravelly clay with cobble and boulders.
- Limestone: typically medium strong to strong grey thinly to medium bedded fine grained fossiliferous limestone with laminations and interbeds of mudstone, recovered by rotary coring below 11.0-11.5m depth.

Groundwater was not detected during drilling of the two boreholes. However, the use of drilling flush would have masked small water entries to the boreholes. A standing water level near the water level in the abandoned canal would be expected in the peat in the area.

15.7 CONSTRUCTION IMPACTS

15.7.1 Geology

Construction of the Ulster Canal from Upper Lough Erne to Clones may have some small localised effects on geology where the rock is close to surface. Potential works along the River Finn navigation may require the permanent removal of some boulders and rock material to create the required navigation draft, or to provide stable foundations for the bridge alterations and the Gortnacarrow tunnel and lock structure. These impacts however would be very localised. It would not be anticipated that the excavation activities for the canal creation or the piling of structures on the canal would have any negative impacts on the local geology.

15.7.2 Soils

Establishment of the River Finn navigation will involve the dredging of the river bed (mainly silt and organic matter) to create a navigation channel of sufficient draft. This material will be permanently lost to the river bed, however may potentially be re-used for soil improvement in the local area, otherwise it will be disposed of at a licensed disposal site. On the route of the canal between Gortnacarrow and Clones it has been estimated that 25% of the cut material is unsuitable for engineering works. Waterways Ireland intend to re-use as much of the cut material as possible on site, therefore hope to use the unsuitable cut material for landscaping purposes, otherwise it will be disposed of at a licensed disposal site. The majority of the canal will be in the vicinity of the old canal line, and therefore much of the soil removed will be fill of unknown origin that was used to infill the canal. However some areas of natural and improved agricultural soils will also be permanently lost in the footprint of the canal.

15.7.3 Groundwater

Construction works at Derrykerrib Bridge, Wattle Bridge and Gortnacarrow are likely to require cofferdams and dewatering during the bridge alterations and the construction of the Gortnacarrow tunnel and locks. It is unlikely that these activities will have significant negative impacts on groundwater quality and quantity in the area. Due to the high groundwater levels in the area any drawdown from dewatering operations is likely to be very localised. In the construction of the canal section there may also be some dewatering required, however at a greater depth to water strike, so potentially lesser volumes. The laying of puddle clay and HDPE liners along the canal section will completely separate the canal from the local groundwater.

15.8 OPERATIONAL IMPACTS

15.8.1 Geology

The operation of the Ulster Canal – Upper Lough Erne to Clones should have no impacts of on the local or regional geology.

15.8.2 Soils

The operation of the Ulster Canal – Upper Lough Erne to Clones should have no significant impacts of on the local or regional soils. However maintenance dredging may occasionally be required in the river navigation and the canal to maintain a navigable channel. This will be removing silt and organic matter from the system.

15.8.3 Groundwater

As the proposed canal will be separated from the natural hydrogeological regime of the area via a 0.3m thick layer of puddle clay and an impermeable HDPE liner, and as the abstraction water for the canal is being re-circulated and not lost from the local water balance, there should be no impacts on the local groundwater levels or groundwater waterbody status. A slight deflection in the water table may occur during wet periods, whereas the groundwater will be unable to ingress into the canal; however this should not have any impacts on local groundwater quality or quantity.

15.9 MITIGATION MEASURES

To prevent unnecessary losses of geological material any construction works that require rock removal should be minimal and occur as accurately as possible. Waterways Ireland have adopted the Design with Nature approach in their river navigation, therefore plan to use the existing deep channels of the River Finn, where possible, to minimise excavation requirements. This is detailed further in the Environmental Management Plan in **Appendix A**. To prevent the unnecessary removal of excess amounts of groundwater it would be recommended that construction of the canal line occurs like a production line with a small working face, whereas the excavation is graded and lined as soon as possible with puddle clay and HDPE liner, while excavators move on down the line. As is standard practice on construction sites it will be important that all oils, greases, fuels and other hazardous materials are stored appropriately, so cannot contaminate the local soil or groundwater resources.

15.10 RESIDUAL IMPACTS

It is unlikely that the construction and operation of the Ulster Canal from Upper Lough Erne to Clones will have any residual impacts upon the local soils, geology and groundwater resources, apart from the initial permanent loss of materials. However the creation of the canal line from Gortnacarrow to Clones with impermeable linings may cause a slight deflection in the water table during wet periods, whereas the groundwater will be unable to ingress into the canal, although this should not have any impacts on local groundwater quality or quantity.

15.11 CONCLUSIONS

Construction of the Ulster Canal from Upper Lough Erne to Clones is likely to have some negative impacts on the local soils, geology and groundwater, through the permanent removal of materials. These impacts will be very localised and where possible materials will be re-used on site. All

groundwater removed during dewatering operations will be returned to the local water system. There would not be anticipated to be any long term significant negative impacts of the operation of the canal.

16 TRAFFIC

16.1 INTRODUCTION

This section of the EIS assessed the potential traffic generated from construction and operation of the Ulster Canal from Upper Lough Erne to Clones.

16.2 CONSTRUCTION TRAFFIC

In order to assess the potential impacts of the reopening of the canal, it has been necessary to base the assessment on a number of assumptions based on experience of similar canal restoration/construction projects with regards to the time frame for delivery of the works and the likely operational hours of the construction crews. Time frame assumptions used within calculations are listed as follows:

- Construction period – **150 Weeks**
- Working Days per week – **5.5 Days**
- Working Hours per day – **8 hours**
- Total Working Hours – **6600 Hours**

Construction traffic generations were calculated based on the above working hour assumptions and required construction quantities for various activities across the 3 year construction period. The following assumptions were made regarding quantity conversions and plant used to transport materials:

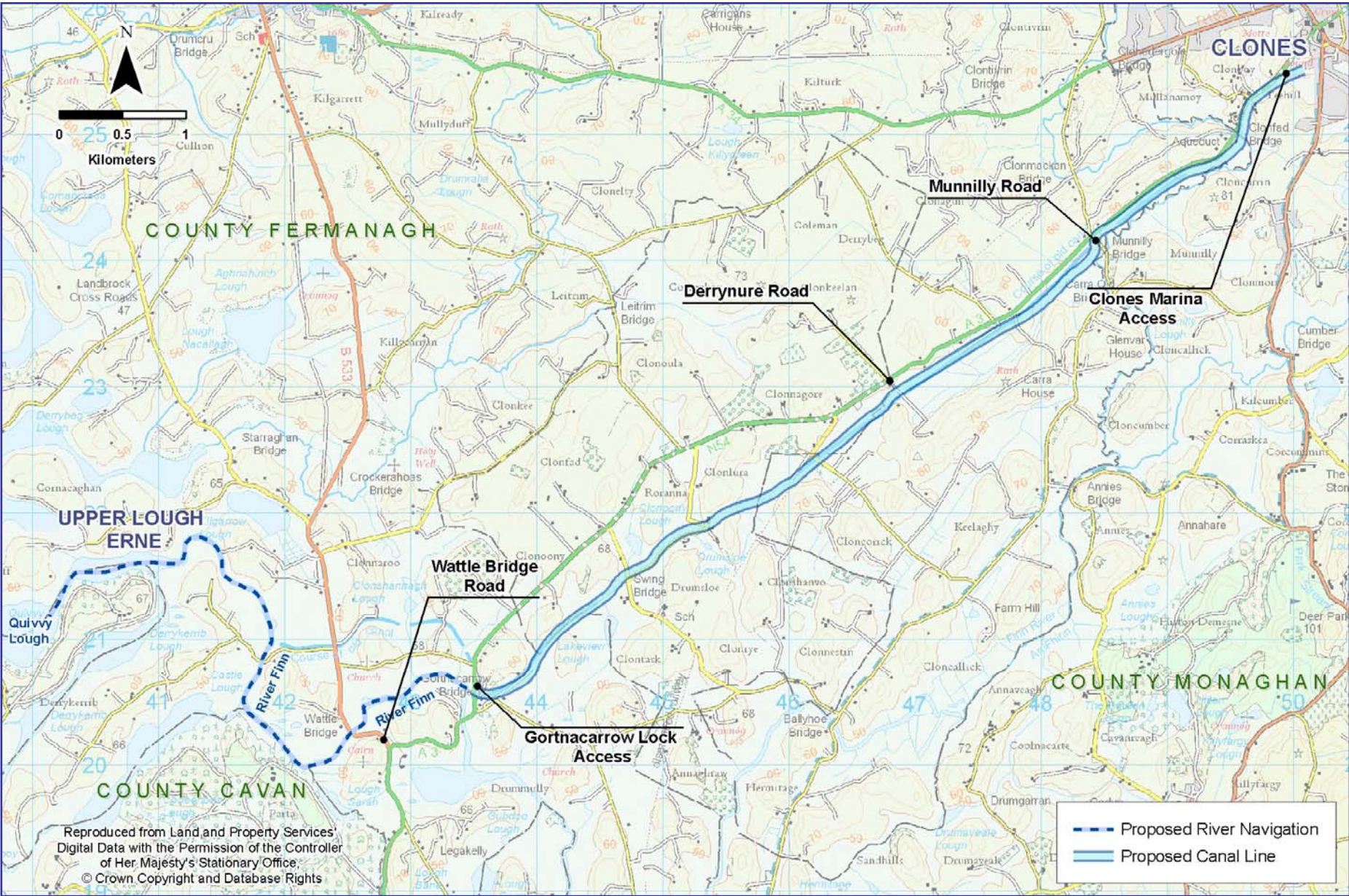
- m³ to Tonnes – **1.7 tonnes per m³** (for robust assessment of cut/fill material)
- Lorries used for material Transportation – **20 Tonnes**
- Lorries that arrive full will leave empty, and vice versa, so most likely overestimating vehicle movements.

It has been assumed that all construction traffic will access the construction working strip via the A3/N54 Cavan Road. In order to estimate the traffic impact on the A3/N54 Cavan Road for the duration of construction works, it was assumed that along the 14km length of the A3/N54, where it runs parallel to the proposed navigation, there would be five construction access points. The traffic will be assigned to each of the accesses based on the construction activity assumed to be associated with each access. This will allow the traffic impact on the A3/N54 to be assessed at each location. **Table 16.1** lists the location of the site access junctions to the A3/N54, which are shown in **Figure 16.1**.

Table 16.1 Assumed Site Access Locations

Access	Junction with A3/N54
1	Wattle Bridge Road
2	Gortnacarrow Lock Access
3	Derrynure Road
4	Munnilly Road
5	Marina Access (Clones)

Figure 16.1 Site Access Locations



Construction material quantity calculations were broken down into 2 sections of similar works in order to estimate the likely HGV movements required for each activity. Movements were assigned to each access based on assumptions regarding the likely level of construction activity at each access. Basic assumptions regarding traffic assignments are detailed later.

The first traffic generations to be calculated are for the proposed canal and road embankments. Cut and fill activities are detailed for each location along the 14km route. Traffic movements associated with canal bed dredging are also indicated at this stage. These HGV movements are considered to be overestimates as all vehicles are assumed to arrive full and leave empty, or arrive empty and leave full, therefore inefficient vehicle usage. Also it has been assumed that all material excavated that cannot be used within that area for embankment construction will be removed from the site, whereas in reality it is likely to be used for landscaping purposes.

Table 16.2 details the likely traffic movements associated with these activities and demonstrates that there is a total hourly movement of 3.7 HGV's associated with the excavation (cut and fill) works and canal bed dredging over the construction period. When assessing traffic impact a private vehicle is generally accepted to be the equivalent of 1 pcu's (personal car units) and a HGV is assigned a 2 pcu value. Therefore the excavation and dredging activities will generate the equivalent of 7 pcu movements. This would be considered to be insignificant impact upon the surrounding junction.

Table 16.2 Traffic Generations associated with Excavation and Dredging Works

Access	Location	Cut Vol. (m ³)	Fill Vol. (m ³)	Excess material (m ³)	Excess material (T)	Lorries Required	Lorries / Hr
1	Derrykerrib	20,000	3,000	17000	44,200	2,210	0.33
	Wattle Bridge	12,500	3,500	9000			
2	Gortnacarrow Lock	20,460	-	20460	199,712	9,986	1.50
	Gortnacarrow Moorings Chainage 3300 - 5000	18,000	15,650	2350			
	Chainage 3,300 – 4,600	24,785	31,848	7063			
	Drumsloe Bridge	1,900	31,600	29700			
	Chainage 4,850-5,450	5,527	17,906	12379			
	Kelly's Bridge	13,110	-	13110			
	Chainage 5,600 – 6,200	13,970	2,074	11896			
	Chainage 6,200-6,350	7,530	-	7530			
	Chainage 6,350 – 6,450	1,370	500	870			
	Cloncorrick Bridge	6,030	-	6030			
	Chainage 6,600-6,700	6,090	-	6090			
3	Chainage 6,700-7,350	20,565	1,130	19435	56,017	2,801	0.42
	Derrynure Bridge	476	-	476			
	Chainage 7,400-8,400	11,165	24,205	13040			
4	Clongowna	1400	-	1400	172,491	8,625	1.30
	Chainage 8,500-9,250	2180	33,320	31140			
	Munilly Bridge	540	16,000	15460			
	Chainage 9,450-10,800	20,535	31,750	11215			
	Clonfad Siphon/Bridge	2,000	8,400	6400			
	Chainage 10,900 -11,100	9,305	980	8325			
	Teehill Bridge	3,160	-	3160			
	Chainage 11,150-11,500	24,365	-	24365			
5	Clones Marina	12,500	-	12500	21,250	1,063	0.16
2	Gortnacarrow Lock	-	-	201	342	17	0.003
	Total	259,463	221,863	290,394			
Total Movements (PCUs) = Lorries / Hr x 2							7*

*Movements rounded to nearest whole trip

Bridge construction works have been broken down into traffic movements associated with the delivery of concrete, steel reinforcement and road construction materials. The following assumptions were made regarding the delivery of each:

- Concrete – Delivered in 5m³ quantities
- Steel Reinforcement – Delivered in 25 Tonne loads
- Road Materials – Delivered in 20 Tonne loads
- For the purposes of assessment 1m³ of stone equates to 2 tonnes.

Table 16.3 outlines the quantities and resulting HGV movements associated with each of the bridge structures. This indicates that there is a total hourly movement of 1.65 HGV's associated with the bridge construction works over the construction period. With the application of a 2.0 pcu conversion factor this results in 3.3 pcu's of generated traffic associated with bridge works. This would be considered to be an insignificant impact upon the surrounding network.

Table 16.3 Traffic Generations associated with Bridge Construction Works

Bridge Works		Concrete Required (m ³)	Concrete Lorries Required	Per Hour	Steel Required (tonnes)	Artic Lorries	Per Hour	Stone (m ³)	Lorries	Per Hour	Total Per Hour
Derrykerrib Bridge	Concrete	1100	220	0.033							
	Steel				350	14	0.002				
	Stone							8250	825	0.125	0.16
Wattlebridge	Concrete	1600	320	0.048							
	Steel				950	38	0.006				
	Stone							2050	205	0.031	0.085
A3 Clone Bridge	Concrete	1600	320	0.048							
	Steel				560	22	0.003				
	Stone							6000	600	0.09	0.141
Drumsloe New Bridge	Concrete	800	160	0.024							
	Steel				550	22	0.003				
	Stone							58600	5860	0.888	0.915
Clongowna Access	Concrete	300	60	0.009							
	Steel				320	13	0.002				
	Stone							1125	113	0.017	0.028
Munilly Lifting Bridge	Concrete	800	160	0.024							
	Steel				950	38	0.006				
	Stone							3200	320	0.048	0.078
Gortnacarrow Bridge	Concrete	100	20	0.003							
	Steel				120	5	0.001				
	Stone							3750	375	0.057	0.061
Derrynure Bridge	Concrete	100	20	0.003							
	Steel				120	5	0.001				
	Stone							3750	375	0.057	0.061
Clonfad Access Bridge	Concrete	100	20	0.003							
	Steel				120	5	0.001				
	Stone							3750	375	0.057	0.061
Teehill Access Bridge	Concrete	100	20	0.003							
	Steel				120	4.8	0.001				
	Stone							3750	375	0.057	0.061
Total Movements (PCUs) = Lorries / Hr x 2											3*

*Movements rounded to nearest whole trip

Table 16.4 summarises the works undertaken during the construction period of the proposed development. This gives the total calculated movements extracted from **Table 16.2** and **16.3** and also the resulting two-way traffic flow i.e. arrivals and departures. It has been assumed that each calculated movement is an arrival on-site and therefore the two-way flow is equal to twice the number of arrivals.

Table 16.4 Traffic Generation Summary

Works	Generated Movements (In PCUs)	Generated Two-Way Flow (Movements x 2)
Excavation & Dredging	7	14
Bridge Construction	3	6
Total Two Way Flow per Hour (PCUs)		20

In order to determine existing traffic conditions in the vicinity of the proposed development, traffic surveys were undertaken at a number of junctions on the A3/N54. **Table 16.5** below summarises the dates, times and locations of the traffic surveys.

Table 16.5 Traffic Survey Details

Site	Location	Date	Survey Time
A	Proposed Access at Clones Jetty	Wednesday 23 rd November 2010	0700-1900
B	Junction of N54/A3 and Drumcrin Road	Wednesday 23 rd November 2010	0700-1900

The impact of the proposed development was assessed as a percentage impact on the two-way flow on the A3/N54 Cavan Road. The generated traffic will be assigned to each junction on a pro-rata basis on an assumed split of the likely generated traffic. **Table 16.6** below details the accesses and the assumed generated traffic split.

Table 16.6 Traffic Assignment

Access	Junction with A3	% Assignment
1	Wattle Bridge Road	20
2	Gortnacarrow Lock Access	40
3	Derrynure Road	20
4	Munnilly Bridge	10
5	Marina Access (Clones)	10

The AM and PM % impacts have been calculated using the two-way flow extracted from traffic counts carried out on the A3/N54. **Table 16.7** details the two way flow at each access in both the AM and PM peaks.

Table 16.7 Two-Way Traffic Flows (Existing 2010)

Access	Junction with A3	AM Two-Way Traffic Flow	PM Two-Way Traffic Flow
1	Wattle Bridge Road	272	285
2	Gortnacarrow Lough Access	272	285
3	Derrynure Road	278	294
4	Munnilly Bridge	278	294
5	Marina Access (Clones)	270	346

Table 16.8 outlines the traffic impact of the generated traffic in the AM and PM peak periods.

Table 16.8 Percentage Impacts – Construction Traffic

Access	Junction with A3	Construction Traffic Assigned to Access* (Pcu's)	AM Two-Way Traffic Flow	AM Two-Way Flow % Impact	PM Two-Way Traffic Flow	AM Two-Way Flow % Impact
1	Wattle Bridge Road	4	272	1.47%	285	1.40%
2	Gortnacarrow Lock Access	8	272	2.94%	285	2.81%
3	Derrynure Road	4	278	1.43%	294	1.36%
4	Munnilly Bridge	2	278	0.72%	294	0.68%
5	Marina Access (Clones)	2	270	0.74%	346	0.58%

*Assigned traffic rounded to nearest whole trip

The Institute of Highways and Transportation (IHT) have published guidelines for Traffic Impact Assessments. These guidelines have been used as a basis for the assessment of the generated traffic by the proposed development.

Guidelines recommend that a TIA should be produced when one or other of the following threshold are exceeded:

- Traffic to and from the development exceeds 10% of the existing two-way flow on the adjoining highway, or;
- Traffic to and from the development exceeds 5% of the existing two-way flow on the adjoining highway, where traffic congestion exists or will exist within the assessment period.

The A3/N54 Cavan Road is not deemed to be congested during the assessment period; therefore the 10% threshold for Traffic Impact Assessment has been applied in this instance.

Table 16.8 indicates that the proposed construction works will not have a detrimental impact on traffic flows on the A3/N54 Cavan Road, even with this robust assessment. The maximum assessed traffic impact during the AM peak period is 2.94% at the Gortnacarrow Lock / A3 junction and the maximum assessed traffic impact in the PM peak period was 2.81% at the same junction.

16.3 OPERATIONAL TRAFFIC

When the development is operational, traffic will be associated with two mooring areas accessing onto the A3/N54 Cavan Road. In order to determine the potential impact of the proposed development, it is common practice to make use of a trip generation database. Throughout this section reference will be made to the Trip Rate Information Computer System, the TRICS database. TRICS is an industry standard platform accepted by both DRD Roads Service and NRA for the generation of trip data for the purposes of Transport Assessment. RPS has used the latest TRICS database 2011 (a) v6.7.1 throughout this assessment. The TRICS category 08/A Marinas was used to generate trip rates for the peak hour periods of the proposed development. **Table 16.9** summarises the total person trip rates and resulting generated trips. Operational traffic is generated using the number of vehicle parking spaces (excluding bus and trailer parking).

For the purposes of this assessment the proposed car park and picnic area at Munnilly lifting bridge has not been included as it is not considered as a traffic generator.

Table 16.9 Generated Operational Traffic

	AM Peak Period		PM Peak Period	
	Arrivals	Departures	Arrivals	Departures
Trip Rate (per parking space)	0.140	0.100	0.143	0.200
Gortnacarrow Moorings Generated Person Trips (32 parking spaces)	(0.140×32) 4	(0.100×32) 3	(0.143×32) 5	(0.200×32) 6
Total Two-way Flow	7		11	
Clones Marina Generated Person Trips (43 parking spaces)	(0.140×43) 6	(0.100×43) 3	(0.143×43) 6	(0.200×43) 9
Total Two-way Flow	9		15	

Given that there are two sets of forecasts available; Nation Road Traffic Forecasts (NRTF) and National Roads Authority (NRA) Traffic Forecasts, the more onerous growth rates have been applied

to the traffic surveys in order to predict opening year traffic flows and traffic impacts. **Table 16.10** details the traffic growth rates.

Table 16.10 Traffic Growth Rates, 2010 - 2014

National Road Traffic Forecasts (NRTF) Central Growth	National Roads Authority (NRA) Traffic Forecasts 2002-2040
6.1%	7.6%

Table 16.11 summarises the impact of the operational traffic at the likely access positions with the A3/N54 Cavan Road. As the operational traffic will only require access to two jetties, junctions 2 and 5 have been assessed for traffic impact.

Table 16.11 Percentage Impacts Opening Year 2014 – Operational Traffic

Access	Junction with A3	AM Generated Traffic	AM Two-Way Traffic Flow	AM Two-Way Flow % Impact	PM Generated Traffic	PM Two-Way Traffic Flow	PM Two-Way Flow % Impact
2	Gortnacarrow Moorings	7	293	2.39%	11	307	3.58%
5	Clones Marina	9	291	3.09%	15	372	4.03%

The A3/N54 Cavan Road is not deemed to be congested during the assessment period; therefore the 10% threshold for Traffic Impact Assessment has been applied in this instance. **Table 16.11** indicates that the proposed construction works will not have a detrimental impact on traffic flows on the A3/N54 Cavan Road. The maximum assessed traffic impact during the AM peak period is 3.09% at the junction with the A3/N54 Cavan Road at the proposed Clones marina and the maximum assessed traffic impact in the PM peak period was 4.03% at the junction A3/N54 Cavan Road at the proposed Clones marina.

16.4 CONCLUSIONS

In conclusion, neither construction traffic nor operational traffic associated with the proposed development is deemed to have a significant impact on the A3/N54 Cavan Road.

17 WATER

17.1 INTRODUCTION

This section of the Environmental Impact Statement details the potential impacts of the restoration of the Ulster Canal from Upper Lough Erne to Clones on water, within the vicinity of the navigation. This section is split into three sub sections which detail the potential impacts of the proposed navigation on local water resources, local water quality and the Water Framework Directive (WFD), and the flood risk in the area.

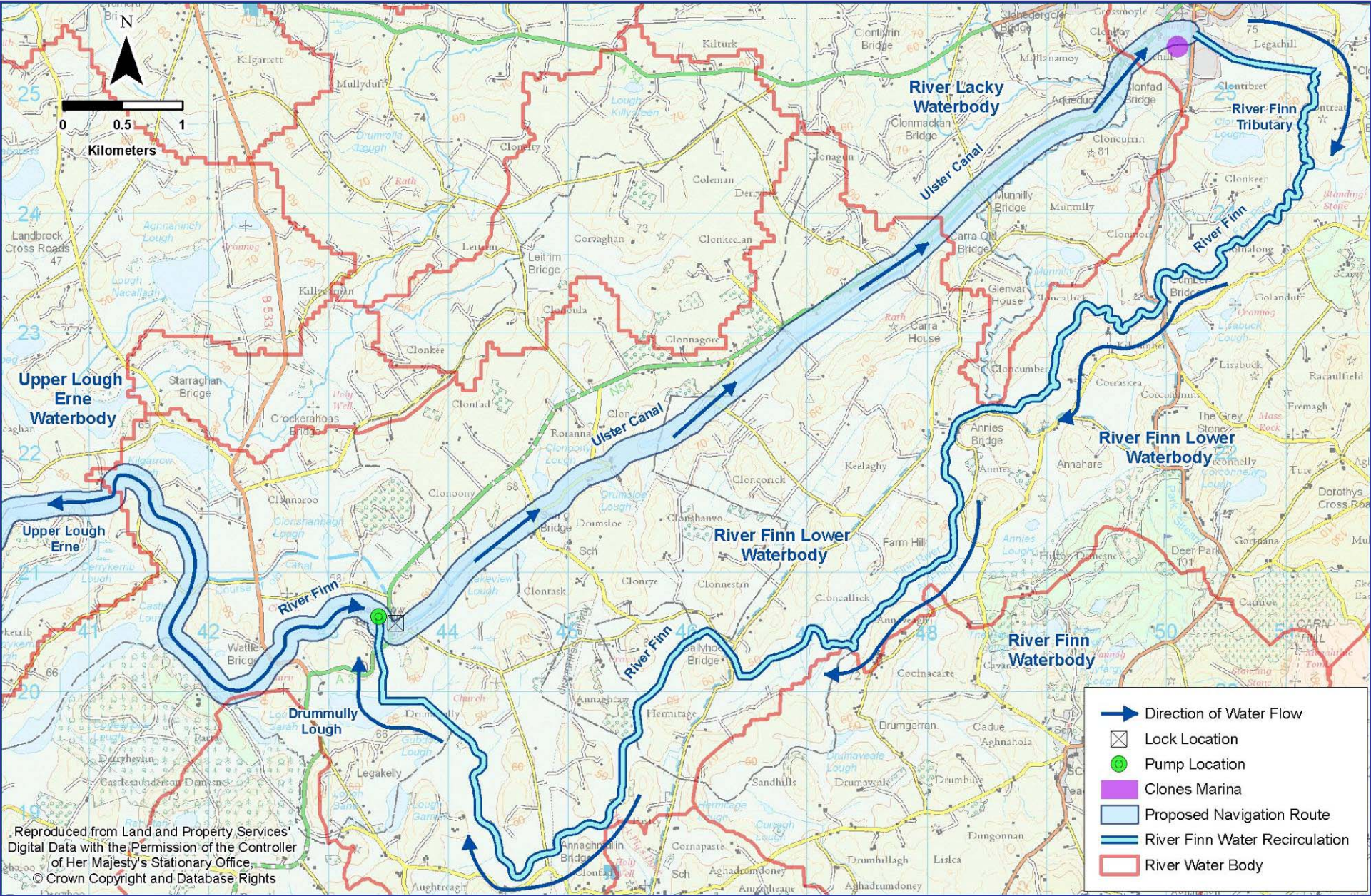
17.2 WATER RESOURCES

This sub-section demonstrates the calculations and modelling carried out for the water resource assessment for the Ulster Canal – Upper Lough Erne to Clones, thus establishing the ability of the proposal to maintain an adequate supply of water in accordance with WFD guidelines. **Section 5** describes the main processes and flows involved in the water supply for the canal. An overview of the water cycle of the proposed navigation is given in **Figure 17.1**, with features A – G explained below:

- A – This indicates the Wattle Bridge gauge location which records the flow conditions that prevail between the River Finn and Upper Lough Erne. This is discussed further in **section 17.2.2**.
- B – This indicates the abstraction location at Gortnacarrow on the River Finn. This will be powered by 3 x 30kW pumps (2 duty and 1 stand-by), with a maximum capacity of 1000 l/s (1m³/s). The pump inlet will be screened to prevent intake of flora or fauna.
- C – This indicates the location of the Gortnacarrow lock. The proposal is to incorporate a double lock system, however all environmental assessments have used a single lock system, which provides a more robust assessment, as a single lock has the potential to require more water, as detailed in **section 4**. All water abstracted for lockages will be returned to the River Finn when emptying the lock via the sluices.
- D – This indicates the gravity flow of the water in the canal. This flow is regulated via the discharge weir at Clones.
- E – This indicates the location of the marina at Clones and the discharge weir of the canal. This weir will be adjustable and will be set to allow 40 l/s to leave the marina. The discharge is to a tributary of the River Finn.
- F – This indicates the location where the through-flow from the canal meets the main channel of the River Finn, at Clonkeen. This is discussed further in **section 17.2.6**.
- G – This indicates the re-circulation route of the through-flow water, from the discharge at Clones, approximately 19kms down the main channel of the River Finn, back to the abstraction point at Gortnacarrow. This through-flow re-circulating down the River Finn remains within the Lower Finn waterbody the entire time, all the way back to the abstraction point. This water recirculation

means the canal through-flow will be non consumptive, with the base flow in the River Finn being slightly augmented from the Clones discharge of 40 l/s.

Figure 17.1 Navigation Water Cycle



17.2.1 Proposed Abstraction and Discharge Locations

The location of the proposed abstraction site for the Ulster Canal is at Gortnacarrow on the River Finn, as shown as **Location B** in **Figure 17.1**. Gortnacarrow Bridge is near the downstream end of the River Finn close to where it enters Lough Erne. The slope of the river at this point is quite shallow with little change in bed levels through to Lough Erne, and as such water levels at the site are predominantly controlled by Lough Erne particularly during low to normal flow conditions. During flood conditions levels at the site are determined by the river flow with a number of small bridges acting as control structures.

17.2.2 Data Collection

The River Finn has a number of gauging stations located along the reach from Clones to Gortnacarrow controlled by Rivers Agency, OPW and EPA. A list of the gauging stations is presented in **Table 17.1** with the data which was obtained for each included, the location of each station is shown on **Figure 17.2**.

Figure 17.2 River Finn Gauge Station Locations

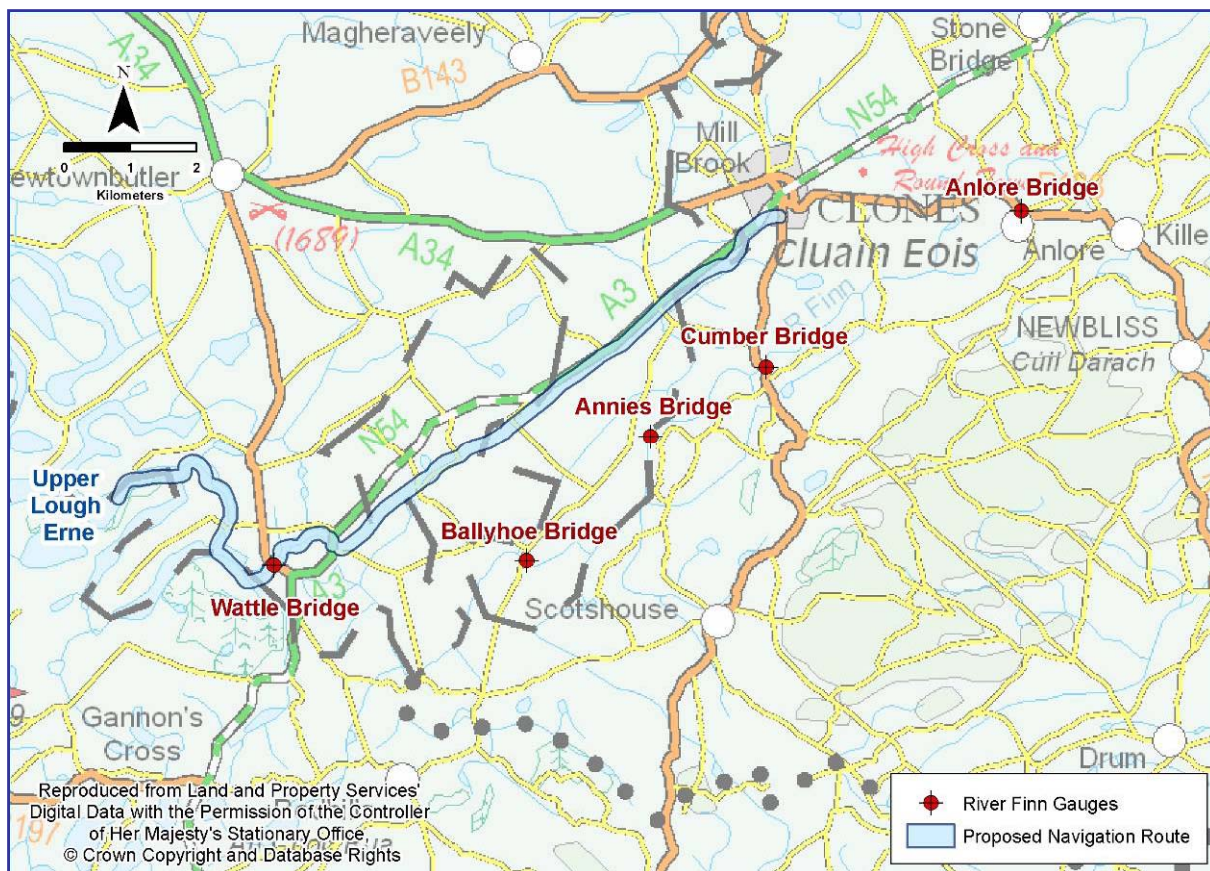


Table 17.1: River Finn Gauging Station Data

Station Name	Owner	Status	Data Received
Anlore	OPW	Active	15min flow data from 1956 to present Daily Mean flow data from 1956 to present
Ballyhoe Bridge	Rivers Agency	Active	Daily max level data from 2002 to present
Annies Bridge	EPA	Inactive	Spot Gaugings
Cumber Bridge	EPA	Inactive	Spot Gaugings
Wattle Bridge	Waterways Ireland	Active	Some recent level data

Anlore gauging station provided the most comprehensive record of flows for the River Finn in the Clones area; however it is located approximately 19km upstream from the proposed abstraction site for the Ulster Canal with a difference in catchment area of 121km². The EPA provided data for two water sampling stations closer to Gortnacarrow (Annies and Cumber Bridges), the closer of which being Annies Bridge approximately 8km upstream. A number of spot gaugings were provided for these stations, providing both level and flow data. Gaugings at Annies Bridge were compared to the corresponding flow values at Anlore, the average increase in flow was found to be 45%, this percentage also relates to the increase in catchment area. The catchment area at Gortnacarrow is 80% larger than at Anlore, therefore assuming that the same relationship between catchment area and flow increase exists, the data for the Anlore gauging station was scaled to provide a long term flow record at Gortnacarrow.

Water level information was also collected for Lough Erne from the Belle Isle gauging station; this provided an accurate indication of the downstream boundary for the computational river modelling which is discussed in more detail in the next section.

In addition to the existing gauges on the River Finn and Lough Erne an additional level and flow gauge was installed by Waterways Ireland at Wattle Bridge which is downstream of the proposed abstraction site. This gauge provides detailed information on the flow and water level regime in the River Finn as it approaches Lough Erne with the data being representative of the conditions experienced at the proposed abstraction site.

17.2.3 Water Level Assessment

One of the potential effects of water abstraction from a riverine water body is the reduction in water levels at the point of abstraction and downstream from that point. The abstraction rate relative to the available water resources should therefore be assessed to quantify this effect and assess any impacts it will have. UK TAG has produced guidelines for water abstraction based on flow conditions in the river and the time of year, limiting it to a percentage of the natural river flow based on the water body standard.

As stated earlier the water levels at the proposed abstraction site are generally controlled by Lough Erne during low and normal flow conditions, this lower part of the River Finn interacts with Lough Erne creating similar water levels with low gradients between the water bodies. To assess the backwater effect Lough Erne has on the water level at Gortnacarrow RPS constructed a computational river model, which enabled any combination of Lough level, river flow and abstraction rate to be investigated.

The computational model of the River Finn was built from upstream of Gortnacarrow Bridge to Quivvy Lough. The model was built using the Innovyze InfoWorks RS2D river modelling package. LiDAR and bathymetric data provided by Waterways Ireland were used to represent the river channel, floodplains and a portion of Quivvy Lough. All structures which would affect the river flow were included in the model to ensure an accurate representation of the flow regime is attained.

17.2.4 Water Resource Availability

17.2.4.1 UK TAG Abstraction Allowances

As the proposed abstraction is located within the River Finn water body the allowances have been conservatively calculated based on the data for the River Finn only, however as previously stated in reality the water levels at the proposed abstraction site are controlled by Lough Erne and as such the flow in the River Finn can be supplemented by a large storage volume available within Lough Erne.

Using the scaled data set described in **section 17.2.2** the percentile flows corresponding to the water resource standards categories used for Good Status water bodies detailed in the UKTAG documentation were calculated, these are presented in **Table 17.2**.

It should be noted that the River Finn is classed as a moderate status water body. However, as the goal of the Water Framework Directive is to increase moderate status water bodies to good status by 2015, which is within the design life of the canal, the UK TAG water resource standards for good status water bodies have been used in these calculations. The use of the good status standards also provides a more conservative approach in assessing the abstraction allowances and requirements.

Table 17.2: UK TAG abstraction allowances

UK TAG categories	Gortnacarrow Percentile Flows (m ³ /s)	% change allowed from natural flow Apr - Oct	% change allowed from natural flow Nov - Mar
>60%	>2.142	25%	30%
60% - 70%	2.142 – 1.42	20%	25%
70% - 95%	1.42 – 0.33	15%	20%
<95%	<0.33	10%	15%

17.2.4.2 Abstraction Volume Availability

Based on the values presented in **Table 17.2** an estimate of the volume of abstraction available from the River Finn can be calculated on a yearly basis as shown in **Table 17.3**.

Table 17.3: River Finn Abstraction Allowance (Yearly)

UK TAG categories	Average Flow available for Abstraction (m ³ /s)	Time Available (Days)	Volume available for abstraction (m ³)
>60%	Apr – Oct 2.475	128.4	27,457,056
	Nov – Mar 2.97	90.6	23,248,685
60% - 70%	Apr – Oct 0.356	21.4	658,230
	Nov – Mar 0.445	15.1	580,565
70% - 95%	Apr – Oct 0.13	53.5	600,912
	Nov – Mar 0.17	37.75	554,572
<95%	Apr – Oct 0.0213	10.7	19,691
	Nov – Mar 0.032	7.55	20,874
Total			53,140,585

The navigation season for the canal is proposed to run from 17th March to 31st October. As this period will see the greatest requirement for water abstraction the volume of water available during this period was calculated to provide a more conservative estimation of resource availability. **Table 17.4** presents the total estimated resource availability for the navigation season.

Table 17.4: River Finn Abstraction Allowance (Navigation Season)

UK TAG categories	Average Flow available for Abstraction (m ³ /s)	Time Available (Days)	Volume available for abstraction (m ³)
>60%	Apr – Oct 2.475	128.4	27,457,056
	Nov – Mar 2.97	9	777,600
60% - 70%	Apr – Oct 0.356	21.4	658,230
	Nov – Mar 0.445	0.9	34,603
70% - 95%	Apr – Oct 0.13	53.5	600,912
	Nov – Mar 0.17	3.75	55,080
<95%	Apr – Oct 0.0213	10.7	19,691
	Nov – Mar 0.032	0.75	2073
		Total	29,605,245

As part of the analysis the flows for the navigation period were abstracted from the data set for the entire period of record. Using the derived dataset the Mean Daily Flow (MDF) was calculated to be 4.78m³/s, which falls into the 60th percentile or greater flow band allowing 25% of this flow to be abstracted. Therefore, based on a conservative value representing the months when low flow conditions are most likely to occur, an average of 1.195m³/s is available for abstraction from the River Finn at Gortnacarrow for 60% of the navigation period, which is greater than the proposed maximum pumping capacity and the maximum rate of abstraction of 1m³/s. It should be further noted that the canal is a non consumptive use and that the water will returned to the river Finn upstream of the abstraction meaning that there will be no net abstraction from the system.

17.2.5 Water Resource Requirements

17.2.5.1 General Water Resource Requirements

Waterways Ireland provided estimates of the water requirements for the operation of the Ulster Canal once filling was completed; these are detailed in **Table 17.5**.

Table 17.5: Waterways Ireland annual water resource estimates

Event	Number of Days	Lockages per day	Total Lockages @ 936m ³ per Lockage*	Volume of water (m ³)
Annual Rally	6	15	90	84,240
Saint Patricks Day	3	10	30	28,080
Easter Week	9	10	90	84,240
May Bank Holiday	3	10	30	28,080
Spring Bank Holiday	3	10	30	28,080
Spring Bank Holiday (ROI)	3	10	30	28,080
July Holiday	9	10	90	84,240
August Bank Holiday (ROI)	3	10	30	28,080
August Bank Holiday	3	10	30	28,080
Weekends	48	10	480	449,280
Normal week Days	140	2	280	262,080
Totals	230		1210	1,132,560
Through Flow	365	40l/s	3456 m ³ per day	1,262,900
Evaporation	365		240 m ³ per day	83,950
Annual operational water volume				2,479,410

Estimated volume of water entering the canal via rainwater per year	118,358
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Estimated required abstraction quantity per year	2,361,052
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* Worst case scenario using single lock structure, with all lockages one way, i.e require refill.

When the yearly estimated resource requirement is compared to the resource availability calculated in **Table 17.3**, only 4% of the estimated abstraction volume available from the River Finn is required to sustain the canal operation throughout the year. However, as the canal will be re-circulating all lockages back to the River Finn at Gortnacarrow (direct to abstraction area) and all through-flow water will re-circulate back to the River Finn to the east of Clones (approximately 19km upstream of the abstraction area), the only water actually used by the canal will be that lost by evaporation, i.e 0.16% of the water resource available.

The resource requirement figures above were reanalysed focusing on the more critical navigation operational period to be more representative of requirement and availability during the navigation season, these are detailed in **Table 17.6**.

Table 17.6: Waterways Ireland navigation season water resource estimates

Event	Number of Days	Lockages per day	Total Lockages @ 936m ³ per Lockage*	Volume of water (m ³)
Annual Rally	6	15	90	84,240
Saint Patrick's Day	3	10	30	28,080
Easter Week	9	10	90	84,240
May Bank Holiday	3	10	30	28,080
Spring Bank Holiday	3	10	30	28,080
Spring Bank Holiday (ROI)	3	10	30	28,080
July Holiday	9	10	90	84,240
August Bank Holiday (ROI)	3	10	30	28,080
August Bank Holiday	3	10	30	28,080
Weekends	48	10	480	449,280
Normal week Days	140	2	280	262,080
Totals	230		1210	1,132,560
Through Flow	230	40l/s	3456 m ³ per day	794,880
Evaporation	230		317 m ³ per day	72,930
Navigation Season operational water volume				2,000,370

Estimated volume of water entering the canal via rainwater during season	65,408
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Estimated required abstraction quantity per navigation season	1,934,962
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* Worst case scenario using single lock structure, with all lockages one way, i.e require refill.

When the navigation season estimated resource requirement is compared to the navigation season resource availability calculated in **Table 17.4** only 6.5% of the estimated abstraction volume available from the River Finn during the navigation season is required to sustain the canal operation. Again, as all lockages and through-flow give the water back into River Finn either directly to the abstraction site or

upstream, the canal only requires 0.25% of the water resource available to cover the evaporative losses of the canal.

As discussed previously, any volume of water abstracted from the River Finn for lockages will be discharged back to the River Finn during subsequent lockages, while any water abstracted for through-flow will be re-circulated by discharging it to the River Finn 19km upstream of the abstraction point. Therefore in reality the only net loss of water resource from the River Finn waterbody will be due to evaporation.

17.2.5.2 Specific Water Resource Requirements

17.2.5.2.1 Through-Flow

USEPA guidelines¹ indicate that some through-flow may be required for the canal and marina to remain as a viable habitat and prevent stagnation. As an initial estimate 40l/s through-flow will be sustained to effectively flush the marina water on average every 4-days. This through-flow requirement will be reviewed based on ongoing monitoring of the habitats which have developed on the canal. In addition to this the canal will have an operational level variation limit of 150mm, which will become the natural regime within the canal and as such water levels should remain within these limits to not only maintain the navigation but also to prevent damage to any habitat which has developed. The through-flow of 40l/s will be discharged to the River Finn 19kms upstream of the abstraction point and as such will be available for abstraction without affecting the natural flow in the River Finn. This discharge to the River Finn will in effect create an additional base flow of 40l/s.

17.2.5.2.2 Hands-Off Flow

UK TAG recommends that a hands off condition is applied if the allowed abstraction rate during flows less than the 95th percentile is greater than 25% of the 98th or 99th percentile flow, which would only be the case at the proposed abstraction site if the canal did not give the water back upstream of the abstraction. To provide an extreme scenario test, this situation was analysed during the computational river modelling with the various abstraction rates being tested up to the maximum of 1m³/s with a sustained flow of 0.33m³/s (Q95) in the River Finn. An insignificant drop in water levels of approximately 0.030m of an overall water depth of 2.3m was observed in the vicinity of the abstraction, reducing with distance downstream due to Lough Erne backing up. The water depth of 2.3m is produced by applying a level for Lough Erne of 43.6m (OD Malin) as the downstream boundary of the model, which is the average water level of Upper Lough Erne over the period of record at Belle Isle.

¹ PIANC Report No. 98 – 2008; 'Protecting Water Quality in Marinas' (US Environmental Protection Agency 1985)

17.2.5.2.3 Intensive Resource Requirements

As shown in **Tables 17.5** and **17.6** the most intensive use of the canal and so highest potential requirement for abstraction and worst case scenario is during the Annual Rally with an estimated 15 lockages per day over 6 days, requiring 14,040m³ of water per day. If it is assumed that the average evaporation rate for the navigation season of 317m³ per day also occurs and 3,456m³ per day is required for through-flow, the total recharge volume required is 17,813m³ per day to maintain the maximum canal water level. It must be noted however that the 14,040m³ of water per day for lockages will be re-circulated daily to the River Finn at Gortnacarrow, while the 3,456m³ per day of through flow will be re-circulated daily to the River Finn upstream of the abstraction site.

There are a number of potential scenarios which could occur during this period of intensive usage relating to the natural flow in the River Finn and the abstraction rates permitted under the UK TAG regulations. **Table 17.7** presents the abstraction scenarios which could occur during the annual rally.

Table 17.7: Abstraction Scenarios during the Annual Rally

Scenario	Abstraction Rate (m ³ /s)	Abstraction period (hrs)	Effects of Abstraction
50 th percentile flow or greater in the River Finn	1	5	Minimal reduction in water levels with all water being abstracted from the River Finn
Canal recharge spread over off-peak electricity period only	0.52	9.5	If the 60 th percentile flow or greater is available abstraction will be from the River Finn, otherwise Lough Erne will supplement
Between 60 th and 70 th percentile flow available	0.428 – 0.284	11.6 – 17.4	All abstraction volume can be supplied by the River Finn. If the rate is increased to reduce abstraction period Lough Erne will supplement
Flows below 70 th percentile	0.213 or less	23.2 or greater	At flows less than the 70 th percentile flow Lough Erne can supplement the available abstraction volume from the River Finn to allow a constant recharge of the canal throughout the day.

17.2.6 Water Resource Conclusions

- From the assessments carried out in this Section it can be concluded that the River Finn has the capacity to provide sufficient resources to sustain the operation of the Ulster Canal during most scenarios, even if the non-consumptive nature of the abstraction is not taken into consideration.
- Due to the water level at the proposed abstraction site being controlled by Lough Erne, water abstraction will be supplemented by Lough Erne during low flow conditions in the River Finn.
- Through computational river modelling the effect of water abstraction at the maximum rate of $1\text{m}^3/\text{s}$ was shown to be insignificant even during low flow conditions in the River Finn.
- Both through-flow and lockage volumes discharge back to the River Finn and so the only net loss of water resource from the River Finn water body will be due to evaporation.
- The filling of the canal will be the most prolonged period of abstraction; however this can be controlled to only take place during periods of high flow without effecting canal operation as canal navigation will not have been opened.

17.2.7 Discharge

Through-flow water from the canal is proposed to be discharged to a tributary of River Finn at the same location as the Clones WwTW. This short section then enters the River Finn at Clonkeen, shown as **Location F** on **Figure 17.1**. This through-flow rate has been initially estimated at 40 l/s, which is based on the previously mentioned USEPA guideline for preventing water stagnation within marinas. If possible this through-flow will be reduced, as discussed in **section 5.5.**, which will mean a lesser requirement for abstraction. Waterways Ireland have the intention of dropping the through-flow rate once a sustainable equilibrium is found that maintains the habitats and prevents stagnation within the canal and marina. The through-flow discharge will increase the River Finn base-flow at Clonkeen by the following amounts:

- Q95 Flow = 186 l/s = + 21.4%
- Mean Daily Flow (MDF) = 2870 l/s = + 1.4%
- Q1 = 19,000 l/s = + 0.2%

Please note these flow values at Clonkeen have been calculated with the same scaling methodology as used in **section 17.2.2**.

The lock gravity discharge via the sluices to the River Finn at Gortnacarrow will occur on an as required basis. This assessment has been using a worst case approach of 15 lockages per day for the annual rally, which is worst case as assumes the lock needs filled and then emptied for each boat passage. The sluice discharge (936m^3 in approximately 20 minutes) will come from either side of the lock gate and

hence the opposing discharge flows will essentially negate one another. There will be slight water turbulence at these opposing points of discharge; however this turbulence will settle over the 40m long and 6m wide tunnel stretch between the lock gate and the River Finn natural waterbody at Gortnacarrow. This lock discharge should not cause increased flows or scour within the River Finn.

17.2.8 NIEA WMU consultation

NIEA are responsible for abstraction licensing under the WFD/CAR regulations and as such consultations have taken place with them. Following an initial review of the data presented in this report by NIEA Water Management Unit (WMU), three scenarios for assessment were put forward. This part of the Section will attempt to address these scenarios and any additional comments provided by the NIEA WMU.

NIEA WMU suggested that flow measurement equipment should be installed to quantify the contributing affect of Lough Erne to provide information in support of the abstraction application. A flow gauging device has been installed at Wattle Bridge, downstream of the proposed abstraction site, and has been operational for a number of months.

The comments recognised that the proposed abstraction is non-consumptive, however unlike most non-consumptive abstractions it is important to note that the canal discharges upstream of the abstraction point, thereby leaving no net loss or depleted section along any reach of the River Finn.

NIEA Scenario 1

This scenario deals with the proposed through-flow of 40 l/s required to prevent stagnation of the marina and canal. **Table 17.8** presents flow estimates along with required and allowable abstraction percentages for various flow conditions and discharge volumes back to the River Finn upstream of the abstraction point.

Table 17.8: Response to NIEA Scenario 1

Flow Condition	Estimated Natural Flow m ³ /d	Abstraction volume m ³ /d	% Take	% Allowable Take	Upstream discharge Volume m ³ /d	Net loss in Volume m ³ /d
MDF	412992	3456	<1	25	3456	0
60	185069	3456	1.8	20	3456	0
70	122688	3456	2.8	15	3456	0
95	26784	3456	12.9	10	3456	0

NIEA Scenario 2

This Scenario is given below in **Table 17.9**, which presents the abstraction relating to the annual rally on the Ulster Canal, with an estimated 15 lockages per day of 936m³ per lockage (assuming single lock, one way boat movement), along with 40 l/s required for through-flow, which equates to a volume of 17,496m³/d required to be pumped into the canal.

Table 17.9: Response to NIEA Scenario 2

Flow Condition	Estimated Flow m ³ /d	Abstraction volume m ³ /d	% Take	% Allowable Take	Upstream discharge volume m ³ /d	Discharge volume at point of abstraction m ³ /d	Net loss in volume m ³ /d
MDF	412,992	17,496	4	25	3,456	14,040	0
60	185,069	17,496	9	20	3,456	14,040	0
70	122,688	17,496	14	15	3,456	14,040	0
95	26,784	17,496	65	10	3,456	14,040	0

NIEA Scenario 3

This Scenario presented figures relating to the maximum abstraction rate which could be achieved with the proposed pumping arrangement. **Table 17.10** presents the figures provided by NIEA relating to the maximum achievable abstraction rate. The proposed maximum pumping capacity is 1 cumec or 1000 l/s, therefore if an adequate volume of water was available 86,400m³/d could be abstracted from the River Finn. This Table illustrates how this maximum daily potential abstraction volume compares to the allowable abstraction volumes. The Table indicates that the maximum extraction rate exceeds the allowable volume for a substantial period of the year; however it is unlikely that this rate of abstraction will be required to sustain the canal. The largest continuous period of abstraction will be required during the filling of the canal, however this can be undertaken during periods of high flows, with restrictions put in place to ensure adherence to the UK TAG abstraction guidelines.

Table 17.10: Response to NIEA Scenario 3

Flow Condition	Estimated Flow m ³ /d	Abstraction volume m ³ /d	% Take	% Allowable Take
MDF	412,992	86,400	21	25
60	185,069	86,400	47	20
70	122,688	86,400	70	15
95	26,784	86,400	323	10

17.3 WATER QUALITY

17.3.1 Introduction

The proposed canal works are located near a number of surface waterbodies and impinge on several cross-border groundwaters. An assessment of the water resources in relation to quantity, quality and the likely impact associated with the construction of the canal was undertaken. Specific mitigation measures have been identified in order to minimise or eliminate the impact of the construction, commissioning and operation of the canal.

The potential impact on aquatic life and associated habitats is recognised as being particularly important given the potential economic benefits through tourism and leisure opportunities which will be generated by the reinstatement of the canal. This topic has therefore been dealt with under a dedicated aquatic ecology in **section 9**.

Information for this water quality section has been obtained predominantly from the Northern Ireland Environment Agency (NIEA), the North Western International River Basin District Project and the Environmental Protection Agency (EPA) in relation to river flows and water quality.

The Rivers Agency and OPW will be consulted with regard to any land drainage, and NIEA Water Management Unit and Local Authorities for discharge, abstraction and other related consents that may be required for works affecting the watercourses. Consultations will also be held with all relevant authorities if required.

17.3.2 Consultation

Preparation of this section included cross-border consultation, either directly or through publicly-available information, with:

- Northern Ireland Environment Agency (NIEA, Natural Heritage)
- National Parks and Wildlife Service
- Environmental Protection Agency
- Department of Environment, Heritage and Local Government
- Department of Arts, Heritage and the Gaeltacht
- Department of Communications, Energy and Natural Resources
- Office of Public Works
- Central Fisheries Board
- Inland Waterways Association Ireland
- Waterways Ireland
- Department of Agriculture, Fisheries and Food

- Northern Regional Fisheries Board Non-Statutory
- North Western International River Basin District Project
- Department of Agriculture and Rural Development – Rivers Agency
- Health Service Executive
- Cavan County Council – Environment Section

Any submissions received in relation to potential water quality issues as a result of the proposed works have been taken into consideration. In Ireland both the Health Service Executive (HSE) and Cavan County Council have commented on the need to ensure there is no impact on water quality and that water supplies do not become contaminated.

In Northern Ireland NIEA Water Management Unit have requested the provision of water quality information (on water treatment and sampling) and general site management/pollution prevention issues which may affect water quality (such as wheel wash, chemicals, oils and spillage prevention).

17.3.3 Methodology

17.3.3.1 Categorising, Assessing and Rating Significance of the Water Quality Impacts

Criteria for Rating Site Attributes

The importance of the hydrological, hydromorphological and ecological attributes of a site will determine the importance of that water body and therefore contribute to the significance of the impact.

In the absence of specific guidelines for environmental assessment of canals the National Roads Authority Guidelines on “Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes” (NRA, 2005) have been consulted and the rating in **Table 17.11** has been applied to the water bodies in the vicinity of the proposed scheme. Where existing data is available for these waterbodies it has been used.

Table 17.11: Criteria for Rating Site Attributes

Importance	Criteria	Typical Examples
Extremely High	Attribute has a high quality or value on an international scale	River, wetland or surface water body ecosystem protected by EU legislation e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	Attribute has a high quality or value on a regional or national scale	River, wetland or surface water body ecosystem protected by national legislation – NHA/ASSI status.
		Regionally important potable water source supplying >2500 homes.
		Quality Class A (Biotic Index Q4, Q5, WFD Status Good, High). Flood plain protecting more than 50 residential or commercial properties from flooding.
		Nationally important amenity site for wide range of leisure activities.
High	Attribute has a high quality or value on a local scale	Salmon fishery.
		Locally important potable water source supplying >1000 homes
		Quality Class B (Biotic Index Q3-4, WFD Status Moderate). Flood plain protecting between 5 and 50 residential or commercial properties from flooding.
		Locally important amenity site for wide range of leisure activities.
Medium	Attribute has a medium quality or value on a local scale	Coarse fishery.
		Local potable water source supplying >50 homes
		Quality Class C (Biotic Index Q3, Q2-3, WFD Status Poor).
		Flood plain protecting between 1 and 5 residential or commercial properties from flooding.
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure activities.
		Local potable water source supplying <50 homes Quality Class D (Biotic Index Q2, Q1, WFD Status Bad)
		Flood plain protecting 1 residential or commercial property from flooding.
		Amenity site used by small numbers of local people.

Criteria for Rating Impact Significance

In order to estimate the magnitude of the impact on the water resource attributes and in the vicinity of the scheme the rating recommended in the NRA Guidelines has been used for the most part. This rating is based on a series of criteria which determines both negative and positive impacts associated with the scheme. **Table 17.12** provides a summary of the criteria as presented in the NRA Guidelines.

Table 17.12: Criteria for Rating Impact Significance

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute and /or quality and integrity of attribute	Loss or extensive change to a water body or water dependent habitat.
		Extensive loss of fishery
		Extensive reduction in amenity value
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Partial loss of fishery
		Partial reduction in amenity value
		Moderate change to a water quality
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Moderate change to a water quality
		Minor loss of fishery
		Slight reduction in amenity value
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	
Minor Beneficial	Results in minor improvement of attribute quality	Minor improvement in the water quality of the water body
Moderate Beneficial	Results in moderate improvement of attribute quality	Moderate improvement in the water quality of the water body
Major Beneficial	Results in major improvement of attribute quality	Major improvement in water quality, hydrological and hydromorphological status of attributes

Rating of Significance of Environmental Impacts

Based on the importance of the receiving hydrological attribute/water body and the impact significance an assessment of the potential environmental impact of the scheme has been made based on the matrix presented in **Table 17.13**.

Table 17.13: Rating of Environmental Impacts

Importance of Attribute	Magnitude of Impact				
		Negligible	Small	Moderate	Large
	Extremely High	Imperceptible	Significant	Profound	Profound
	Very High	Imperceptible	Significant / Moderate	Profound / Significant	Profound
	High	Imperceptible	Moderate / Slight	Significant / Moderate	Severe / Significant
	Medium	Imperceptible	Slight	Moderate	Significant
	Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

17.3.3.2 Collation of Water Quality Data

All information relating to the available water quality data for the North Western River Basin District within which the scheme is located was collated through consultation with the North Western International River Basin District (RBD) Project and the Northern Ireland Environment Agency. The RBDs have been set up under the EU Water Framework Directive. The EU Water Framework Directive (2000/60/EC) (WFD) is legislation introduced in October 2000 and requires all Member States to manage and improve the quality of their surface and groundwaters through a catchment based approach. The Directive has been transposed into national law by the European Communities (Water Policy) Regulations 2003 (SI 722 of 2003) in Ireland and the *Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003*. The production of River Basin Management Plans in 2009 is the mechanism for achieving the objectives of the Directive. All rivers, lakes, estuaries, coastal waters (within 1 nautical mile of the shoreline) and groundwaters have been characterised into water bodies and a water quality status (ecological and chemical status) has been assigned to each water body. The objective of the WFD is to ensure that all waters achieve at least good status by 2015 and that there is no deterioration in status therefore any planned development must not result in deterioration in the status of the surrounding water bodies.

Ireland

Water Quality in Ireland's rivers has been recorded since the baseline survey of 1971. Presently, 1,080 of the country's rivers and streams are surveyed for biological quality equating to 13,200 km in channel length. This baseline includes all of the readily accessible rivers and streams depicted on the Ordnance Survey map entitled "Rivers and their Catchment Basins" and is surveyed on a rolling three year cycle.

A Water Framework Directive monitoring programme has been developed by the EPA for all the River Basin Districts in Ireland. The biological monitoring programme occurs on a three year cycle. Each year the EPA publishes an interim report on the biological quality of Irish rivers. These reports give a river by river assessment of water quality. The review is based on data arising from surveys carried out on some 1,080 rivers and streams (13,200 km of channel). Individual reports cover approximately one third of the major rivers in Ireland. Values indicating water quality are assigned to more than 1,000 river sites each year. Assessments of the status of individual rivers are given and the causes of pollution are indicated. In each three-year cycle some 13,200 km of river channel is surveyed at 3,200 different locations. All the rivers depicted on the Ordnance Survey River Catchment Map of Ireland are surveyed. The survey began in 1971.

The information published by the EPA relates to biological and chemical analysis at various stations along the reaches of river sampled.

Northern Ireland

In Northern Ireland NIEA Water Management Unit is responsible for water quality and pollution control, water resources and conservation in Northern Ireland. NIEA monitors both surface waters and groundwaters. River quality monitoring has been carried out in Northern Ireland since 1973 on a routine basis. In 1994, approx. 290 river quality monitoring sites were sampled regularly and the samples analysed for up to 18 variables such as Biochemical Oxygen Demand, dissolved oxygen, ammonia, suspended solids, etc.

From 1990, chemical monitoring of rivers has been complemented by biological monitoring. The monitored network developed over the years until, by the late 1990s, the length of rivers biologically classified under the General Quality Assessment (GQA) was more than 5,000 km. Since 2000, the chemical monitoring programme has been extended to include the measurement of GQA parameters on secondary rivers.

Quantitative and qualitative data on water quality are available via computer database published for public information.

An overview of this information from the authorities in both jurisdictions has been used to support and explain the WFD status which has been assigned to the relevant waterbodies which are encroached by the Ulster Canal works.

Water Dependant Protected Areas

A significant portion of waters in the River Basin Districts (RBD) are protected under existing EU Legislation and they require special protection due to their sensitivity to pollution or their particular economic, social or environmental importance. All of these areas are recorded in a Register of Protected Areas for each RBD under the requirements of Article 6 of the Directive. Detailed information on these water dependant protected areas has been provided in **section 9**, Aquatic Ecology.

17.3.4 Legislation and Policy Context

17.3.4.1 Ireland

In relation to Water Pollution the most relevant legislation to the construction of the canal is the *Local Government (Water Pollution) Act, 1977 (No.1 of 1977)*. This Act defines its purpose as “*an Act to provide for the control of water pollution and for other matters connected with water pollution.*”

Under this Act, Local Authorities have been assigned the primary responsibility for the control of pollution to waters. The provisions of the Act also extend to the planning and implementation of measures for the protection and improvement of water quality.

The Act was amended in 1990 to contain provisions for pollution caused by agricultural effluent. Regulations were also made in relation to licensed discharges to watercourses and sewer under section 4 and section 16 of the Act.

Other relevant legislation includes:

Protection of Groundwater Regulations, 1999 (S.I. No.41 of 1999) – These regulations are intended to provide protection of groundwater against pollution caused by certain dangerous substances.

European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989 (S.I. No. 294 of 1989) – Where surface waters have been classified for abstraction purposes it is the duty of the sanitary authority to take the necessary measures to ensure that each of the waters concerned meets the quality standards appropriate to its category except where a departure is granted.

European Communities (Drinking Water) Regulations, 2000 (S.I. No. 106 of 2007) – These regulations state that it is the responsibility of the sanitary authority to ensure that water intended for human consumption is wholesome and clean and meets the requirements of the regulations. Water will be

regarded as wholesome and clean if it is free from micro-organisms and from any substances which in numbers or concentrations, constitutes a potential danger to public health.

The Arterial Drainage Act, 1945 (No. 3 of 1945) - This Act gives the Commissioners of Public Works in Ireland the responsibility for the “*drainage and improvement of land by the execution of works of arterial drainage, to provide for the maintenance of those works and make further and better provision for the maintenance of existing drainage works, and to provide for matters incidental to or connected with the matters aforesaid or relating generally to the drainage of the land.*” In this respect the Office of Public Works would need to be consulted with regard to river crossings and the proposed methodology.

European Communities (Water Policy) Regulations 2003 (SI 722 of 2003) – These regulations transpose the Water Framework Directive into Irish law. The WFD aims to promote common approaches, standards and measures for water management on a systematic and comparable basis throughout the European Union. It establishes a new, integrated approach to the protection, improvement and sustainable use of Europe's rivers, lakes, transitional waters (estuaries), coastal waters, groundwaters and includes artificial water bodies (AWB i.e. canals and reservoirs). The WFD requires that Member States manage their waters on the basis of River Basin Districts (RBDs).

Public bodies (including Waterways Ireland), identified in the 2003 *Water Policy Regulations*, are required to exercise their functions in a manner which is consistent with the objectives of the river basin management plan.

Assessment and Management of Flood Risks, Regulations 2010 (S.I. No. 122 of 2010) - The EC Floods Directive was transposed into law in Ireland through the Assessment and Management of Flood Risks, Regulations 2010. (S.I. No. 122 of 2010). The Regulations set out the responsibilities of the Office of Public Works (OPW) and other public bodies in the implementation of the Directive, on consultation, and details the process for implementation of the measures set out in the flood risk management plans

The OPW are also responsible for ensuring particularly for the preparation of a preliminary assessment by 2011, flood risk mapping by 2013 and flood risk management plans by 2015 (ref section 1.3.1). It is the principal agency involved in the preparation of FRAMs.

17.3.4.2 Northern Ireland

The main piece of legislation that deals with issues relating to water resources is *The Water (Northern Ireland) Order 1999*. This Order was fully implemented on the 24th August 2001 and has brought Northern Ireland in line with the provisions of European Community law.

Part II of the Order highlights the statutory duty of the NIEA to promote the conservation of water resources and the cleanliness of water in waterways and underground strata. In performing this duty the Department is required to have regard to the needs of industry and agriculture, the protection of fisheries

and of public health, the preservation of amenity and the conservation of flora and fauna and the conservation of geological or physiographical features of interest.

Under the terms of the *Water (Northern Ireland) Order 1999*, the NIEA is responsible for taking action to prevent or minimise the effects of polluting discharges made to our waterways and for instigating enforcement action where appropriate. The consent of the NIEA is required to discharge any trade or sewage effluent or any other potentially polluting matter from commercial, industrial or domestic premises to waterways or underground strata.

Other important legislation includes:

The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003 - These regulations outline the responsibilities of the NIEA in relation to the Water Framework Directive and the measures and actions required under the Directive to achieve good status classification for water bodies throughout Northern Ireland. The approach adopted in this legislation is a holistic one, with water quality being managed on a River Basin District level and encompasses all water bodies within a river basin level.

The Water Quality Regulations (Northern Ireland) 1994 and The Water and Sewerage Services (Northern Ireland) 1973 (and as amended 1993 and 2010) - the most relevant information in this legislation is the role of the NIEA in ensuring that water quality is preserved for the purposes of domestic or food production purposes.

The Drainage (Northern Ireland) Order 1973 (and as amended 2005) (specifically Schedule 6) - Schedule 6 of this order outlines the measures and procedures that will be undertaken under the Order to ensure the protection of watercourses for drainage purposes. A Schedule 6 application must be made to the Rivers Agency to attain consents in order to carry out works across, over or under any designated watercourse. *The Drainage (Environmental Impact Assessment) Regulations (Northern Ireland) 2001* set out the main considerations when assessing the environmental impact of major drainage schemes. Whilst the work carried out under this project is not classified as major drainage works, the guidance provided in this legislation is still relevant.

The Water Environment (Floods Directive) Regulations (Northern Ireland) 2009 - The EC Floods Directive was transposed into law in Northern Ireland through The Water Environment (Floods Directive) Regulations (Northern Ireland) 2009.

The Rivers Agency (Department of Agriculture and Rural Development) are the competent authority for the implementation of the Directive in the North. DARD, Rivers Agency also has the responsibility for flooding from rivers and the sea. However, there are other sources of flooding which are the responsibilities of other authorities. As there is often a complex relationship between the sea, rivers, sewerage systems and surface water in the generation of a flood it is essential that all responsible

authorities co-ordinate their activities to effectively management flood risk. However, the Regulations place a statutory duty on all public bodies to exercise their relevant functions in a manner which ensures compliance with the requirements of the Directive. The Regulations also place obligations on public bodies to provide information and assistance to the Department in implementing these Regulations.

Legislation concerning groundwater preservation and pollution include *The Groundwater Regulations (Northern Ireland) 2009 (and as amended 2011)* and *The Pollution of Groundwater by Dangerous Substances Regulations (Northern Ireland) 1994*. This legislation includes criteria for the assessment of good chemical status and for identifying and reversing upward trends in pollution. It also details measures to prevent or limit pollutants into groundwater. The *Groundwater Regulations (Northern Ireland) 2009 (and as amended 2011)* were made on 2nd July 2009. These Regulations came into operation on 10th August 2009 revoking the Groundwater Regulations (NI) 1998. However the new Groundwater Regulations incorporate the requirements of the 1998 Regulations providing continuity and clarity for groundwater protection. The new Regulations also provide for existing authorisations to remain valid whilst allowing a slightly more comprehensive risk based approach to pollution prevention and control.

Pollution Prevention Guidelines

The following Pollution Prevention Guidelines, produced by the Northern Ireland Environment Agency (NIEA) and Scottish Environment Protection Agency (SEPA), may also be relevant to canal works:

- *PPG05: Works in, near or liable to affect watercourses* - These guidelines have been prepared to assist all those who may have cause to work in or near watercourses. This covers potential pollutants such as silt, cement, concrete, fuel, lubricating and shutter release oils, petrol, sewage and other waste materials. In planning and carrying out any work in or near rivers, streams, ditches and other watercourses, precautions must be taken to ensure complete protection against pollution, silting and erosion;
- *PPG06: Working at construction and demolition sites* - These guidelines aim to assist those in the construction or demolition industry with responsibility for managing the environmental impact of their activities;
- *PPG20: Dewatering underground ducts and chambers* - Guidance to assist those engaged in the dewatering of underground ducts and inspection chambers;

Other guidelines that will be relevant to construction include;

- *PPG01: General guidance on the prevention of water pollution* - These guidelines are an introduction to the prevention of water pollution and provide guidance on the implications of site drainage.
- *PPG02: Above ground oil storage tanks* - These guidelines assist those responsible for above ground oil storage tanks at sites other than oil refineries and distribution depots.

- *CIRIA/EA/NIEA/SEPA joint guidelines: Masonry bunds for oil storage tanks* - Details the proper construction of simple, reinforced masonry bunds for oil storage tanks up to 3.5m wide and 1200mm high. It is based upon CIRIA Report 163 “*Construction of bunds for oil storage tanks*”.
- *CIRIA/EA/NIEA/SEPA joint guidelines: Concrete bunds for oil storage tanks* - Details the construction of simple, reinforced concrete bunds for oil storage tanks up to 3.5 metres wide and 900mm high. It is based upon CIRIA Report 163 “*Construction of bunds for oil storage tanks*”.
- *PPG04: Disposal of sewage where no mains drainage is available* - These guidelines offer advice on the disposal of sewage where no mains drainage is available.
- *PPG08: Storage and disposal of used oils* - Guidelines to assist all who handle used oils, from a single engine change to large industrial users.
- *PPG21: Pollution incident response planning* - Guidance to assist in the development of site specific pollution incident response plans to prevent and mitigate damage to the water environment caused by accidents such as spillages and fire.

17.3.5 Existing Environment

The Water Framework Directive (WFD) classifies waterbodies by their “water status,” which is a determination of the status of the waterbody in chemical and biological terms. The study area lies within the Erne hydrometric area within the North Western International River Basin District. The main surface water bodies within the immediate vicinity of the Ulster Canal, from Upper Lough Erne to Clones, are the River Finn, tributaries of Upper Lough Erne and the River Erne.

17.3.5.1 Rivers

These three waterbodies are also protected under the Urban Waste Water Treatment Directive as they could be sensitive to discharges from WWTWs. The Rivers Lackey, Finn and Starraghen Tributary are all protected under the Freshwater Fish Directive as Salmonid waters. A section of the River Erne / Upper Lough Erne, approximately 5km downstream of the proposed navigation is designated as a drinking water river.

Current Ecological Status and Protected Areas

The Ulster Canal from Upper Lough Erne to Clones only traverses two separate river waterbody sub-catchments, as delineated under WFD reporting. The two waterbodies concerned are within the Finn River catchment; one waterbody delineates the main channel sub-catchment, and the other contains tributaries and feeding waters of the main channel. Their respective information and quality status data are summarised below;

Table 17.14: WFD Waterbody Information

Waterbody Code	River Lackey	River Finn
Area units	35.6	77.9
MacroInvert Status	Moderate	Moderate
Diatoms		Moderate
Morphology		Good
Specific Pollutants		High
Ecological Status	Moderate	Moderate
Chemical Status	n/a	Pass
Drinking Water		Yes
SAC Name	Kilroosky Lough Cluster	Lough Oughter and Associated Loughs
PA Code	PA5_SAC_001786	PA5_SAC_000007
Objective	Restore_2015	Restore_2021

The River Finn Main Channel waterbody is currently at Moderate Ecological Status as a result of the invertebrate community present. This information is made available from the Q-values taken at the monitoring stations at Wattle Bridge and Ballyhoe Bridge. This would normally require an improvement to at least Good Ecological Status by the year 2015 under WFD regulations. However due to high soil phosphorus levels in the area the recovery timescale to environmentally sustainable levels nutrient losses to waters may persist and the waterbody has been granted an extension to 2021 to comply with WFD standards.

This WFD waterbody also contains the Lough Oughter and Associated Loughs SAC (code SAC_000007) from EPA protected area designation in Ireland downstream of the canal and the Upper Lough Erne SAC (PA5_10042) and Upper Lough Erne SPA (PA6_10009) from NIEA protected area designation upstream of the canal. The extent of the proposed works is not within close proximity of the boundary of the SAC however the designation is downstream of the proposed works.

The second WFD water body contains the River Lackey and a number of smaller tributaries which feed into the River Finn main channel. This waterbody is also currently at Moderate Ecological Status as a result of invertebrate analysis from the monitoring stations on the River Lackey at Carra Old Bridge. This waterbody has not been assigned any extensions to its water quality objectives and so must be restored to Good Ecological Status by 2015.

This WFD waterbody also contains the Kilroosky Lough Cluster SAC (code SAC_001786). However, like the River Finn Main Channel waterbody, the extent of the proposed works does not impinge on the boundary of the SAC which is located upstream of the proposed works.

The current surface water status and nearby protected area information is displayed in **Figures 17.3** and **17.4**.

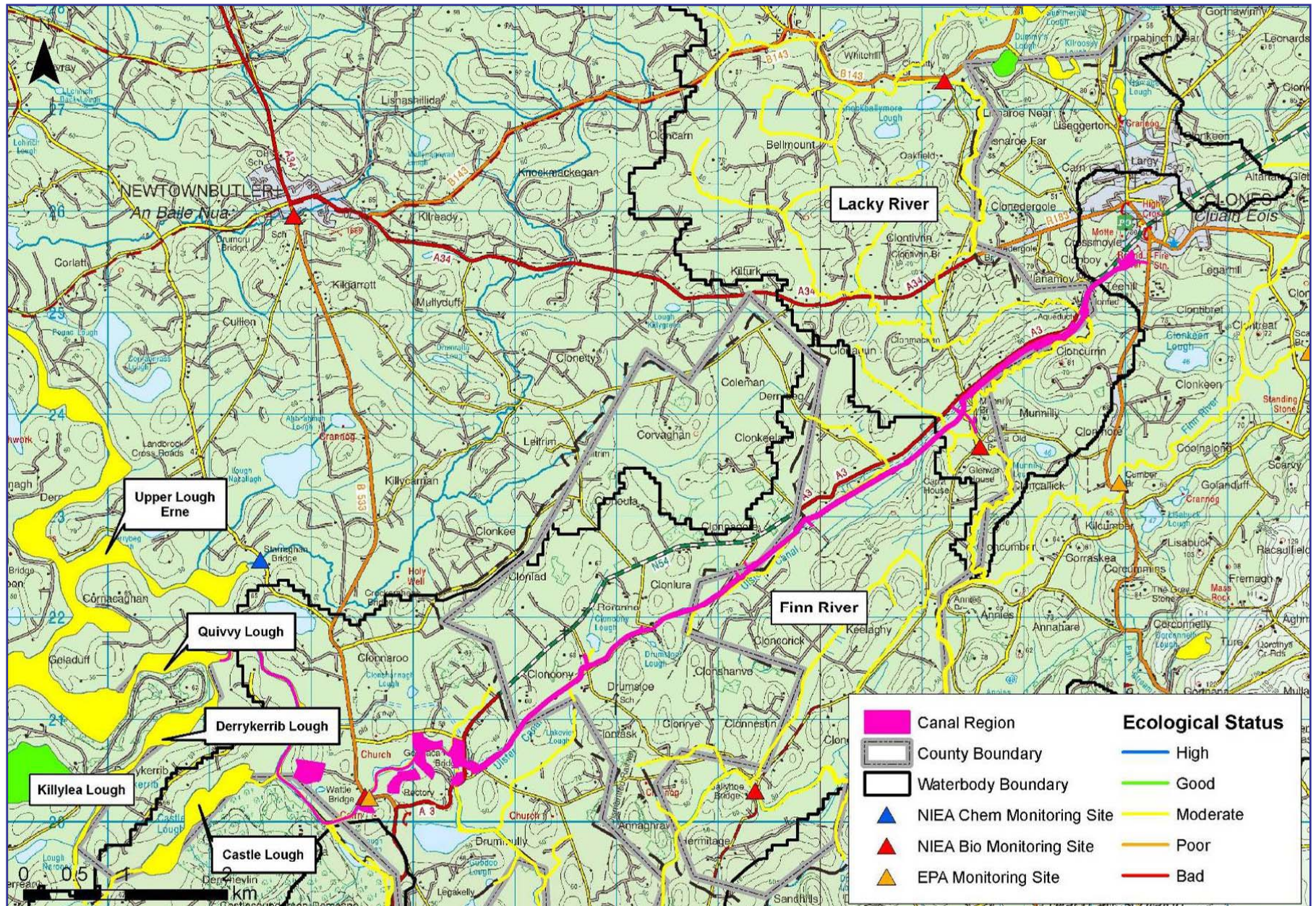
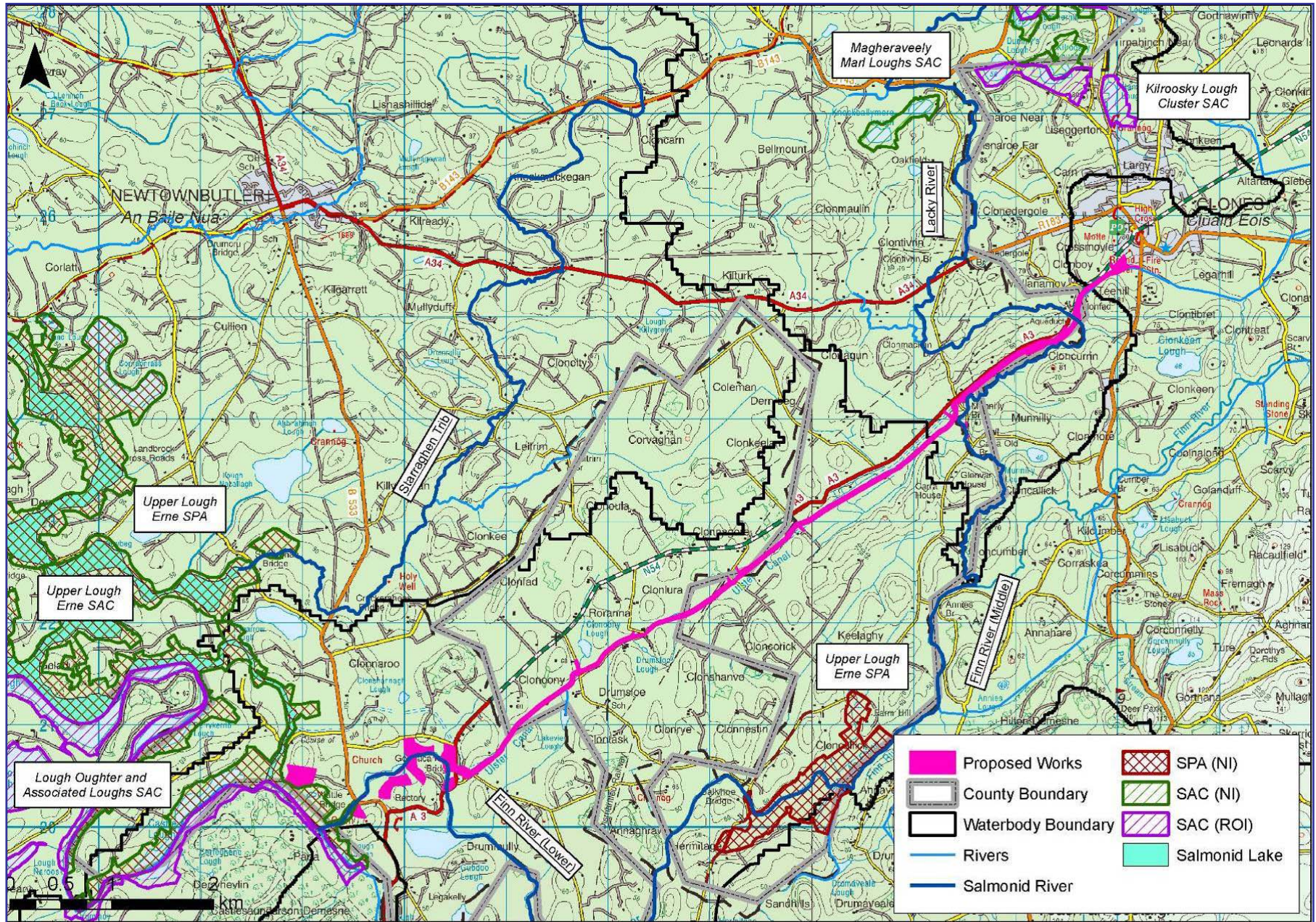
Figure 17.3: Surface Water Status within the locality of the proposed canal works

Figure 17.4: Protected Areas within the locality of the proposed canal works

EPA Water Quality Data

Biological

The EPA water quality results for the Finn River are shown below (**Table 17.15**); Stations 0400 (Scarvy Bridge) and 0500 (Cumber Bridge) are those nearest to the proposed canal works.

- River and Code: **FINN (MONAGHAN)** **36F01**
- Tributary Of: Upper Lough Erne OS Catchment No: 123
- OS Grid Ref of confluence: H 422 200

Table 17.15: Biological Quality Ratings (Q Values)

Station Nos.	1971	1973	1977	1980	1982	1984	1989	1993	1997	1998	2001	2004	2007	2010
0010	-	-	-	-	-	-	3-4	4-5	4-5	4	3	3-4*	4	4
0080	-	-	-	-	-	-	3	4	3	4	4	4	-	3-4
0100	5	5	4-5	4	4-5	4-5	3-4	4	3-4	4	3-4	3-4	3	3-4
0200	5	4-5	4-5	4	4	4	3-4	4	3	3-4	3	4	3-4	3-4
0400	-	-	3-4	3-4	3-4	3-4	3-4	3	3-4	3-4	3	4	-	3-4
0500	3-4	3	1	3	3	3	3	3	3	3	3	3-4	3-4	3-4
0600	-	-	-	-	3	3	3	-	-	-	-	-	-	-

Physico-Chemical Monitoring Data

Further information regarding physico-chemical monitoring is also available for the River Finn (**Table 17.16**). This was taken from the EPA monitoring station at Cumber Bridge. Environmental Quality Standards for physico-chemical parameters have been set in the Environmental Objectives (Surface Water) Regulations 2009 (SI 272 of 2009) for temperature (Temp.), biochemical oxygen demand (BOD), dissolved oxygen (DO) (lower and upper limits), pH, total Ammonia (mg N/l), and molybdate reactive phosphorus (MRP) mg P/l. The physico chemical monitoring data on the River Finn at Cumber Bridge suggests that the phosphates, ammonia and BOD are at concentrations that are considered to be less than good status based on the Environmental Quality Standards which supports the biological assessment of moderate status.

Table 17.16: Chemical Monitoring Results

Determinand	No. Samples	Min	Mean	Max	Std Dev
Alkalinity-total (mg/l CaCO ₃)	44	80.0	183.8	280.0	46.4
Chloride (mg/l Cl)	45	9.0	21.2	43.0	7.0
Conductivity @25°C (µS/cm)	42	214.0	447.7	643.0	96.5
pH	45	7.4	7.7	8.1	0.2
Temperature °C	42	2.8	10.7	22.1	4.8
Total Hardness (mg/l CaCO ₃)	44	106.0	205.2	336.0	50.9
True Colour (Hazen)	45	33.0	75.2	234.0	40.9
Nitrite (mg/l N)	41	0.007	0.034	0.145	0.028
ortho-Phosphate (mg/l P)	44	0.030	0.080	0.250	0.043
Total Oxidised Nitrogen (mg/l N)	45	0.510	1.192	2.640	0.457
Ammonia-Total (mg/l N)	45	0.030	0.194	0.880	0.205
BOD - 5 days (Total) (mg/l O ₂)	45	0.5	2.2	5.5	1.2
Dissolved Oxygen (% Saturation)	42	48.0	82.5	101.0	10.3

NIEA Water Quality Data

According to NIEA Water Quality reporting the status of the waterbodies in the vicinity of the proposed scheme are consistent with that of the EPA and are all at Moderate Ecological Status. As these water bodies are cross border the coordination between the two jurisdictions ensures the same classification. This is summarised in **Table 17.17**.

Table 17.17: NIEA Water Quality Information

Parameter	River Finn Lower	River Lackey - River Killylack Lower
Water body identification code	UKGBNI1NW363602097	UKGBNI1NW363602103
Catchment stakeholder group	Erne & Melvin	Erne & Melvin
Local management area	Upper Lough Erne	Upper Lough Erne
2015 Objective	Moderate Status	Good Status
2021 Objective	Good Status	Good Status
2027 Objective	Good Status	Good Status
Water body type	Altitude <80m, alkalinity 100-200 (as mg/l of CaCO ₃)	Alkalinity >200 (as mg/l of CaCO ₃)
Current overall status	Moderate	Moderate
Confidence in overall status	Low	Medium
Benthic invertebrates	Good	Moderate
Macrophytes	Good	Good
Dissolved oxygen	Poor	Moderate

Table 17.17: continued

Parameter	River Finn Lower	River Lackey - River Killylack Lower
Soluble reactive phosphorus	High	High
pH	High	High
Biochemical oxygen demand*	Good	High
Temperature*	Good	High
Hydrological regime	High	High
Ammonia	High	High
Chloroform (trichloromethane)	Good	
Total copper	Good	Good
Carbon tetrachloride	Good	
1,2-Dichloroethane	Good	
Phenol	Good	
Tetrachloroethylene	Good	
Trichloroethylene	Good	
Total zinc	Good	Good

17.3.5.2 Lakes

Under the WFD Upper Lough Erne is listed as a waterbody GBNI3NW0008, which is classed as being of moderate ecological potential, based on a chemical status of “Good” and an ecological status of “Moderate”. Upper Lough Erne water status is defined in terms of ecological potential as it is classified as being a Heavily Modified Waterbody (HMWB), as it has its water levels managed by structures at Portora and Ballyshannon.

17.3.5.3 Artificially and Heavily Modified Waters

A stretch of the Ulster Canal at Monaghan Town is classified as an Artificial Waterbody (AWB), however under the WFD AWB classification process it has been classed as “non-functional”. The stretch between Upper Lough Erne and Clones is currently unclassified, as it has not been used as a canal for over 80 years. With restoration of this canal section the morphological alteration will inevitably lead to the stretch being classified as an artificial waterbody and therefore it will be required to achieve Good Ecological Potential, as defined by the WFD. The proposed navigation, including any altered natural waterbodies used, will have to go through the designation process as stipulated in the CIS Toolbox on the *Identification and Designation of Artificial and Heavily Modified Water Bodies*, 2003 before it can officially be designated as an AWB. Planning of the canal will then be subject to guidance such as the AINA guidance on *Management Strategies and Mitigation Measures for the Inland Navigation Sector in Relation to Ecological Potential for Inland Waterways*, 2008.

17.3.5.4 Groundwaters

There are three delineated groundwaters in the vicinity of the proposed works. These are; Clones, Crom Castle and Newtown-Ballyconnell. All three of these groundwaters are currently achieving Good status and so need to be maintained as per WFD regulations.

17.3.5.5 Characterisation of the hydrological environment of water courses along the proposed route

The different water courses along the route of the restored canal have been assessed in term of their hydrological attributes based on the criteria identified in **Table 17.11**. This will assist in the determining the importance of that waterbody which contributes to the significance of the impact. **Table 17.18** outlines the significance of the hydrological attributes of water bodies within the study area.

Table 17.18: Significance of hydrological attributes of water bodies in the vicinity of the proposed scheme

Water Course Name	Importance	Criteria for ranking
Ulster Canal	Very High	Downstream system within the Lough Oughter and associated Loughs SAC, Upper Lough Erne SAC and SPA On restoration will become a nationally important amenity site for wide range of leisure activities.
River Finn	Extremely High	Designated Salmonid Water Lough Oughter and Associated Loughs SAC, Upper Lough Erne SAC and SPA
River Lackey	Extremely High	Designated Salmonid Water Kilroosky Lough Cluster SAC located within the waterbody
Tributaries of Finn River	High	Downstream significance of the River Finn and associated protected areas
Upper Lough Erne / Lough Oughter	Extremely High	Upper Lough Erne SAC and SPA Lough Oughter and associated Loughs SAC

17.3.6 Impact Assessment

17.3.6.1 Impacts upon Designated Sites

In support of the EIS, a Natura Impact Statement (NIS) has been prepared for the proposed scheme. This more focussed type of assessment is often referred to as an “Article 6 assessment” and has been undertaken in accordance with current EC guidance and national Guidance.

This NIS has been informed by the water quality and aquatic ecology assessment for the relevant habitat and species which represent qualifying features of the Natura 2000 sites along the proposed scheme.

17.3.6.2 Construction Phase Impacts

General

Temporary impacts on surface waters can occur during construction. Pollution from mobilised suspended solids (silt) is generally the prime concern. Suspended sediment due to run off from stripped construction areas and excavations can have a severe negative impact on water quality, water dependant habitats and aquatic ecology. This is particularly true in sloping areas with

underlying clay following topsoil stripping. In areas of moderate to high rainfall, the potential problems are clearly exacerbated. If allowed to enter surface watercourses this run off can give rise to high suspended solids and detrimental impacts, in particular to fisheries.

Suspended solids may have an effect on:

- Increases in sediment movement through rivers and its settlement onto the river bed cause formerly clean gravels to become clogged with fine sediment. This prevents oxygen movement into the waters in the river bed;
- The survival of fish eggs in gravel beds or spawning grounds as a result of deoxygenation caused by silt deposition;
- Increased turbidity reduces light penetration and therefore primary productivity which has a knock on effect throughout the food chain;
- The survival of plants and algae by smothering;
- The survival of young fish and aquatic invertebrates such as mayfly larvae (*Calopteryz sp.*) through gill damage from sediment particles;
- The success of angling due to increased turbidity; and
- Amenity value through impaired visual appearance.

There is the potential for other harmful substances to enter a water course or ground water body during construction. These include accidental spillage of fuels, lubricants and hydraulic fluids from construction plants; concrete spillage; wash down water from exposed aggregate surfaces, concrete trucks and cast in place concrete; wastewater from site toilets, wheelwashing facilities; and bitumen and water proofing compounds.

Specific impacts associated with the construction phase are summarised below:

River Finn Dredging

The in river section is approximately 5.5km long and extends from the existing limit of navigation at Quivvey Lough to Gortnacarrow. This section of the River Finn will be spot dredged at a number of sites to provide a 13m wide navigation channel which will follow the natural deep channel within the river. The navigation channel has been located based on the Design with Nature principle, i.e. the channel is located in the naturally eroding deeper sections of the river.

The proposed dredging works give rise increased suspended solids through the re-suspension of particulate matter during the dredging process which has associated water quality and aquatic ecology impacts as identified above and in **section 9**. Any significant suspended solids increases have the potential to cause a fish-kill and must be mitigated against, both in relation to the control of suspended solids and also the timing of the works.

The opening of the new connection between the old line of the Ulster Canal at Gortnacarrow and the Finn River / Upper Lough Erne downstream of Gortnacarrow Bridge may potentially give rise to water

quality impacts including increases in suspended solids and discharge of deleterious, polluting substances arising from the construction works. It is a requirement that the proposed works do not conflict with the objectives of this watercourse to meet 'good ecological status'. Impacts affecting water quality during the construction phase are of particular importance with respect to the natura 2000 designation of the study area, including the associated waterbodies such as Lough Sarah, which is currently relatively undisturbed.

Given the protected areas interested associated with the River Finn, i.e. Lough Oughter and Associated Loughs SAC, Upper Lough Erne SAC, a salmonid water and nutrient sensitive area under the UWWTD the water body can be considered to be of extremely high importance. The impact associated with dredging and the opening of a new connection between the old line of the Ulster Canal and the Finn River can be considered as moderate adverse as it could result in a moderate impact on water quality over a temporary timescale. Based on **Table 17.3** the significance of the impact can therefore be assessed as profound in the absence of appropriate mitigation measures.

Canal Excavation

Whilst the excavation and construction of the embankments for the canal will be in the dry using traditional mechanical construction methods and equipment surface water run-off entering the works has the potential to become polluted with suspended solids and fuel/oils. The dewatering of the excavation has therefore the potential to impact on water quality at the proposed location of the discharge.

Whilst the exact location of any discharge from the canal excavation is not yet known it is likely that the discharge location would be to the tributary of the River Finn. This has the potential to impact on the tributaries and the River Finn Downstream. Given the downstream importance of the River Finn these tributaries should be considered to be of high importance and any dewatering of the canal excavation has the potential to have a moderate adverse impact on the water quality. On this basis the significance of the impact is assessed to be moderate to significant in the absence of appropriate mitigation measures.

Clones Marina and Gortnacarrow Facilities

The marina will be excavated in the dry from a green field site using mechanical excavators and will be designed to provide 1.55m of water depth. The proposed quay structure for the Clones Marina will be a retaining wall clad in stone. The marina floor will be sealed with puddle clay and an impermeable liner as used along the Grand Canal and Royal Canal to prevent leakage. Traditional construction / building techniques will be used for the construction of the marina, service block, car park, landscaping and street furniture. Management of surface water run-off will be important as the dewatering of the marina during construction may be required with the potential for polluting matter in terms of suspended solids, accidental spillages of harmful substances and concrete wash out.

The construction of the marina at Clones and jetties, moorings and other facilities at Gortnacarrow will require the removal of riparian habitats within the footprint of the proposed works, with shoreline access of construction vehicles and equipment posing a further risk to water quality. There is therefore the potential for temporary pollution risks to water quality and aquatic interests including salmonids, coarse fish and aquatic macroinvertebrates.

The construction of the marina and facilities at Gortnacarrow could result in a moderate adverse impact directly on the River Finn or its tributary. The significance of the impact is assessed to be significant / profound in the absence of appropriate mitigation measures.

Bridge Structures

The four existing bridges will be retained and the existing towpath under them removed to allow modern navigation traffic to use the canal. The exposed bridge abutments will be refaced with the original facing stone using a traditional mortar mix. New road bridges will be of reinforced concrete construction (In situ concrete or precast concrete or a mixture) finished with textured concrete or stone clad finish depending on location and planning conditions. As the canal is currently defunct the impact on water quality associated with the bridge works should be imperceptible.

Canal Drainage

A number of watercourses cross the site. These watercourses will be collected and directed under the canal in culverts. Existing watercourses which run through the site may be temporarily diverted during the construction works.

Impacts to water quality can take place where the canal is constructed over existing water bodies. Where culverts are being installed there is a potential impact associated with the disturbance of the channel and release of suspended solids and possible indirect effects on the River Finn. In addition other polluting matter such as concrete can be release into the water body.

The alteration or removal of bankside vegetation can also have a significant impact on the water quality and associated aquatic ecology. The pollution risk associated with suspended solids entry from the riparian zone can be significant as detailed in the general construction phase impacts.

The loss of the riparian habitat will also have an impact on the biodiversity of the river corridor and will result in the loss of a natural buffering strip that can filter run-off from the adjacent land zone thereby providing buffering capacity against nutrient and suspended solids run off.

Given the importance of the downstream aquatic environment and the River Finn with associated designations the importance of the tributaries can be considered to be high and in the case of the River Lackey extremely high. The magnitude of the impact is moderate adverse and the rating of the impact is therefore considered to be profound where the River Lackey is concerned and significant for the other tributaries of the River Finn.

17.3.6.3 Operational Phase Impacts

Restoration of Ulster Canal from Clones to Gortnacarrow

Waterways Ireland (WI) is the competent authority with responsibility for ensuring the canals under its remit are Water Framework Directive compliant and for reporting on their ecological potential to the relevant environmental authorities. To achieve this, WI has implemented environmental monitoring and management practices for the canals under its remit which will be replicated for the Ulster Canal.

A number of monitoring points will be selected along the Ulster Canal from Clones to Gortnacarrow once this section is restored. The monitoring programme will then be implemented to determine if the canal is WFD compliant. This includes water quality parameters, biological metrics including invertebrates and macrophytes, and hydromorphology. The formal monitoring and reporting programme will commence two years following restoration of the canal and will ensure that the canal is WFD compliant allowing for continued beneficial uses for navigation, recreation, environmental and amenity value.

The restoration of the canal represents a major beneficial impact as there will be a major improvement in water quality, hydrological and hydromorphological status of the attributes associated with the existing defunct canal.

Maintenance Dredging in the Canal and River Finn

Because canals are generally slow flowing, sediment inputs and the decomposition of plant material lead to heavy silt deposits. Dredging is, therefore, necessary to remove these deposits which can impair navigation and other amenity uses.

The dredging of the River Finn will involve partially dredging at a limited number of locations as the navigation channel between Quivvy Lough and Gortnacarrow was located using the *Design with Nature* principle i.e. the channel is located in the naturally eroding deeper sections of the river, where feasible. The *Design with Nature* approach ensures a minimal amount of river habitat is disturbed during the construction phase of the project. It also ensures that maintenance dredging is kept to an absolute minimum throughout the operational phase.

Water quality can be impacted upon by the re-suspension of particulate matter during the dredging process. The impacts of suspended solids are summarized in the general construction impacts included at the beginning of the impacts section of this chapter. The magnitude of the impact associated with maintenance dredging based on **Table 17.12** can be considered as small to moderate adverse and the significance on the impact on the Finn River and Ulster canal can be considered as profound and significant respectively in the absence of appropriate mitigation measures.

Weed Removal

Weed removal operations can occasionally require the use of heavy plant operating from the bank edge, resulting in impacts upon the existing bank structure, riparian habitat and marginal vegetation.

For this reason, Waterways Ireland utilise waterborne machinery, where possible. The physical removal, or uprooting of aquatic plants, can result in sediment becoming disturbed or destabilised, and subsequently entering the watercourse. In terms of water quality this can have an impact on suspended solids and the mobilization of sediment.

Once restored the Ulster Canal will represent a significant amenity and it has therefore been classified as a high importance water body. The magnitude of the impact can be considered as small and the rating of the impact significance is therefore moderate in the absence of appropriate mitigation measures.

Storm and foul water systems

There is potential for impact from foul water systems from both the pump out facilities on the marinas but also from accidental spillage to the canal water course from pleasure craft. The impact of sewage discharge to the canal or River Finn could have a significant impact on the water quality and given the water recirculation system this could have a knock on effect on the River Finn and tributaries. The magnitude of the impact is assessed to be moderate adverse and the significance ranges from moderate to profound depending on the receiving water, i.e. canal, River Finn or tributary of the River Finn.

Storm water systems may carry fuel and oils from hard standing areas that can have a negative impact on water quality. Given the extent of the hard standing areas and the volume of traffic expected it is not anticipated that this represents a significant risk to the watercourses to which the storm water sewers will discharge at Clones and Gortnacarrow. Whilst not confirmed, storm water discharge is likely to be to the tributary of the Finn at Clones and to the River Finn at Gortnacarrow. The magnitude of the impact is assessed as negligible and therefore the rating of the environmental impact based on **Table 17.3** is assessed as imperceptible.

Boatwash

Water quality impacts can occur as a result of boat wash in the canal or the River Finn. Heavy boat traffic can act in isolation or in combination with wind-induced turbulence to re-suspend bottom sediments with the potential to cause water quality impacts. Given the volume of boat traffic the impact associated with boat wash and sediment re-suspension is likely to be small, however given the importance of the River Finn this could still represent a significant impact if not appropriately mitigated.

Fuels, oils and hydrocarbons

Hydrocarbons can enter the environment as a result of recreational boating and marinas. These can arise at marinas from leakages from storage areas, spillages during fuel transfer and in open water through leakage of poorly combusted fuel and fuel exhaust especially from inefficient, larger or poorly maintained two-stroke engines. Mineral oils tend to be of relatively low toxicity, volatile and readily biodegradable so that in trace amounts they are unlikely to have significant impacts. Accidental spillage represents the greatest impact associated with fuels, oils and hydrocarbons. If a spillage

occurs this has the potential to have a large adverse impact which would result in a significant or profound effect on the receiving water and associated ecology.

Water Recirculation and discharge

A through-flow will be created in the canal to help maintain viable habitats and to prevent stagnation either in the canal or the marina. This will benefit the water quality of the canal and therefore result in a minor beneficial impact on the hydrological attributes of the canal.

Waterways Ireland currently proposes to discharge a through-flow of 40l/s at Clones to a tributary of the River Finn. Given the potential impacts on water quality from the different operational activities identified above there is the potential for the discharge to have a moderate adverse impact on the tributary of the River Finn. Given the downstream importance associated with the River Finn and its associated protected areas the tributary can be considered as of high importance and therefore a moderate to significant impact could occur in the absence of appropriate mitigation measures.

17.3.6.4 Rating of Environmental Impacts

Based on the rating of environmental impact matrix presented in **Table 7.13** an assessment of the significance of the impacts has been made (**Table 17.19**). This is based on the importance of the receiving environment and the scale/significance of the impact.

Table 17.19: Rating of Water Quality Impacts from Construction Phase

Impact	Rating of Impacts
Construction Impacts	
River Finn Dredging	Profound
Canal Excavation	Moderate- Significant
Clones Marina and Gortnacarrow Facilities	Significant/Profound
Bridge Structures	Imperceptible
Canal Drainage	Significant/Profound
Operational Impacts	
Restoration of the Canal	Major Beneficial
Maintenance Dredging	Significant - Profound
Weed Control	Moderate
Foul Systems	Moderate – Profound
Boatwash	Significant
Fuels, oils and hydrocarbons	Significant/Profound
Water Circulation and discharge	Moderate - Significant

17.3.7 Mitigation Measures

17.3.7.1 General Construction Mitigation

Sediment, including all soils, mud, clay, silt, sand etc, is the single main pollutant generated at construction sites and largely arises from the erosion of exposed soils by surface water runoff. The adoption of appropriate erosion and sediment controls during construction is essential to prevent sediment pollution.

It is important to distinguish between erosion control and sediment control:

- Erosion control is intended to prevent runoff flowing across exposed ground and becoming polluted with sediments;
- Sediment control is designed to slow runoff to allow any suspended solids to settle out *in situ*.

Mitigation measures to address the impact from suspended sediments associated with construction activities should follow good working practices and sound design principals. The following measures will be used to mitigate the impact of suspended sediments to natural water bodies together with the associated habitats and species along the proposed scheme:

- Minimisation of in-stream works and timing of such works so as to avoid seasonal fish runs and spawning periods. Machinery will work on the river bed only when sheet-piling has been completed and the area is pumped dry. Trampling or installation of scaffolding or works platforms within the aquatic habitats and water's edge constitutes instream works

and appropriate method statements will be required to minimise the impacts to these habitats based on the works programme;

- Apart from discrete areas that may need to be sheet-piled, all work will be undertaken from the bank and excavated bank material shall be removed to the landward side. Loose material and debris shall not be dumped back into the river;
- Interception, channelling and/or discharge of surface water from sumps, excavations and exposed soil surfaces to silt traps or settlement lagoons;
- Construction of silt traps, settlement lagoons / ponds, wetlands or hydrocarbon interceptors (either temporary or permanent) at sensitive outfalls at an early stage in the construction programme;
- Construction of cut-off ditches to prevent surface water run-off from entering excavations;
- Placing of granular materials over bare soil in the vicinity of watercourses in order to prevent erosion of fines and/or rutting by site traffic;
- Regular communication should be maintained with NPWS rangers, NIEA, IFI and DCAL Inland Fisheries;
- Sediment control from all dredging and excavating operations will be confined to the immediate area of operation by the employment of full depth sediment curtains (see Waterways Ireland Environmental Management Plan for the Ulster Canal – Upper Lough Erne to Clones). These curtains will consist of a geotextile material suspended from floats to weights to ensure that the entire depth of the water column is protected;
- Regular checks should be undertaken by an experienced ecologist to ensure the management measures stipulated in the Method Statement for the protection of the natural surface waters are been implemented by the contractor. Additionally the ecologist should act as the principal point of contact between the contractors, site foreman and regulatory authorities;
- Tool Box talks should be given by an experienced ecologist with the contractor to inform them of the mitigation measures required to ensure protection and conservation of the water quality and aquatic ecology. This will alleviate any mis-conceptions and mis-understandings in terms of the measures;
- Establish vegetation as soon as practical on all areas where soil has been exposed e.g. cut and fill embankments and side casting. In particular stabilisation of the side casting areas should be carried out in order to reduce any run-off or erosion from the excavated soil.

The control and mitigation of potential water quality impacts from other substances associated with the construction of a canal scheme will include:

- Storage of fuel, oils and chemicals will be on an impermeable base, a minimum of 10 metres away from drains and watercourses. Fuel storage areas should be bunded to provide adequate retention capacity (providing 110% capacity of the largest stored unit) in the event of a leak or spillage occurring;

- Refuelling of plant and vehicles will take place on impermeable surfaces, a minimum of 10 metres away from drains and watercourses;
- Provision of spill kits will be required at high risk and/or sensitive sites;
- Installation of wheelwash and plant washing facilities will be considered and will have no overflow where effluents are retained pending treatment and disposal;
- Implementation of measures to minimise waste and ensure correct handling, storage and disposal of waste will be required (most notably wet concrete and asphalt);
- Regular monitoring of surface waters during the construction period will be required to ensure no deterioration in water quality.

Contractors shall establish contact with the Inland Fisheries Ireland, Ballyshannon, NIEA, NPWS and DCAL Inland Fisheries (particularly where works adjacent to aquatic habitats are within Natura 2000 sites) before works commence, with ongoing liaison throughout the construction. Contractors shall be familiar with the requirements of best practice and relevant guidelines including:

- Control of Water Pollution from Construction Sites: Guidance for Consultants and Contractors (CIRIA, 2001);
- Requirements for the protection of Fisheries Habitat during Construction and Development Works at River Sites. Eastern Regional Fisheries Board (Murphy, 2004);
- Pollution Prevention Guidelines (PPG6);
- Fisheries Guidelines for Local Authority Works. Department of Communications, Marine & Natural Resources, Dublin, (Anonymous, 1998).

The appointed contractor will be required to provide a detailed method statement and design showing how water quality impacts and habitat loss during the works will be minimised. The methodology will be approved prior to any works taking place. The recommended mitigation measures outlined in the EIS, in combination with further requirements agreed with the NPWS and the NIEA will be formatted as an Environmental Commitments Checklist with the Construction Method Statement as part of the Construction Management Plan. This will then allow for efficient implementation of the measures proposed, reflecting the basis of the EIS process and also allow for transparent ecological monitoring.

The contractor will also be responsible for developing a detailed emergency plan which will be activated in the event of fire, chemical spillage, cement spillage, collapse of structures, failure of equipment etc. The Emergency Plan must include contact names and telephone numbers for the Ambulance; Fire brigade and the PSNI / Garda Authorities.

17.3.7.2 Specific Construction mitigation

River Finn Drainage

It is envisaged that the dredging will be undertaken by floating plant and transported to shore in barges. It will be off loaded from the barges by mechanical plant and transported to the embankment and laydown sites located along the canal and placed by traditional mechanical methods. If necessary, wet material which is deemed unsuitable for immediate filling will be stored in lagoons / laydown areas and dried before placing as fill. Excess water will be discharged in accordance with Pollution Prevention Guidelines 6 (PPG6) to a local water course.

To avoid excessive changes in water quality every precaution should be taken to minimise initial re-suspension. This could include:

1. Using contained dredging operations such as suction dredging,
2. Working in the dry by diverting water or creating cofferdams,
3. Isolation of turbid waters from the rest of the waterbody by erection of silt curtains,
4. Lower water levels prior to dredging,
5. Reduce flow rate in the canal,
6. Undertake dredging in the dry – but avoiding continuous stretches of canal. Staggering large dredging operations allows for natural recolonisation.
7. Use of GeoTubes TM.
8. A water quality monitoring programme may also be initiated, when appropriate.

Canal Excavation

The excavation and construction of the embankments for the canal will be in the dry using traditional mechanical construction methods and equipment. Surface water entering the works shall be collected in sumps and pumped into settlement ponds from where it will be discharged in accordance with PPG6 to agreed watercourses.

Canal Drainage

A number of watercourses cross the site. These watercourses will be collected and directed under the canal in culverts. The relevant drainage authorities consent will be obtained for all work on watercourses through the site. All temporary and permanent works on watercourses will be agreed with the relevant drainage and fishery authority. Toe drains will be constructed along both banks of the canal, which will pick up existing land drains and local surface water drains and direct them to local watercourses. The relevant drainage authorities consent will be obtained for these discharges.

Guidance on the requirements for the “Protection of Fisheries Habitat during Construction and Development Works at River Sites” published by the Eastern Regional Fisheries Board and the

“Culvert Design and Operation Guide” published by CIRIA should be followed to ensure the appropriate installation of culverts for watercourses traversed by the canal.

17.3.7.3 Specific Operational mitigation

Waterways Ireland (WI) has a significant role to play in advocating and implementing high quality environmental management of the restored Ulster Canal (Upper Lough Erne to Clones), given the long-term viability of this unique asset is dependent on its environmental status. Consequently, WI has developed this Environmental Management Plan to assist in compliance with habitat and wildlife regulations, water pollution legislation, waste management during the operational phase of the navigation and also with future compliance with Water Framework Directive (WFD) to ensure Good Ecological Potential (GEP) is achieved.

The aim of the EMP is to maximise the overall ecological value of this section of canal. This will be achieved through the creation of a sustainable ecosystem whilst ensuring the conservation interests of Upper Lough Erne and its environs are protected.

Boatwash

Speed limits for vessels are recommended in line with Waterways Ireland current practice to reduce boat wash. However, it is considered that lower limits may be required at constricted channels within the Finn (i.e. between Gortnacarrow and Wattle Bridge) where the riparian habitats may require additional protection.

Storm and foul water systems

Separate storm and foul water systems will be provided at Clones and Gortnacarrow. The foul water system in Clones will be directed to the municipal sewer. The foul water system in Gortnacarrow will be directed to a storage tank which shall be collected and discharged under licence to a local municipal sewage system. Waterways Ireland's Bye laws require boats to have holding tanks which can be discharged to on shore pump out facilities and do not permit boats to discharge to waterways. Suitable pump outs are provided on Lough Erne, with new facilities to be provided at Castle Saunderson and Clones Marina.

Weed Removal

The Waterways Ireland Environmental Management Plan identifies the mitigation measures that will be taken during aquatic vegetation control. These measures include:

- Selective vegetation technique;
- Appropriate vegetation control regime (Note aquatic plant control by means of herbicide has been made illegal since march 2010);
- Appropriate harvesting technique;
- Appropriate timing.

Maintenance Dredging in the Canal and River Finn

The mitigation measures proposed under the dredging required in the River Finn during the construction of the proposal are also applicable to the maintenance dredging in both the canal and the River Finn.

Fuels, oils and hydrocarbons

The main pollution risk associated with these chemicals during the operational stage relate to accidental spillage during refueling. To address this proposed pollution incident management operations for the Ulster Canal navigation from Upper Lough Erne to Clones are detailed within section 2 of the Environmental Management Plan. The Environmental Management Plan identifies pollution risks and controls for hydrocarbons, but also spillages of foul water, elevated suspended solids and leakages of hydraulic fluids from lock gate operations.

Water Recirculation and discharge

The mitigation measures identified for the different impacts associated with the operation of the canal as identified above and in the Waterways Ireland Environmental Management Plan should ensure the water quality in the canal will be of good ecological potential under the objectives of the WFD and the water circulation and discharge from the canal to the tributary of the River Finn. Therefore the discharge should not have an impact on the receiving water quality.

17.3.8 Residual Impacts

Provided the mitigation measures identified and the Waterways Ireland Environmental Management Plan are fully implemented the impact of the development on water quality will be slight to moderate as highlighted in the table of residual impacts below which has been prepared based on the rating of environmental impacts presented in **Table 17.13**.

Table 17.20: Summary of Residual Water Quality Impacts

Impact	Rating of Impacts
Construction Impacts	
River Finn Dredging	Slight
Canal Excavation	Imperceptible
Clones Marina and Gortnacarrow Facilities	Moderate
Bridge Structures	Imperceptible
Canal Drainage	Slight
Operational Impacts	
Restoration of the Canal	Major Beneficial
Maintenance Dredging	Slight
Weed Control	Slight
Foul Systems	Imperceptible
Boatwash	Imperceptible
Fuels, oils and hydrocarbons	Imperceptible
Water Circulation and discharge	Imperceptible

17.4 FLOODING

Investigation of OPW and DARD Rivers Agency historical and modelled flooding information highlights that south west Clones, in the vicinity of the Cavan Road (N54) and McCurtain Street (R212), was historically susceptible to flooding, but is now benefiting from flood defences in the area. The River Finn from Drumully to the Upper Lough Erne navigation channel, Lough Sarah and Drumully Lough have all flooded in the past, with much of the low lying areas surrounding these waterbodies being seasonally submerged. The River Finn, 2kms to the south of the Ulster Canal at Cloncallick, has also been recorded as flooding in the past. Strategic flood modelling of the area has also highlighted that the area of Ulster Canal, by the River Finn at Clongowna may also be subject to flooding within a 1:100 return period, as well as the above mentioned areas near the River Finn, Lough Sarah and Drumully Lough. Strategic flood modelling for 2030, which incorporate an 11% increase in river flows due to climate change, show slight increases in floodplain areas within the above highlighted zones.

A detailed flood risk assessment (FRA) for various parts of the proposed navigation has been carried out separately to this Environmental Impact Assessment. This FRA is a separate document to the EIS and is entitled “Ulster Canal – Lough Erne to Clones: Flood Risk Assessment” created by Atkins for Waterways Ireland, October 2011. This FRA will accompany the planning documentation being submitted for the Ulster Canal – Upper Lough Erne to Clones.

18 WASTE MANAGEMENT

18.1 INTRODUCTION

As part of the EIS there is a requirement to implement a Waste Management Strategy and Site Waste Management Plans to ensure that, where possible, waste is prevented and minimised and where this is not possible it is re-used or recycled. In combination with this, a procedure will be put in place to ensure the disposal of waste at landfill as the last option for the waste produced.

The objectives of this section are to undertake the following:

- A review of the proposed restoration works;
- A review of applicable legislation;
- A review of the Southern Waste Management Partnership Plan and the North East Region Waste Management Plan;
- A review of the construction phase of the project;
- A review of the operational phase of the project;
- An assessment of sediment characterisation data;
- Potential waste management techniques; and
- Predicted impact.

18.2 PROPOSED RESTORATION WORKS

Restoration of the canal will involve the construction of the following elements which may give rise to waste materials:

- Site clearance;
- Bulk earthworks;
- Dredging of channel;
- Construction of navigation channel;
- Re-profiling of side slopes of channel;
- Canal restoration;
- Construction of pathways, agricultural laneways and local access points as necessary;
- Construction of canal embankments and cuttings;

- Construction of siphons / culverts;
- Construction works on bridges along the route as required;
- Construction of moorings and associated facilities, including car and coach parking, toilets, service blocks, slipway, picnic and play area;
- Construction of infrastructure, drainage and water supply;
- Construction of a new marina;
- Construction of canal locks as necessary; and
- Landscaping, planting and environmental mitigation.

18.3 LEGISLATION REVIEW

A review of applicable legislation has been undertaken as part of the preparation of this section of the EIS. This legislation review includes applicable waste and environmental European Directives and relevant domestic legislation, set out as those applicable to Northern Ireland and those for Ireland.

European Directives

- EU Waste Framework Directive (2008/98/EC)
- EU Hazardous Waste Directive (91/689/EEC)
- EU Landfill Directive (1999/31/EC)
- EU Waste Electrical and Electronic Equipment Directive (2002/96/EC)
- EU Environmental Liability Directive (2004/35/EC)
- EU Integrated Pollution Prevention and Control Directive (2008/1/EC)
- EU Batteries Directive (2006/66/EC)

Domestic Legislation – Northern Ireland

- Controlled Waste (Duty of Care) Regulations (Northern Ireland) 2002 and Amendments
- Controlled Waste (Registration of Carriers and Seizure of Vehicles) Regulations 1999
- Waste and Contaminated Land (Northern Ireland) Order 1997 and Amendments
- Waste Management Regulations (Northern Ireland) 2006
- Waste Management Licensing Regulations (Northern Ireland) 2003 and Amendments
- Waste Regulations (Northern Ireland) 2011
- Transfrontier Shipment of Wastes Regulations 2007
- Waste Electrical and Electronic Equipment Regulations 2006 and Amendments

- Landfill Regulations (Northern Ireland) 2003 and Amendments
- Pollution Prevention and Control Regulations (Northern Ireland) 2003

Domestic Legislation – Ireland

- Protection of the Environment Act 2003
- Waste Management Act 1996 and Amendments
- Waste Management (Hazardous Waste) Regulations 1998
- Waste Management (Electrical and Electronic Equipment) Regulations 2005
- Waste Management (Licensing) Regulations 2004
- Waste Management (Batteries and Accumulators) Regulations 2008 and Amendments
- Waste Management (Facility Permit and Registration) Regulations 2007

18.4 REGIONAL WASTE MANAGEMENT PLANS

A section of the proposed canal route falls within Northern Ireland with the remaining part of the canal falling within the jurisdiction of Ireland. The canal route is therefore within two different regional waste management planning areas: the Southern Waste Management Partnership (SWaMP) in Northern Ireland and the North East Region Waste Management Plan in Ireland. A description of these Waste Management Plans is set out in the section below.

18.4.1 Southern Waste Management Partnership Waste Management Plan

A section of the proposed canal is located in the Southern Waste Management Partnership Plan (SWaMP) region in Northern Ireland and therefore the development will have to take account of the waste management measures outlined in the plan for the Region.

The Southern Waste Management Partnership comprises of the following eight Local Authorities: Armagh City and District Council, Banbridge District Council, Cookstown District Council, Craigavon Borough Council, Dungannon and South Tyrone Borough Council, Fermanagh District Council, Newry and Mourne District Council and Omagh District Council.

These local authority areas are situated in the southern region of Northern Ireland and represent approximately 48% of the total area and 27% of the population of Northern Ireland. The purpose of the Plan is to set out a framework for the management of controlled wastes arising in the SWaMP Region over the period 2006 to 2020. This includes identifying capacity needs, potential sites and/or siting criteria, and the services needed for the collection, treatment and disposal of the wastes. This Plan seeks to build upon the significant progress made by the previous Waste Management Plan,

which set out detailed actions for the period 2000 to 2005. The revised Plan has been developed on the basis of a Review and consultation with stakeholders, including the public.

The SWaMP Waste Management Plan reinforces targets and initiatives which have been set for the Construction, Demolition and Excavation sector, from a number of different sources including the Northern Ireland Waste Management Strategy: Towards Resource Management, the Waste and Resources Action Programme (WRAP) Halving Waste to Landfill Commitment and the introduction of Site Waste Management Plans. Each of these focus on maximising the prevention, reduction, reuse and recycling of Construction, Demolition and Excavation (C, D and E) wastes, and limiting the quantities of wastes disposed of to landfill.

The Waste Management Plan therefore identifies key aspects for this waste stream as follows:

- **Waste prevention** to limit quantities of C, D and E wastes produced, through the designing out of waste, and the specification of re-useable or recyclable materials, as far as is practicable.
- **Site waste management planning** using the published Guidance and checklists to identify opportunities for the re-use and recycling of waste, on and off-site, and improve site management practices.
- **On-site reuse and recycling** through the use of mobile plant to produce materials that are used on the project (for example, reuse of excavated soil for embankments where possible).
- **Disposal** – the least preferred option, but unavoidable for some waste types, including some hazardous wastes.

18.4.2 North East Region Waste Management Plan

A section of the proposed works is also located in Counties Cavan and Monaghan in the North East Waste Management Plan Region in Ireland, and therefore the development will also have to account of the waste management measures set out in this Plan.

The North East Region, for the purposes of the Waste Management Plan, consists of the administrative areas of the counties of Meath, Louth, Monaghan and Cavan. The North East Region Waste Management Plan was originally prepared in 1999 and covered the period 1999 - 2004. The Local Authorities in the Region commenced a review of the Waste Management Plan in 2004 examining new legislation and policies, regional changes and cross-border opportunities and challenges. In addition, consultation with the public, industry and regional stakeholders was undertaken and all relevant issues were considered. A revised Plan was developed and implemented covering the period 2005 – 2010, which is still the current Waste Management Plan in operation in the Region.

The purpose of the Plan was to provide a framework for the management of non-hazardous wastes in the North East Region over a five year period in accordance with national and EU waste legislation and policy. The Plan 2005 - 2010 addresses all areas of waste management – from waste prevention and minimisation, to its collection, treatment, recovery and final disposal. The waste management policy statement in the Plan is as follows:

- The Waste Management Plan implements a **regional approach** to waste management that is sustainable and based on national and EU legislation and policy.
- The Waste Management Plan therefore also implements an **integrated waste management approach** grounded on the Waste Management Hierarchy which will be applied to waste generated, implementing maximum recycling, recovery of energy from residual waste, and moving away from landfill disposal.
- The Waste Management Plan was developed to incorporate the need to **progress towards meeting waste management targets**, established at EU and National level, for businesses and households in terms of waste reduction, reuse, recycling and disposal.

In addition to this, the Region, through the measures set out in the Waste Management Plan, needs to ensure that the re-use and recycling of C, D and E wastes are maximised and that illegal collection and disposal of this material ceases. Furthermore the Local Authorities in the Region support and promote the endeavors of the National Construction and Demolition Waste Council (NCDWC) and its producer responsibility initiative to reduce the generation of unnecessary C, D and E wastes.

18.5 CONSTRUCTION, DEMOLITION AND EXCAVATION WASTES

The proposed canal restoration works will be a significant construction project, therefore it is considered that a significant quantity of Construction, Demolition and Excavation (C, D and E) wastes may be generated. These are defined as follows:

- **Construction wastes:** wastes arising from site management practices, for example, excess materials and packaging, over-ordering materials, off-cuts and damaged materials. Typically, it is "cleaner" than demolition waste. Packaging waste makes up a significant part of this waste stream.
- **Demolition wastes:** wastes generated by the demolition of existing structures/buildings rather than opting to refurbish them. This is made up of several sub-waste streams, which are often mixed, depending on the amount of selective demolition and separate collection that has taken place. Demolition waste can also contain hazardous substances that are present in buildings when demolished or renovated.

- **Excavation wastes:** typically consisting of materials e.g. soil, made ground and existing foundations removed as a function of design or from excavations for new construction. Depending upon the previous use of the site, this may, or may not be contaminated.

It is therefore estimated that these C, D and E wastes may include the following materials:

- Concrete;
- Block work;
- Tiles, ceramics;
- Plasterboard and gypsum wastes;
- Steelwork;
- Other metals;
- Asphalt, Tar and Tar products;
- Timber;
- Excavation materials; and
- Sediment arising from dredging.

18.5.1 C, D and E Wastes in the SWaMP Region

C, D and E wastes generated within the SWaMP Region will be managed by private waste operators. All waste operators collecting and transporting C, D and E wastes from construction sites are required to be registered by the Northern Ireland Environment Agency (NIEA) under the Controlled Waste (Registration of Carriers and Seizure of Vehicles) Regulations (Northern Ireland) 1999.

Targets have been set within the Northern Ireland Waste Management Strategy: Towards Resource Management 2006 -2020 to encourage the reuse or recycling of C, D and E wastes, in line with the Waste Management Hierarchy. These targets are as follows:

- 75% of C, D and E wastes to be recycled or reused by 2020.
- A minimum of 10% of the materials value of public sector construction projects should derive from recycled or reused content.

In addition to these targets, the WRAP Halving Waste to Landfill Commitment is a voluntary agreement that provides a framework through which the construction industry can support and deliver against the target of halving waste to landfill by 2012. Halving waste to landfill by 2012 is a collective target, through which individual organisations set their own targets for the prevention, reduction, reuse and recycling of C, D and E wastes. The commitment can be applied to all members of the construction industry supply chain including clients, design teams, contractors and their sub contractors, suppliers, manufacturers and waste management contractors.

In addition to these, the Department of the Environment Northern Ireland (DOENI) has recently undertaken a consultation on the draft *'The Site Waste Management Plans Regulations (Northern Ireland) 2011'* which would make Site Waste Management Plans a legal requirement for certain construction and demolition projects in Northern Ireland. These are scheduled to come into force in autumn 2011. These regulations would place a duty on developers to keep a record of how much C, D and E waste is generated and how it is managed for projects valued at £300,000 or greater, with additional requirements for those projects valued at more than £500,000.

18.5.2 C, D and E Wastes in the North East Region

As identified in the North East Region Waste Management Plan private waste collectors and permitted contractors within the construction industry collect and transport C, D and E wastes in the Region. Contractors transporting C, D and E wastes arising from construction sites are required to obtain a Waste Collection Permit from the relevant Local Authority. Local Authorities encourage contractors to re-use C, D and E wastes on site, where possible, or alternatively transport the material to a separate site for recovery.

The North East Region Waste Management Plan reinforces the overall targets for C, D and E wastes set out in the 'Changing our Ways' document of achieving 85% recycling by 2013, through the implementation of the waste hierarchy and the producer responsibility principle.

18.5.3 Sediment Arising from Dredging Activities

The proposed development will also include spot dredging on the River Finn between Quivvy Lough and Gortnacarrow during construction to achieve suitable navigation levels and from maintenance during operation for maintenance purposes. Samples of sediment to be dredged have been obtained through site investigation and have been tested to determine their physical and chemical characteristics, and therefore to identify the most suitable disposal route.

Sediment samples gathered during site investigation were tested using a single batch test as it was not possible to test all samples using a two stage batch test due to the moisture content of the sediment. The results for those samples that were tested using a single batch test have indicated that they should be classified as non-hazardous due to the Total Organic Carbon (TOC) content. However, it is noted that a higher TOC limit value may be permitted at an inert landfill provided a Dissolved Organic Carbon (DOC) value of 500mg/kg is achieved. This issue will also be considered following future testing of samples.

The sediment samples that were tested by a two stage batch test were classified as inert. It is therefore recommended that further testing of the material to be dredged takes place prior to construction works, where the sample is stockpiled to achieve the required moisture level and a two

stage batch test carried out to confirm the results of the testing and to ensure that a suitable disposal route is maximised.

18.6 CONSTRUCTION PHASE

The construction phase of the proposed development will include the following activities that may give rise to waste materials:

- Site clearance;
- Bulk earthworks;
- Dredging of channel;
- Construction of navigation channel;
- Re-profiling of canal side slopes of channel;
- Canal restoration;
- Construction of pathways, agricultural laneways and local access points as necessary;
- Construction works on bridges along the route as required;
- Construction of moorings and associated facilities, including car and coach parking, toilets, slipway, picnic and play area;
- Construction of infrastructure, drainage and water supply;
- Construction of a new marina;
- Construction of locks as necessary; and
- Landscaping, planting and environmental mitigation.

18.6.1 Construction Phase Waste

During the construction phase it is estimated that the waste types produced will include, but not be limited to:

- Green wastes from clearing of the canal area;
- Concrete;
- Block work;
- Tiles, ceramics;
- Plasterboard and gypsum wastes;
- Steelwork;
- Other metals;
- Asphalt, Tar and Tar products;
- Timber;
- Excavation materials; and
- Sediment arising from dredging.

The methodology for managing the construction phase waste including ensuing disposal at landfill is minimised is outlined further in **section 18.8** of this report.

18.7 OPERATIONAL PHASE

The operation of the restored Ulster Canal (Upper Lough Erne to Clones) will produce wastes associated with boats and members of the public visiting the canal. Wastes will also be generated from the maintenance of both the canal and the surrounding areas and facilities. A list of the main potential waste streams that may be generated by the operation of the restored canal are outlined below:

- Litter including glass, paper, cardboard, plastic, food waste and mixed municipal waste may be generated at amenity and service blocks along the length of the canal;
- Other wastes such as metals, wood (including wood pallets), fluorescent tubes and batteries;
- Sediment arising from maintenance dredging;
- Waste oils from maintenance vehicles
- Hydraulic oil from lock chambers;
- Green wastes from maintenance of the canal area;
- Chemical wastes;
- Foul water arising from amenity areas and service blocks; and
- Waste Electrical and Electronic Equipment (WEEE).

Waterways Ireland will ensure that all wastes are reused, recycled or disposed of by appropriately licensed contractors, as the use of unlicensed or non-permitted waste contractors could give rise to inappropriate management of waste and result in environmental impacts / pollution. In addition, if waste is not managed and stored correctly, this may lead to litter or pollution issues along the canal route.

18.8 WASTE MANAGEMENT TECHNIQUES

In order to mitigate against the impact that the proposed canal restoration may have on the production of waste during construction and operation, actions will be put in place to ensure that all waste is dealt with in a sustainable and legislatively compliant manner. Further details on how the impact from construction and operational waste will be managed are outlined in **sections 18.8.1** and **18.8.2**.

18.8.1 Construction Phase Waste Management

A site specific Construction, Demolition and Excavation Waste Management Plan (C, D and E WMP) for the construction phase of the proposed development will be prepared to ensure effective waste management and recycling of waste generated during the works. This C, D and E WMP will be

prepared taking account of both the SWaMP and North East Waste Management Plan objectives and issues raised by key stakeholders.

The C, D and E WMP will be prepared in line with the waste management hierarchy with waste reduction and re-use on site being of primary focus. It is envisaged that the C, D and E WMP will be prepared and implemented prior to construction works commencing and as a minimum will include the following waste mitigation measures:

- **Green wastes** from clearing of the canal area may be generated by staff carrying out clearing of the canal route. These wastes should be collected separately from other wastes and collected for composting or mixing by an appropriately licensed contractor and processed at a permitted facility for possible reuse in the landscaping works.
- **Construction wastes** generated during the restoration of the canal will be segregated on-site into appropriate categories for recycling including, for example:
 - Tiles and ceramics;
 - Concrete;
 - Plasterboard and gypsum wastes;
 - Steelwork and other metals;
 - Asphalt, Tar and Tar products; and
 - Timber.

These wastes will be stored appropriately in skips, or other suitable receptacles, in a designated area on-site. These waste streams will be collected by either the local council or by appropriately licensed or permitted private waste contractors that have been appointed by the contractor for recycling or disposal and taken to suitably licensed facilities. All waste leaving site will be recycled, recovered or reused where possible, with the exception of those waste streams where appropriate facilities are currently not available. In addition to this, the contractor will if possible endeavour to reuse any left over materials, such as timber off-cuts, on-site.

Waterways Ireland will also, where possible on-site, implement measures to ensure that construction wastes are minimised including controlling ordering of construction materials and through appropriate storage of construction materials on site to reduce wastage.

Waterways Ireland will ensure that only appropriately licensed or permitted waste contractors are used to either recycle or dispose of wastes generated. The use of unlicensed waste contractors may give rise to inappropriate management of waste and result in environmental impacts / pollution. In addition, if waste is not managed and stored correctly, this may lead to litter or pollution issues on the lands surrounding the canal or on adjacent lands.

In order to ensure effective waste minimisation, re-use and appropriate recycling of materials during the construction of the restored canal, Waterways Ireland will ensure that staff that are carrying out works on the canal route will receive training as part of their induction to the site including: instructions

on the appropriate segregation, handling, recycling, re-use methods to be employed by all parties on site for wastes generated.

Waterways Ireland will ensure that all waste leaving the site is recorded and copies of the relevant documentation are maintained under Duty of Care requirements.

- **Excavation materials and sediment arising from dredging** will be generated from the restoration of the canal route. Samples of sediment arising have been obtained during site investigation have been tested to determine their physical and chemical characteristics, and therefore to identify the most suitable disposal route. Please refer to Section 18.5.3 for further information on sediment testing. Reuse or disposal of this material will be determined by the classification following testing, therefore it is recommended that Waterways Ireland stockpile material following dredging to achieve the required moisture content for testing and then undertake a two stage batch test on the samples to determine the most appropriate disposal route. If possible Waterways Ireland have stated that the sediment will be reused, if the material is suitable and classified as inert, along the length of the site for improvements to the canal, bank or towpath. If reuse is not required on site approved and licensed facilities will be sought for the disposal of the sediment, at either an inert, non-hazardous or hazardous facility.

Initial consultation with Northern Ireland Environment Agency (NIEA) Transfrontier Shipment (TFS) Section and the National TFS Office of Dublin City Council has indicated that uncontaminated soil and stones can be reused along the length of the canal in either jurisdiction provided it is uncontaminated and reused on the same site. Uncontaminated soil and stones to be used for engineering purposes does not fall under the remit of waste control. This is clarified in Article 2 1 c) of the EU Waste Framework Directive (2008/98) which states:

'uncontaminated soil and other naturally occurring material excavated in the course of construction activities where it is certain that the material will be used for the purposes of construction in its natural state on the site from which it was excavated'.

However, if material is not suitable for reuse it must be disposed of in its country of origin at appropriately licensed facilities.

The storage and disposal to land of sediment arising from dredging will be subject to a number of waste licence requirements. In Northern Ireland, these activities will be subject to a number of Waste Management Licensing Exemptions under the Waste Management Licensing Regulations (Northern Ireland) 2003, a brief explanation of each of these Exemptions is provided below:

- **Paragraph 25:** Deposit of Waste Arising from Dredging Inland Waters or from Clearing Plant Matter from Inland Waters;

- **Paragraph 9:** Land Treatment for Agricultural Benefit or Ecological Improvement; and
- **Paragraph 11:** Reclamation, Restoration or Improvement of Land

These Exemptions are issued by the Northern Ireland Environment Agency (NIEA), and Waterways Ireland will make the appropriate applications for these Exemptions following receipt of Planning Permission.

Paragraph 25

This Exemption allows for the deposit, and treatment by screening or dewatering of waste arising from dredging or from clearing plant matter from inland waters. For this Exemption to apply:

- The total amount of waste deposited along the bank or towpath on any day must not exceed 50 tonnes for each metre of the bank or towpath along which it is deposited;
- The deposit of the waste must be along the bank or towpath of the waters where the dredging or clearing take place or along the bank or towpath of any inland waters so as to result in benefit to agriculture or ecological improvement.

In addition to this:

- The deposit of waste does not apply to waste deposited in a container or lagoon;
- The Exemption only applies where waste deposited is the establishment or undertaking's own waste; and
- The treatment by screening or dewatering of the waste must be on the bank or towpath of the waters where either the dredging or clearing takes place or the waste is to be deposited, or at the place where the waste is to be spread, prior to it being spread in accordance with a paragraph 9 or 11 exemption.

Paragraph 9

This Exemption allows for certain wastes to be spread on land used for agriculture where the spreading will result in benefit to agriculture or ecological improvement or on land not used for agriculture where the spreading will result in ecological improvement. This Exemption applies as follows:

- Dredging spoil is suitable to be spread on land used for agriculture where the spreading results in benefit to agriculture or ecological improvement;
- The quantity of waste spread shall be determined by the crop requirement and shall be based on the soil and waste analyses;
- No more than 5,000 tonnes of waste per hectare can be spread in any 12 month period;
- No more than 1,000 cubic metres of waste can be stored and storage must be at the place where it is to be spread. Waste must be stored in a secure container or lagoon or place; and
- A certificate demonstrating the Benefits to Agriculture or Ecological Improvement must be submitted with a Paragraph 9 Exemption.

Paragraph 11

This Exemption allows for the spreading and storage of waste for the purpose of reclaiming, restoring or improving land which has been subject to industrial or other man-made development where the use to which that land could be put would be improved by the spreading. This Exemption applies as follows:

- Dredging spoil is suitable to be spread on land;
- The activity and quantity of waste used must be carried out in accordance with the Planning Permission for the site;
- The waste must be spread to a depth not exceeding the lesser of 2 metres or the final cross sections shown on any plan or drawings submitted in support of the Exemption application;
- The waste spread must not exceed 20,000 cubic metres per hectare; and
- The waste must be securely stored for a period not exceeding 6 months and storage must be at the place where it is to be spread.

In Ireland the storage and disposal of sediment arising from dredging will be subject to the requirements of the Waste Management (Facility Permit and Registration) Regulations 2007 and require a Waste Facility Permit. This activity would be subject to: Class No 5 – Recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purposes of the improvement or development of land, where the total quantity of waste recovered at the facility is less than 100,000 tonnes. This Permit is issued by the Environmental Protection Agency (EPA) and Waterways Ireland, if required, will make the appropriate application for this Permit following receipt of Planning Permission.

18.8.2 Operational Phase Waste Management

A site specific Operational Waste Management Plan (OWMP) will be prepared for the operational phase of the proposed development to ensure effective waste management and recycling of waste generated during the day to day running of the canal. The OWMP will be prepared taking into account the objectives of both the SWaMP and North East Waste Management Plan and issues raised by key stakeholders. It is envisaged that the OWMP will be prepared and implemented prior to completion of the site and as a minimum will include the following waste mitigation measures:

- **Litter and other waste materials** will be segregated on-site into appropriate categories for recycling including, for example:
 - Cardboard / Paper;
 - Plastics;
 - Mixed non-recyclable waste;
 - Organic (Green) waste;
 - Glass (Green, Clear and Brown);

- Metals;
- Timber pallets;
- Other wood;
- Fluorescent tubes; and
- Batteries.

Appropriate receptacles and recycling bins as agreed with the Local Authorities will be provided at Clones Marina, Gortnacarrow moorings and any public parking area.

In order to ensure effective waste minimisation, re-use and appropriate recycling of materials during the operation of the restored canal users of the waterway will be informed of the recycling facilities available to them at moorings and recreation areas. In addition to this, Waterways Ireland will ensure that staff that are carrying out maintenance work on the canal also receive training as part of their induction to the site including: instructions on the appropriate segregation, handling, recycling, re-use methods to be employed by all parties on site for wastes generated.

Waterways Ireland will ensure that all waste leaving the site is managed in accordance with appropriate waste management legislation and policy.

- **Sediment arising from dredging** will be generated from routine canal maintenance. Samples of sediment arising have been obtained during site investigation have been tested to determine their physical and chemical characteristics, and therefore to identify the most suitable disposal route. Please refer to Section 18.5.3 for further information on sediment testing. Reuse or disposal of this material will be determined by the classification following testing, prior to maintenance dredging works being carried out. If possible Waterways Ireland have stated that the sediment will be reused, if the material is suitable and classified as inert, along the length of the site for improvements to the canal, bank or towpath. If reuse is not required on site approved and licensed facilities will be sought for the disposal of the sediment, at either an inert, non-hazardous or hazardous facility.

For further information on disposal of this material please refer to **section 18.8.1**.

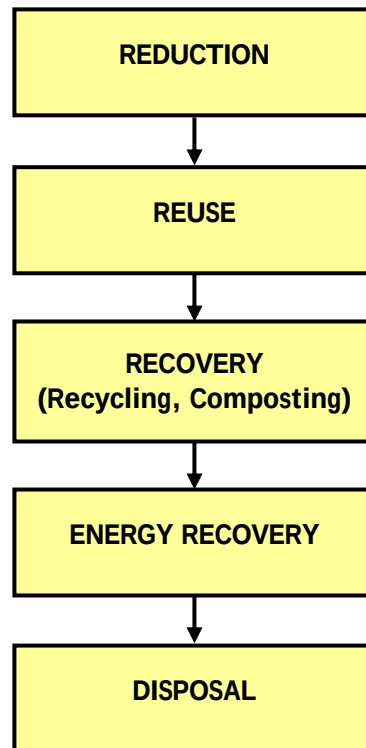
- **Waste oils from maintenance vehicles** will be collected, transported and disposed of by contractors appropriately licensed for the recovery, recycling or disposal of waste oils. Waste oils, filters and canisters should also be appropriately stored in waste oil receptacles or bunded units until collection. Waterways Ireland will ensure that the contractors appointed to transport and recover or dispose of waste oils are appropriately licensed for these wastes therefore minimising the potential of pollution incidents. Waterways Ireland will ensure that all waste leaving the site is recorded and copies of the relevant documentation are maintained.

Waterways Ireland will ensure that staff that are carrying out maintenance work on the canal also receive training as part of their induction to the site including: instructions on the appropriate segregation, handling, recycling, re-use methods to be employed by all parties on site for wastes generated.

- **Hydraulic oil from lock chambers.** In order to minimise waste hydraulic oil lock chambers will be designed and operated to ensure that there is minimal loss of oil. Filters and bypass systems in the lock mechanisms will be designed to allow for the regular cleaning and maintenance of filters eliminating the need for oil changes. Waterways Ireland will also use biodegradable hydraulic oil which will reduce any potential detrimental environmental impact.
- **Green wastes from maintenance of the canal area.** Green wastes will be generated by staff carrying out routine maintenance along the length of the canal. These wastes will be managed in compliance with the site Environmental Management Plan, and will generally be mulched and left to compost in-situ.
- **Chemical wastes.** The control of weeds along the canal may involve the use of herbicide solutions. Where these are used the wastes will be treated in accordance with appropriate waste management legislation and policy. Standard household chemicals may be used in the cleaning and maintenance of toilet facilities and the majority of these wastes will be disposed of along with foul water through foul sewer lines for treatment at a Waste Water Treatment Works.
- **Foul water arising from amenity areas and service blocks.** All foul water will be diverted into main foul sewer lines for treatment at a Waste Water Treatment Works. Any surface waters will be passed through silt and petrol / oil interceptors before discharge under approved discharge licences.
- **Waste Electrical and Electronic Equipment (WEEE)** may be generated by both users of the canal or from redundant equipment used on site. Waterways Ireland will ensure that this equipment will be reused or refurbished where possible, and if required will be disposed of to an appropriately licensed facility.

18.9 PREDICTED IMPACT

Waterways Ireland are committed to disposing of wastes generated in line with waste management best practice and the Waste Management Hierarchy, as set out in **Figure 18.1**.

Figure 18.1 Waste Management Hierarchy

The predicted impact of the wastes generated both during the construction and operation of the canal will be minimised by Waterways Ireland carrying out the waste management measures in line with the Waste Management Hierarchy set out in this section.

In addition to this, the period of construction works for canal restoration is considered to be relatively insignificant in relation to the operation and given that construction waste will be carefully managed in line with the Waste Management Hierarchy the predicted impact of the construction phase on the environment will be short term and slight.

Waterways Ireland will also ensure that operational wastes are managed in line with the Waste Management Hierarchy to achieve a high rate of reuse, recycling and recovery where possible. By managing wastes in this way, Waterways Ireland will assist in ensuring that waste is managed in a sustainable manner, and therefore the predicted impact of the operational phase on the environment is considered to be long term and imperceptible.

18.10 CONCLUSIONS

The proposed restoration of the canal will result in the production of construction based wastes, including:

- Green wastes from clearing of the canal area;
- Concrete;
- Block work;

- Tiles, ceramics;
- Plasterboard and gypsum wastes;
- Steelwork;
- Other metals;
- Asphalt, Tar and Tar products;
- Timber; and
- Sediment arising from dredging activities.

It is proposed that a Construction and Demolition Waste Management Plan (C&D WMP) will be prepared prior to construction on site. This C&D WMP will ensure that waste production on site is minimised and waste produced is re-used where possible. If waste cannot be minimised or re-used on site then this waste will be recycled where possible or disposed of in a legislative compliant manner.

The operation of the restored canal will produce wastes associated with boats and members of the public visiting the canal. Wastes will also be generated from the maintenance of both the canal and the surrounding areas and facilities. The potential waste streams generated include:

- Litter including glass, paper, cardboard, plastic, food waste and mixed municipal waste may be generated at amenity and service blocks along the length of the canal;
- Other wastes such as metals, wood (including wood pallets), fluorescent tubes and batteries;
- Sediment arising from maintenance dredging;
- Waste oils from maintenance vehicles;
- Hydraulic oil from lock chambers;
- Green wastes from maintenance of the canal area;
- Chemical wastes;
- Foul water arising from amenity areas and service blocks; and
- Waste Electrical and Electronic Equipment (WEEE).

A site specific Operational Waste Management Plan (OWMP) for the operational phase of the proposed development will be prepared to ensure effective waste management and recycling of waste generated during the day to day running of the site. The OWMP will be prepared taking into account the objectives of both the SWaMP and North East Waste Management Plan and issues raised by key stakeholders.

With regard to the construction of the proposed development it is considered that the impact will be short term and imperceptible. With regard to the operational phase of the development it is considered that the impact will be long term and imperceptible if the measures set out in both the site specific Construction and Demolition and the Operational Waste Management Plans are implemented.

19 CLIMATE CHANGE

19.1 INTRODUCTION

This section of the EIS outlines the potential large scale impacts of climate change on the island of Ireland and assesses the potential for climate change to impact upon the long-term operation of the proposed Ulster Canal – Upper Lough Erne to Clones, and the potential of the restored navigation to affect climate change.

Climate is described by the Department of Energy and Climate Change (DECC, 2011) as the average weather experienced over a long period of time, which includes temperature, wind and precipitation (rainfall, hail, sleet and snow). The DECC refine this however by commenting that the Earth's climate is not fixed and in the past has changed many times in response to a variety of natural causes. The DECC describe climate change as an identifiable change in the climate that persists for an extended period, typically decades or longer, and is often taken to mean man-made changes that have occurred since the onset of the industrial revolution.

19.2 PREDICTED NEGATIVE IMPACTS OF CLIMATE CHANGE

The 2007 report of the Intergovernmental Panel on Climate Change (IPCC), a global body which collates and assesses the results of international climate research, identifies several indicators of climate change on a global scale:

- Global average temperatures have risen by nearly 0.8 °C since the late 19th century;
- Global temperatures have risen fastest in the past 25 years, by about 0.5 °C;
- 11 of the warmest 12 years ever recorded occurred since 1994;
- Reduction in the extent of sea-ice could result in the Arctic being ice-free in summer by 2013;
- Glaciers are retreating on all continents;
- Sea level has risen by 3.1mm per year since 1993 due to thermal expansion of water and ice melt;
- The frequency of extreme rainfall events has increased, and
- Tropical droughts have become, on average, longer and more intense.

In Northern Ireland climate data recorded at Armagh Observatory since 1841 demonstrates some of these indicators (NIEA, 2010):

- Mean annual temperature in Northern Ireland has been increasing steadily since the early 1980s;

- The number of extremely hot days (over 18°C) per year has increased since 1980 while the number of extremely cold (below 0°C) days has declined. and
- The number of days with snow has declined dramatically since 1980.

Within Northern Ireland and Ireland the following impacts of climate change have been predicted (EPA, 2010):

- The sea-level is projected to rise by between 18cm and 59cm this century;
- There will be more intense storms and rainfall events;
- There will be an increased likelihood and magnitude of river and coastal flooding; increased storm surges;
- There will be water shortages in summer in the east of Ireland, and a need for the irrigation of crops;
- There will be negative impacts on water quality;
- Changes in the distribution of species will occur, and it is possible we will see the extinction of vulnerable species requiring cooler conditions, e.g. the Arctic char;
- There will be effects on fish species that are sensitive to small changes in temperature, e.g. cod, and
- There will be an increased frequency of wild fires and pest infestation.

The NIEA identify two actions to deal with climate change, being mitigation and adaptation. Mitigation aims to cut down human activities which produce greenhouse gases while adaptation aims to prepare the environment for the potential changes in climatic conditions through ensuring that habitats are in the best condition possible.

19.3 POTENTIAL IMPACTS

The main potential impacts of climate change on the proposed Ulster Canal – Upper Lough Erne to Clones will be those associated with the variability of water supply. The potential for greater frequencies of floods and droughts could impact the ability of the canal to operate at favourable conditions, which would then have the potential to endanger the established habitats and species. The canal has however been designed to operate within a range of water levels, which take into account long term high and low flow conditions. These flow conditions and the increased potential for flood risk in the future due to climate change is assessed in **section 17**. As the canal is separate from the natural surface water and groundwater flows the impacts of greater climatic variability are more likely to impact the river navigation to the canal, which may be subject to being in flood or being in low flow for greater frequencies, which would mean the canal is inaccessible from Upper Lough Erne for a greater proportion of the year.

Climate change in Ireland may give rise to favourable conditions for certain invasive species which will enable them to spread more quickly, colonise more effectively and thus dominate over native species.

However as this will be a managed navigation the increased risk of invasive species spread can be lessened or even prevented through effective environmental management. The proposed management of invasive species is given in the Environmental Management Plan for the Ulster Canal – Upper Lough Erne to Clones in **Appendix A**

The development of the canal should not significantly contribute to increasing the rate of climate change and should in fact be creating a sink for greenhouse gas (GHG) emissions with the planting of new vegetation. Power for the pumping system and marina facilities will however most likely come from the national electricity grid and thus mainly from fossil fuels (currently). The development of the canal will encourage the creation of new wetland habitats, which will be managed to ensure there is no stagnation and thus emission of GHGs.

19.4 MITIGATION MEASURES

The construction and operation of the canal will have a carbon footprint size that is dependant on the choices made by Waterways Ireland. To reduce the construction carbon footprint (and usually costs also) all construction materials should be sourced from as near to the canal as possible, reducing the burning of fossil fuels in material transport. Also, all construction and operational staff should ideally also come from the vicinity, which will once again reduce fossil fuel burning in the transport of personnel.

Power for the water abstraction pumps and for marina facilities is currently proposed to come from the national electricity grid and thus mainly from the burning of fossil fuels. Waterways Ireland could investigate the potential for purchasing only renewable energy from the grid via schemes such as Power NI Eco Energy or to even generate their own renewable energy via a small wind turbine close to the canal or from a small hydro plant at their discharge point.

19.5 CONCLUSIONS

With climate change expected to increase the frequency of flood and drought conditions there is the danger that the Ulster Canal – Upper Lough Erne to Clones may become temporarily inaccessible to navigation traffic and that habitats within the canal may be temporarily put under water stress. However the navigation has been designed to work within a range of water level conditions based on long term water flow and level data. Operation of the navigation should have no impact on influencing climate change in the future. Any contribution of the navigation to greenhouse gas and carbon emissions can be minimised by utilising renewable energy for abstraction and facility power supply, and by sourcing construction materials and staff from the local vicinity rather than from far afield.

20 MATERIAL ASSETS

20.1 INTRODUCTION

This section of the EIS describes the material assets in the existing environment surrounding the area of proposed restoration works. The aim of this assessment is to determine the impact on the material assets from the proposed restoration works to the Ulster Canal, or whether these material assets will impact the development.

20.2 METHODOLOGY

A desktop based assessment of material assets considered relevant to the proposed works was undertaken. The material assets which have been identified as being within and adjacent to the area and which may be affected by the proposed restoration works are addressed below in terms of the receiving environment, associated impacts and proposed mitigation measures.

The impacts are assessed in terms of their magnitude, duration and resulting significance. The principal impacts which require consideration are loss and disturbance to material assets due to the restoration activities. Once restored, there are unlikely to be any further impacts on material assets in the area.

20.3 EXISTING ENVIRONMENT

The section of the Ulster Canal to be restored under this proposal is approximately 14km long and runs from Upper Lough Erne to Clones. The route involves utilizing some 8.5km of the original canal route, with 5.5km of extended navigation in Upper Lough Erne. This would open a new route through Derrykerrib Bridge, along the River Finn to Gortnacarrow under the A3 road and into the original Ulster Canal route. Significant sections of the original canal still exist and the new canal will largely follow its channel but where the original canal has been infilled or built upon, the canal will be formed through green field sites.

For the purposes of this assessment, potential impacts on the following aspects were considered:

- Agricultural Properties;
- Transport Infrastructure;
- Land-use and Development potential;
- Major utilities (electricity supply and water supply); and
- Waste management.

20.3.1 Agriculture Properties

The majority of agricultural lands in and around the restoration area are primarily used for grazing and drystock farming. Beef production accounts for approximately 60% of farming use in the area, followed by approximately 24% for dairy production and 9% for mixed grazing livestock.

20.3.1.1 Potential Impacts

The potential effects of the proposed restoration works on agriculture are primarily related to the type of farming practiced in the area and the intensity that the enterprise is farmed. The proposed restoration works that may affect different farm enterprises are as follows:

- Grassland - Most of the agricultural land is used as grassland for grazing and silage. The works will include excavation of the in-filled land following the historical route of the Ulster Canal. The main impact of this is likely to be permanent land take and permanent loss of areas for grazing or grass harvesting;
- Drystock – Drystock farming (beef, dairy and sheep) is the most common farm enterprise in the vicinity of the proposed restoration works. The main impacts will be associated with the construction activities. These have the potential to cause temporary stress to grazing animals remaining in the area during the construction phase. It is also likely that temporary access disturbance in the immediate vicinity of the restoration works will occur.

20.3.2 Transport Infrastructure

The main road in the area of the proposed canal restoration is the Cavan Road (A3/N54), which runs parallel to the canal for the majority of the distance between Clones and Upper Lough Erne. Other roads in the area that may impact on or be impacted by construction and operation of the canal would be the Wattlebridge Road (B533) at Gortnacarrow, the Drumully Road, the Drumcrin Road, the Clonfad Road and McCurtain Street (R212).

20.3.2.1 Potential Impacts

The construction phase of this project is expected to last for approximately 36 months. This will represent appreciable but short term negative impact on the existing road infrastructure in the area. A detailed review of the expected increase in traffic during the construction phase of the works is provided in **section 16**, however it is expected that the local road network will accommodate the expected increase in traffic.

There is the potential for an increase in dust, noise and vibration impacts to the area during the construction works period however control measures, as detailed in **section 8 Air Quality** and **section 13 Noise & Vibration**, will be put in place.

Derrykerrib and Wattle Bridge are to be by-passed by short a canal by-pass channel which will necessitate minimal works to the existing structures. Significant parts of this work can be undertaken without closing the road ensuring minimal disruption to local travel.

20.4 LAND-USE AND DEVELOPMENT POTENTIAL

There are just over 1,300 properties within 1km of the old canal route and potential canal routings between Upper Lough Erne and Clones. The majority of these properties are located within Clones Town.

20.4.1 Potential Impact

As this is a linear development, the potential impact will vary at different locations during the construction phase. There may be a potential short term impact on property during the construction phase of the proposed restoration works however in the context of the rural location of much of the works this is not likely to be significant.

It is anticipated that the restoration of the Ulster canal will enhance the aesthetic qualities of the area and have a positive impact on land-use and development potential within the area.

20.5 MAJOR UTILITIES (ELECTRICITY SUPPLY, WATER SUPPLY)

20.5.1 Electrical Supply – Potential Impact

The main site compound will be located in Clones, Co. Monaghan. All power supplies will be by connection to the local electricity system.

The double lock, moorings and pumps at Gortnacarrow will be connected to the local electricity supply system

The construction works along the canal will be self contained with respect to power. Power will be provided as follows:

- Electrical requirements for construction will be provided by diesel generators;
- All construction plant and machinery will be powered by diesel engines.

During operation, electrical power will be required on a permanent basis for lighting, water pumps and hydraulic power for the locks. This will be provided through a connection to the local electricity grid.

20.5.2 Water Supply – Potential Impact

Water will be required for certain activities such as cleaning plant and machinery and welfare facilities throughout the construction phase. All water supplies for the main compound in Clones, Co. Monaghan will be sourced from the mains water supply.

Water will be imported from the main site compound for use along the canal route.

Water from a mains supply will be required for the permanent toilet facilities at both Clones marina and Gortnacarrow.

It is proposed that water to supply and operate the canal will be pumped from The River Finn/Lough Erne at Gortnacarrow and returned to The River Finn/Lough Erne via gravity as the canal is operated.

20.6 WASTE MANAGEMENT

A waste management section has been prepared and forms part of the Environmental Impact Assessment (EIA) for the Ulster Canal (Upper Lough Erne to Clones) Restoration. This is summarised below:

The proposed restoration of the canal will result in the production of construction based wastes, including:

- Green wastes from clearing of the canal area;
- Concrete;
- Block work;
- Tiles, ceramics;
- Plasterboard and gypsum wastes;
- Steelwork;
- Other metals;
- Asphalt, Tar and Tar products;
- Timber; and
- Sediment arising from dredging activities.

It is proposed that a Construction and Demolition Waste Management Plan (C&D WMP) will be prepared prior to construction on site. This C&D WMP will ensure that waste production on site is minimised and waste produced is re-used where possible. If waste cannot be minimised or re-used on site then this waste will be recycled where possible or disposed of in a legislative compliant manner.

A site specific Operational Waste Management Plan (OWMP) for the operational phase of the proposed development will be prepared to ensure effective waste management and recycling of waste generated during the day to day running of the site. The OWMP will be prepared taking into account

the objectives of both the SWaMP and North East Waste Management Plan and issues raised by key stakeholders.

20.7 MITIGATION MEASURES

20.7.1 Agriculture

The following measures are proposed to mitigate against the potential impacts identified in **section 20.3.1**.

- All agricultural lands will be re-instated to pre-construction conditions subject to the agreement of landowners;
- Permanent landtake and temporary loss of areas for grazing will be dealt with by compensation;
- Where necessary, suitable stock proof temporary fencing will be erected for the duration of the construction phase, which will include re-instatement;
- Where any fences or walls are damaged they will be made stock proof immediately where necessary. Any necessary permanent restoration of fences, walls, drains or land will be completed as soon as practicable after work has concluded;
- Damaged hedges will be protected and restored at the appropriate season.
- All drainage likely to be affected or disturbed during the construction phase will be identified and reinstated as quickly as possible;
- Where required, machines will undergo appropriate biosecurity protocols prior to arrival on site; and
- Discussions will take place with landowners who are concerned that noise levels, dust or traffic interference from the construction phase is causing a disturbance to their stock and as a consequence mitigation measures will be implemented where considered necessary. Mitigation measures regarding traffic, air and noise are outlined in **sections 16, 8 and 13**.

20.7.2 Transport infrastructure

Mitigation measures for the construction phase of the project regarding traffic are outlined in **section 16**. These will include a Traffic Management Plan to be agreed with Roads Service and the appropriate local authority which will give consideration to the following:

- Vehicle movements associated with the proposed restoration works will be minimised where possible through efficient scheduling of construction materials and works; and
- Deliveries can be phased so as not to coincide with peak traffic movements.

No mitigation measures are considered necessary for the operational phase of the restoration works.

20.7.3 Land-use and Development potential

It is considered that the development potential of lands along the proposed restoration route is very limited in its current unchanged state.

It is also considered likely that the canal restoration works will improve the environmental character of the area and this is likely to have a positive impact on property values along the route.

The principal economic impact of the restoration will be to boost tourist and leisure opportunities along the canals' corridor and bring forward development on sites adjacent to the canal, by making sites more attractive to developers. Restoration is expected to bring significant economic and social benefits to the town of Clones, the rural villages within the vicinity of the canal, as well as to the wider sub-region. The restored canal will attract visitors to the area to participate in outdoor recreation (including walking, cycling, angling, canoeing and boating) which will be complemented by information on the historic and cultural aspects of the canal. The increased visitor numbers are anticipated to act as a catalyst for enabling the establishment of new tourism and leisure businesses in the area and creating new jobs in the tourism sector.

20.7.4 Major Utilities

The following mitigation measures will be implemented to prevent or minimise impact on utility supplies:

- All utilities will be identified prior to restoration works. Liaison with the relevant authority and utility company will be carried out to establish the exact location of all utilities along the canal route;
- In the event that any utilities will be disrupted, advance notice will be given and approval for the works to proceed will be received from the relevant authority or utility company in advance of construction;
- Diesel generators will provide power in remote locations along the canal route. Diesel fuel will be managed carefully to ensure that the risk of spillage is minimised. A Spillage Response Plan will be included as part of a site-specific environmental management plan;
- The use of water during the construction phase will be controlled and minimised where possible;
- Water will be tankered in from the main site compound for use in remote locations along the canal route.

No mitigation measures are considered necessary with respect to water use for the operational phase of the canal. The water supply for the canal as detailed in the Water section of the EIA will be abstracted from the River Finn at Gortnacarrow and pumped into the canal by pumps which will be housed in a pumping well at Gortnacarrow. A through flow is incorporated into the design and this will

discharge into the River Finn at the Scotshouse Road. All water with the exception of evaporation will return to the River Finn catchment.

20.8 SUMMARY OF IMPACTS AND MITIGATION MEASURES

The proposed restoration works will require the removal of vegetation to restore the canal. The main impact of this is likely to be permanent land take. This will be compensated by new planting and natural habitat creation. As these plantings mature, the impact of the overall works will have a beneficial impact on the local landscape character and visual quality of the existing canals corridor.

During construction, it is likely that temporary stress will be caused to grazing animals however noise mitigation measures will be implemented where considered necessary.

During construction, minor short term impacts are expected on the existing road infrastructure. It is anticipated however that significant parts of the restoration works can be undertaken without closing the road network. It is expected that the local road network will accommodate the expected increase in traffic.

It is anticipated that the restoration of the Ulster Canal will have a positive impact on the land use and development potential for the area. The Ulster Canal Restoration offers opportunities for regeneration and leisure-related facilities for the entire region.

The potential impacts on major utilities are not anticipated to be significant. Water supply for the canal will be pumped from River Finn / Upper Lough Erne and returned to River Finn / Upper Lough Erne via gravity as the canal is operated.

A construction and demolition waste management plan will be prepared prior to construction work at the site. A site specific operational waste management plan will be prepared to ensure effective waste management during the day to day running of the canal.

