

3.5 WATER

This section of the Constraints Study describes the existing hydrological environment of the Study Area and the immediate surrounding area, in addition to the potential impacts arising as a result of the River Deel (Crossmolina) Flood Relief Scheme.

3.5.1 Methodology

The establishment of potential hydrological constraints within the Study Area involved a review of desktop information, including:

- EPA water quality database and maps
- Well card data compiled by the Geological Survey of Ireland (GSI)
- National Water Study, County Mayo (2000)
- OPW Database of Hydrometric Stations
- Western River Basin District Management Plan (2009 – 2015)

The desktop study was supplemented by a site visit to the Study Area on 24th October 2012, in order to further establish the overall hydrological regime within the Study Area.

3.5.2 Receiving Environment

3.5.2.1 Water Supply

3.5.2.1.1 Existing River Abstractions

There is no record of surface water abstraction from the River Deel for human consumption. There is a public water supply scheme in operation in Crossmolina town, along with a number of Group Water Schemes in operation in and in the vicinity of the Study Area. The public supply to Crossmolina town is fed by a combination of the Ballina Regional Water Supply Scheme and a local groundwater source described in the section below. The Ballina Regional Water Supply Scheme is supplied by Lough Conn from an intake works at Wherrew, located downstream of Crossmolina on the north eastern shore of the lake.

Part of the public water supply scheme and the Group Water Schemes are fed by groundwater sources as described below.

3.5.2.1.2 Existing Groundwater Abstractions

Well card data produced by the Geological Survey of Ireland (GSI) indicates that there are four wells in the vicinity of the Study Area which are used for potable water supply and agricultural purposes.

There are three groundwater abstractions for potable use within the study area, including an abstraction for the Tobermore Group Water Scheme, the Carrowkeel Group Water

Scheme and the Crossmolina Public Water Supply Scheme. The locations of these wells are shown in Appendix D.

A groundwater abstraction for the Crossmolina Public Water Supply is located in the townland of Tobermore and provides 910m³/day from a small pump house at the well. It is noted that Crossmolina town was connected to the Ballina Regional Water Supply Scheme in 2007 as described above, however this groundwater source remains the predominant supply for the town at the time of this report.

There is an additional groundwater abstraction point within the Study Area located in the townland of Knockbaun which is used for agricultural and domestic purposes.

3.5.2.1.3 Hydrometric Stations

There is a gauging station located on the River Deel located at Ballycarroon upstream of Crossmolina town. OPW is responsible for the management of this automatic recorder. Information from this gauging station was also utilised by the OPW in the study of the recurring flooding in Crossmolina.

3.5.2.1.4 Surface Water Features

The main hydrological feature within the Study Area is the River Deel, which flows into the Study Area from the south-west. The river flows south-westwards through the town of Crossmolina before veering to the north and then arcing southwards to where it enters Lough Conn in the townland of Wherrew (Grid reference: E117,010 N317,060).

In addition, there are three main tributaries that flow into the Deel River within the Study Area; the Tooreen and Rathnamagh Rivers and the Rappa Stream.

The EPA website <http://www.epa.ie/rivermap/data>, contains information regarding water quality in selected Irish rivers based on surveys carried out by the EPA. Information was gained from EPA monitoring stations on the Deel River within and upstream and downstream of the study area. No EPA monitoring data was available for the Tooreen and Rathnamagh Rivers. One monitoring station is located on the Rappa Stream and monitoring data from this station is included in this Section. Biological information is provided in the form of Q values. Q Values are used to express biological water quality and are based on changes in the macro invertebrate communities of riffle areas brought about by organic pollution. Q1 indicates a seriously polluted water body and Q5 indicates unpolluted water of high quality. A value of Q3 indicates moderately polluted water. These Q value ratings are shown in Table 3.5.1.

Quality Ratings	Quality Class	Pollution Status	Condition (re beneficial uses)
Q5, Q4-5, Q4	Class A	Unpolluted	Satisfactory
Q3-4	Class B	Slightly Polluted	Unsatisfactory
Q3, Q2-3	Class C	Moderately Polluted	Unsatisfactory
Q2, Q1-2, Q1	Class D	Seriously Polluted	Unsatisfactory

Table 3.5.1 Q value classification

In addition, various chemical parameters were also tested and are available for some of the monitoring points. Biological and chemical data for a number of the monitoring points within the study area are shown in Tables 3.5.2 and 3.5.3 below.

Information was gained on the River Deel as a whole, including seven monitoring points that are within the Study Area (highlighted in blue in Tables 3.5.3 and 3.5.4 overleaf) and three that were located upstream (Bridge at Keenagh, Deel Bridge and the Ford S.W. of Knockbrack).

		Biological Quality Ratings (Q Values)												
	Station Nos.	1971	1973	1977	1980	1984	1989	1993	1995	1998	2001	2005	2007	2010
Bridge at Keenagh	0006	-	-	-	-	-	5	4-5	4-5	4	4	4	4	4
Deel Bridge	0010	-	-	-	5	5	4-5	4-5	4	4	4	4	4	4
Ford S.W. of Knockbrack	0025	-	-	-	4-5	4-5	4-5	4	4	3-4	4	4	4	4
Ford at Ballymulty	0050	-	-	-	-	5	-	-	-	-	-	-	-	-
Ford E. of Ballycarroon House	0100	5	-	-	5	5	4-5	4-5	4	4-5	5	4-5	4-5	4-5
Crossmolina Bridge	0120	-	-	-	-	-	-	-	-	-	-	4	4-5	4
S.E. of Crossmolina	0150	-	-	-	4	-	4	4	-	-	-	-	-	-
800m d/s Crossmolina Bridge	0200	-	-	-	-	-	4-5	4-5	-	4	-	4-5	-	-
1.3km d/s Crossmolina Bridge	0250	-	-	-	-	-	-	-	3	-	4	4	-	-
Knockadangan Bridge	0300	5	5	4-5	3-4	3-4	4	5	3-4	4	4-5	4	4	4
Bridge at Deelcastle	0400	-	-	-	-	4	4-5	4-5	4	4-5	4-5	4-5	-	4-5

Table 3.5.2 Biological water quality in the Deel River Study Area based on EPA data

Chemical Data				
Parameter	Unit	Station No. 0010 Deel Br		
		Minimum	Mean	Maximum
Alkalinity-total	mg/l CaCO ₃	4.0	27.4	101.0
Chloride	mg/l Cl	11.0	20.3	28.0
Conductivity @25°C	µS/cm	51.0	132.7	291.0
pH		6.0	7.2	8.0
Temperature	°C	4.3	9.5	14.9
Total Hardness	mg/l CaCO ₃	15.0	44.5	119.0
True Colour	Hazen	56.0	117.1	245.0
Nitrite	mg/l N	0.003	0.003	0.003
ortho-Phosphate	mg/l P	0.006	0.018	0.034
Total Oxidised Nitrogen	mg/l N	0.200	0.200	0.200
Ammonia-Total	mg/l N	0.015	0.022	0.050
BOD - 5 days (Total)	mg/l O ₂	0.5	0.8	1.6
Dissolved Oxygen	% Saturation	87.0	96.0	105.0
Parameter	Unit	Station No. 0100 – Ford E. of Ballycarroon House		
		Minimum	Mean	Maximum
Alkalinity-total	mg/l CaCO ₃	11.0	56.4	131.0
Chloride	mg/l Cl	14.0	21.6	30.0
Conductivity @25°C	µS/cm	95.0	190.4	340.0
pH		6.7	7.5	8.2
Temperature	°C	4.4	9.7	14.8
Total Hardness	mg/l CaCO ₃	15.0	73.9	158.0
True Colour	Hazen	57.0	119.1	278.0
Nitrite	mg/l N	0.003	0.003	0.003
ortho-Phosphate	mg/l P	0.006	0.018	0.026
Total Oxidised Nitrogen	mg/l N	0.200	0.213	0.400
Ammonia-Total	mg/l N	0.015	0.017	0.040
BOD - 5 days (Total)	mg/l O ₂	0.5	0.7	1.8
Dissolved Oxygen	% Saturation	94.0	98.5	106.0
Parameter	Unit	Station No. 0300 – Knockadangan Bridge		
		Minimum	Mean	Maximum
Alkalinity-total	mg/l CaCO ₃	20.0	137.4	292.0
Chloride	mg/l Cl	13.0	24.2	34.0
Conductivity @25°C	µS/cm	133.0	351.3	656.0
pH		6.7	7.7	8.2
Temperature	°C	3.0	11.1	17.7
Total Hardness	mg/l CaCO ₃	43.0	159.9	340.0
True Colour	Hazen	27.0	114.6	281.0

Nitrite	mg/l N	0.003	0.003	0.008
ortho-Phosphate	mg/l P	0.005	0.023	0.052
Total Oxidised Nitrogen	mg/l N	0.050	0.487	1.400
Total Phosphorus	mg/l P	0.010	0.033	0.095
Ammonia-Total	mg/l N	0.003	0.018	0.076
BOD - 5 days (Total)	mg/l O ₂	0.5	0.9	2.8
Dissolved Oxygen	% Saturation	63.0	95.1	120.0
Suspended Solids	mg/l	1.0	5.8	20.0

Table 3.5.3 Chemical water quality in the Deel River Study Area based on EPA data

Table 3.5.4 below shows the surface water quality standards applied across a range of relevant legislation.

Parameter	Units	European Communities (Quality Of Surface Water Intended For The Abstraction Of Drinking Water) Regulations, 1989 (S.I. No. 294/1989)*	European Communities Environmental Objectives (Surface Water) Regulations (S.I. No. 272 of 2009)	European Communities Drinking Water Regulations S.I. 106 of 2007	Salmonid Water Regulations (Mandatory Level) (S.I. No. 293 of 1988)
BOD	mg/l	5 – A1 & A2 7 – A3	High status ≤ 1.3 (mean) or ≤ 2.2 (95%ile) Good status ≤ 1.5 (mean) or ≤ 2.6 (95%ile)	N/A	≤ 5
Suspended Solids	mg/l	50	N/A	N/A	≤ 25
pH	-	5.5-8.5 – A1 5.5-9.0 – A2 & A3	4.5-9.5 (Soft Water) 6.0-9.0 (Hard Water)	≥ 6.5 & ≤ 9.5	≥ 6 & ≤ 9
Conductivity	$\mu\text{S/cm}$	1,000	N/A	2,500	N/A
Phosphates	mg/l P ₂ O ₅	0.5 – A1 & A2 0.7 A3	N/A	N/A	N/A
Molybdate Reactive Phosphorus (MRP)	mg/l P	N/A	High status ≤ 0.025 (mean) or ≤ 0.045 (95%ile) Good status ≤ 0.035 (mean) or ≤ 0.075 (95%ile)	N/A	N/A
Chloride	mg/l Cl	250	N/A	250	N/A
Ammonium	mg/l NH ₄	0.2 – A1 1.5 – A2 4 – A3	N/A	N/A	≤ 1.0
Total Ammonia	mg/l N	N/A	High status ≤ 0.040 (mean) or ≤ 0.090 (95%ile) Good status ≤ 0.065 (mean) or ≤ 0.140 (95%ile)	N/A	N/A
Nitrate	mg/l NO ₃	50	N/A	50	N/A
Nitrite	mg/l NO ₂	N/A	N/A	0.5	≤ 0.05
Dissolved	-	>60% - A1	Lower limit: 95%ile>80%	N/A	50% ≥ 9 mg/l

Parameter	Units	European Communities (Quality Of Surface Water Intended For The Abstraction Of Drinking Water) Regulations, 1989 (S.I. No. 294/1989)*	European Communities Environmental Objectives (Surface Water) Regulations (S.I. No. 272 of 2009)	European Communities Drinking Water Regulations S.I. 106 of 2007	Salmonid Water Regulations (Mandatory Level) (S.I. No. 293 of 1988)
Oxygen		>50% - A2 >30% - A3	saturation Upper limit: 95%ile<120 %saturation		
Total Hardness	mg/l CaCO ₃	N/A	N/A	N/A	N/A
Copper	mg/l Cu	0.05 –A1 0.1 – A2 1.0 – A3	5 - water hardness ≤100mg/l CaCO ₃ 30 - water hardness >100mg/l CaCO ₃	2.0	≤ 0.005 [1, 6] ≤ 0.022 [2, 6] ≤ 0.04 [3, 6] ≤ 0.112 [4, 6]
Zinc	mg/l Zn	3–A1 5- A2 & A3	0.008 - water hardness ≤10mg/l CaCO ₃ 0.05 - water hardness>10 ≤100mg/l CaCO ₃ 0.1- water hardness >100mg/l CaCO ₃	N/A	≤ 0.03 [1, 6] ≤ 0.2 [2, 6] ≤ 0.3 [3, 6] ≤ 0.5 [5, 6]
Total coliforms	no/100ml	5,000 – A1 25,000 – A2 100,000 – A3	N/A	N/A	N/A
Faecal coliforms	no/100ml	1,000 – A1 5,000 – A2 40,000 – A3	N/A	0	N/A

Table 3.5.4 Mandatory levels for physiochemical parameters for specific legislation

[1] At water hardness 10 mg/l CaCO₃; [2] At water hardness 50 mg/l CaCO₃; [3] At water hardness 100 mg/l CaCO₃; [4] At water hardness 300 mg/l CaCO₃; [5] At water hardness 500 mg/l CaCO₃; [6] To be conformed with by 95% of samples over a period of 12 months where sampling is carried out at least once a month; where sampling is less frequent, to be conformed with by all samples.

*S.I. No. 294/1989 is superseded by S.I. No. 272 of 2009. If a particular parameter is not found in SI 272 of 2009 then the 1989 value applies.

Water Framework Directive

The Study Area is located within the Water Framework Directive (WFD) Western River Basin District and the management plan for this area was consulted. The main objectives of this management plan were to prevent deterioration, restore good status, reduce chemical pollution in surface waters and to achieve water-related protected areas objectives. The programme of measures designed to achieve these objectives are outlined in this document and include the following:

- Control of urban waste water discharges
- Control of unsewered waste water discharges
- Control of agricultural sources of pollution
- Water pricing policy

- Sub-basin management plans and programmes of measures for the purpose of achieving environmental water quality objectives for Natura 2000 sites designated for the protection of Freshwater Pearl Mussel populations
- Pollution reduction programmes for the purpose of achieving water quality standards for designated shellfish waters
- Control of environmental impacts from forestry

Information on status, objectives and measures in the Western RBD has been compiled for smaller, more manageable geographical areas than river basin districts, termed water management unit action plans. There are 16 water management units (WMUs) in the Western RBD. These units represent smaller river and lake basins where management of the pressures, investigations and measures will be focussed and refined during implementation of this plan. In addition, action plans focusing on groundwater and a transitional and coastal water management have been prepared for the Western RBD. WMU action plans are key background documents to the plan.

The Study Area is within the Conn Water Management Unit (WMU). There are 104 river water bodies in this WMU –24% High, 58% Good, 13% Moderate and 5% Poor Status. In addition, there are 13 lake water bodies within this WMU – 46% High, 8% Good and 46% Moderate Status. The status of the various water bodies in this area is calculated using the EPA data described above.

The status of the Deel is described in the Conn WMU as follows:

'The upper reaches of the Deel river network are at Good status, with some tributaries such as the Glasheens river and the Shanvolahan river at Moderate status. The middle part of the Deel is at High status, with the inflowing Owenbeg river at Good status also. Entering and exiting the village of Crossmolina, the Deel river is at Moderate status, with tributaries such as the Tooreen and Rathnamagh river entering downstream of the village at Good status. One of the tributaries, the Rappa stream has Poor status. The section of the Deel entering Lough Conn is classed as Moderate status.'

The identified pressures/risks in this WMU include the following:

- Nutrient Sources: Over 80% of Total Phosphorus load within the WMU is from diffuse sources, with agriculture accounting for over 70% of TP and forestry accounting for 10% of TP.
- Point Pressures: There are 10 Waste-water Treatment Plants (WwTPs), 12 Section 4 licenced facilities, 2 Section 16 licenced facilities 4 IPCC licenced facilities and

two Water Treatment Plants (WTPs) within the WMU, as well as numerous Group Water Scheme (GWS) abstractions.

- Wastewater Treatment Plants and Industrial Discharges: Crossmolina WWTP is within the Study Area. Risks connected to this WWTP relate to insufficient BOD and nutrient assimilative capacity and historical deterioration in downstream Q value within 3km of outfall.
- Quarries: There are 8 quarries within the WMU.
- Agriculture: 21 water bodies have been determined to be at risk from agriculture within the WMU.
- On-site Water Treatment Systems: There are 9,363 OSWTS within the WMU Boundary, 8,685 OSWTS lie within 104 river water bodies. Within the river water bodies 1,147 OSWTS constitute a potential risk to waters because of where they are sited and constitute a risk to 7 water bodies
- Forestry: There are 9 water bodies within the WMU that have been determined to be at risk from forestry
- Morphology: There are 22 water bodies that have been determined to be at risk from morphology within the WMU
- Abstractions: One water body has been determined to be at risk from abstractions within the WMU : IE_WE_34_2843 (Derryhick Lough)

In a scoping response dated the 3rd October 2012, the Western River Basin District (WRBD) office provided the following information and comments concerning the status of the waterbodies within the Study Area:

- The ecological status of Lough Conn has improved from moderate (interim status) to good (updated status) in the last five years. This status must be maintained.
- As the lake is designated as an SPA and is part of the River Moy cSAC, an Appropriate Assessment screening report will be necessary to determine if significant adverse impacts may occur. If a disturbance is likely both mitigation measures and possible alternatives must be proposed.
- The River Deel is designated as part of the River Moy SAC and therefore the protection of the annexed species and habitats for which it is selected must be prioritised.

- Issues such as siltation of salmonid spawning grounds and pearl mussel beds, as well as disturbance during peak salmonid migration and spawning periods must be taken into account.
- It is essential that any flood relief scheme takes into account the current ecological water body status and the overall conservation restore date for the waterbody.
- High and good status waterbodies need to be protected and their status retained
- The status of the poor and moderate water bodies cannot decrease and any flood relief scheme needs to include proposals to maintain or improve their ecological status.
- It is recommended that each waterbody in the Study Area should be independently assessed to confirm its current ecological status.

The full text of this scoping response is included in Appendix A to this report.

3.5.2.2 Hydrogeology

The Geological Survey of Ireland (GSI) online database shows the Study Area as being underlain by Regionally Important bedrock aquifers along with a locally important sand/gravel aquifer which occupies the majority of the South Eastern portion of the Study Area. An extract from the GSI Online Database is included in Appendix D showing the location of aquifers in the Study Area.

The GSI online database has a record of one karst feature within the Study Area, namely a spring located in the vicinity of the Tooreen River to the west of Crossmolina. No other karst features are recorded on the database within the Study Area, however, local anecdotal information suggests that there are several more karst features within the Study Area including swallow holes and caves in the vicinity of the River Deel at Ballycarron. These were not evident during a site visit on the 24 October 2012, however they may be evident at lower water levels.

The direction of groundwater flow is likely to be influenced by the topography of the surrounding area. Groundwater within the Study Area is likely to be hydraulically connected to the River Deel and its tributaries.

3.5.3 Summary of Key Constraints and Implication for the Proposed Scheme

- The design of the proposed River Deel (Crossmolina) Flood Relief Scheme should take into account the impacts (both Quality and Quantity) that any proposed flood relief scheme might have on the yields of existing groundwater abstractions, taking into account the presence of productive gravel aquifer's within the Study Area.

- The design of the proposed flood relief scheme should take into account the main objectives of the Water Framework Directive River Basin District Management Plan (RBDMP) by ensuring that any works proposed do not result in the deterioration of water quality and where possible contribute to the achievement of “good” status within the Study Area.

3.6 SOILS AND GEOLOGY

This section describes the soils and geology underlying the Study Area for the River Deel (Crossmolina) Flood Relief Scheme.

3.6.1 Methodology

The section describes the bedrock geology, superficial deposits, economic geology and geological heritage of the Constraints Study Area identified from desktop information sources only. An inventory of the geological constraints identified by this desktop study is detailed below.

Soils and Geology constraints have been assessed with reference to the following:

- The Geological Survey of Ireland (GSI) online database
- Mayo County Council Planning Department (Application for Registration of Quarries under Section 261, Planning and Development Act 2000),
- Mayo County Development Plan (2008 - 2014)
- Concrete Products Directory (Irish Concrete Federation)
- Aerial Photographs
- ENVision Mines Site, the EPA's online Historic Mines Inventory

3.6.2 Receiving Environment

3.6.2.1 Bedrock Geology

The River Deel rises in the Nephin Beg mountain range at the foot of Birreencorragh Mountain. It flows northward through the valley between the Bullaunmore and Birreencorragh mountains and continues in this direction until turning eastward where it intersects the R312. The river continues eastwards until it enters the Study Area at Ballycarroon and gradually turns northward to flow through Crossmolina town. Downstream of Crossmolina, the River Deel loops around to the East and South to discharge into Lough Conn just north of Wherrew. Its total length is approximately 36km.

The Geological Survey of Ireland (GSI) Online Database indicates that the Study Area is underlain by Limestone with calcareous shale and contains Marine Shelf facies which indicate oceanic influence during the bedrock formation.

The GSI Online Database shows variable subsoil within the Study Area. A significant deposit of Glaciofluvial Sands and Gravels with small pockets of Peat and Till derived chiefly from Limestone extends in a South Westerly direction from Crossmolina town. The portion of the Study Area to the North East of Crossmolina town is dominated by Till derived from Limestone, with large pockets of Peat and Alluvium in the vicinity of the Deel and Tooreen Rivers. A very small amount of Alluvium is also present in the immediate vicinity of the River Deel near Ballycarroon. Pockets of Lake Deposits are recorded in the vicinity of Lough Conn while the subsoils underlying Crossmolina town are described as

Made Ground. Appendix E contains extracts from the GSI Online Database showing the geology in the Study Area.

3.6.2.2 Economic Geology

The term 'economic geology' refers to commercial activities involving soil and bedrock. The activities involved principally comprise aggregate extraction (sand and gravel pits and quarries) and mining. A number of sources were examined for information on such commercial activities within the Study Area, including the:

- Mayo County Development Plan (2008 - 2014)
- Concrete Products Directory (Irish Concrete Federation)
- Aerial Photographs
- ENVision Mines Site, the EPA's online Historic Mines Inventory

A review of the abovementioned sources has revealed that there is no mining activity in or in the vicinity of the Study Area.

3.6.2.3 Geological Heritage

To date, sites of geological interest have not been comprehensively covered by existing nature conservation designations. This is currently being addressed by the Department of Environment, Communications & Local Government and the Geological Survey of Ireland who are drawing up a list of sites of geological interest which will be proposed as Natural Heritage Areas in the future.

The Mayo County Development Plan (2008 - 2014) states '*In addition to sites designated under European and national legislation, there are also other areas in the County, which are of recognised conservation value, including a number of geological and geomorphological sites. Such areas are recognised as stepping stones and components of wider ecological corridors and networks, the maintenance of which are necessary to halt or reverse the negative effects of progressive or cumulative habitat fragmentation.*'

The Development Plan identifies 121 sites of geological and geomorphological interest in the county which could potentially become proposed Natural Heritage Areas (pNHAs). None of the 121 sites are located within the Study Area.

There is one pNHA within the Study Area, however it is considered separately in Section 3.4 of this Constraints Study Report.

3.6.3 Summary of Key Constraints and Implication for the Proposed Scheme

- It is recommended that a preliminary geotechnical investigation be carried out once the potentially viable flood risk management measures are developed in order to identify local geology and ground conditions.

3.7 ARCHAEOLOGY AND ARCHITECTURAL HERITAGE

This section describes the archaeological and heritage constraints within the Study Area of the River Deel (Crossmolina) Flood Relief Scheme.

3.7.1 Methodology

An Archaeological and Architectural Heritage Constraints Study was commissioned in order to identify all recorded archaeological monuments and protected structures within the Study Area including the legal status, if any, of these features.

This study is based on a detailed desk study of the archaeological, architectural and cultural heritage resource within the Study Area (published & non-published datasets). This information has provided an insight into the development of the Study Area over time and an evaluation of both recorded and potential cultural heritage sites.

The principal sources reviewed for the archaeological resource were the Sites and Monuments Record (SMR) and the Record of Monuments and Places (RMP). The Record of Protected Structures (RPS), as published by Mayo County Council and was reviewed in order to assess the architectural heritage. The following sources were also consulted:

- Various editions of Ordnance Survey maps;
- Excavations Database (www.excavations.ie);
- County Mayo Heritage Plan 2011-2016
- Mayo County Development Plan 2008-2014;
- National Inventory of Architectural Heritage;
- Aerial imagery; and
- Various published sources.

A full copy of the full Archaeological Constraints Report is included in Appendix F.

3.7.2 Receiving Environment

The tables presented in Appendix F provide lists of the various protected archaeological and architectural heritage sites within the Study Area. The key constraints that are protected by legislation comprise the recorded archaeological monuments (RMP Table 1.1; Appendix F) and protected structures (RPS Table 1.2; Appendix F). There may be some overlap between these two categories as built structures can be listed in both the RMP and RPS. In addition, a number of areas of cultural heritage potential identified through consultation of cartographical sources have also been included (Table 1.3; Appendix F). These are not protected structures or recorded archaeological monuments but may indicate the presence of potential unrecorded cultural heritage features.

It is recommended that, where possible, the scheme be designed to avoid any impacts on the 70 archaeological sites listed in Table 1.1 (Appendix F). Given the provisions of the National Monuments Acts, no disturbance or interference to any archaeological sites listed in the RMP can take place without first consulting the National Monuments Service. In the event that flood risk management measures, or increased potential for flooding, are required in the vicinity of any of recorded archaeological sites it is recommended that appropriate mitigation measures be designed in consultation with the National Monuments Service.

There is also the potential for the presence of unrecorded archaeological sites and artefacts within the Study Area. This is demonstrated by the recovery of a bronze axehead on the shores of the River Deel during 1960s arterial drainage works and the discovery of a number of previous archaeological sites during previous site investigation works in the Study Area. Any lands that may be impacted by ground disturbance works required by the proposed scheme (e.g. access tracks, compounds, site clearance works, trial-pits) may require archaeological investigations, such as test trenching or monitoring of works. The appropriate mitigation measures will be determined during the design phase in consultation with the National Monuments Service.

In the event that dredging, channel widening or embankment works along the river will be required as part of flood relief scheme, then there will be the potential for impacts on both recorded and unrecorded heritage features within the river channel, such as bridges, weirs, fords, wrecks, landing features, etc. If such works are to be considered as part of the design it is recommended that the Underwater Archaeological Unit, National Monuments Service be consulted in order to agree the appropriate underwater archaeological assessment and mitigation strategies. The riverine assessments required may consist of river bank and underwater archaeological surveys, test trenching around the bridges and other potential heritage sites along the river course and full monitoring of all sediment extraction works.

All Record of Protected Structures sites have statutory protection and avoidance of these features is recommended. In the event that works are required that may have a negative impact on protected structures then prior consultation with Mayo County Council will be required.

Should works be required in the vicinity of recorded archaeological monuments and protected structures then the formulation of site specific mitigation strategies is recommended. This will be carried out in consultation with the National Monuments Service and Mayo County Council. It is advised that this takes place well in advance of main construction works in order to allocate adequate time and resources to implement the agreed mitigation measures. Depending on the nature and extent of the works the mitigation measures may take the form of pre-works assessment (including test trenching) and/or monitoring of construction works carried out during the scheme.

It is also recommended that consideration should be given to the avoidance of visual impacts on protected archaeological and architectural heritage sites as part of the design of the proposed scheme.

3.7.3 Summary of Key Constraints and Implication for the Proposed Scheme

- Given the provisions of the National Monuments Acts, no disturbance to, or interference with, any known archaeological sites can take place without first consulting the National Monuments Service of the Department of Arts, Heritage and the Gaeltacht (DAHG).
- It is recommended that all impacts on identified archaeological and heritage sites, and their immediate vicinities, be avoided in the design of the proposed flood relief scheme.
- Should this not be possible then archaeological investigations are recommended for archaeological and heritage sites in the vicinity of, or those that would be directly impacted by the proposed scheme. It is recommended that this programme take place well in advance of construction works in order to allocate adequate time to evaluate and record any archaeological features that may be revealed.
- It is recommended that any ground disturbance works associated with the proposed scheme be assessed for archaeological monitoring. Appropriate mitigation should be determined during the design phase in consultation with the National Monuments Service (DAHG).
- It is recommended that the Underwater Archaeological Unit (DAHG) be consulted during the design of the proposed flood relief scheme in order to agree appropriate underwater archaeological assessment and mitigation strategies. Depending on the flood alleviation measures chosen, the riverine assessments required by the DAHG may consist of river bank and underwater archaeological survey pre-works, possible testing around the bridges and other sites along the river course, and full monitoring of all works.
- All Record of Protected Structures sites have statutory protection and avoidance of these features is recommended.
- The National Monuments Service of the Department of Arts, Heritage and the Gaeltacht should be consulted at all stages of the scheme development.

3.8 LANDSCAPE

This section of the Constraints Study Report addresses the landscape and visual constraints that have been identified within the Study Area. The Study Area is described with reference to Landscape Character and Landscape Type, and the ratings that have been assigned to it in terms of Sensitivity. The relevant recommendations that have been set out for this area by Mayo County Council in terms of landscape and visual characteristics are also addressed.

3.8.1 Methodology

This section of the Constraints Study is based on a desk study of the previous landscape character assessments and reviews that have been carried out within the Study Area. It incorporates a description of the policies and objectives of Mayo County Council with regards to Landscape Character Assessment, Scenic Amenity, Views and Prospects, and Scenic Routes, with specific reference to the Study Area location. The primary sources of information consulted during the course of the desk study include:

- Mayo County Development Plan 2008-2014
- Landscape Appraisal of County Mayo, 2008
- Environmental Protection Agency CORINE Land Cover Map

3.8.2 Receiving Environment

3.8.2.1 Landscape Character Units

It is mandatory objective of the current Mayo County Development Plan to preserve the character of the county's landscape. One of the County Development Plans Environment Development aims is to '*ensure that the resource that is Mayo's diversity and variety of landscapes is utilised prudently and sustainably and that new development is integrated sympathetically into the landscape in a manner that will ensure that the landscape can be handed on to future generations without being degraded*'.

The Landscape Appraisal of County Mayo, which forms part of the Mayo County Development Plan, identifies and describes the landscape character of the entire County.

The Landscape Appraisal of County Mayo, which was included as an Appendix to the County Development Plan 2008 – 2014 subdivides the county into 16 landscape character units, each of which contains an area of land that has similar elements such as slope, vegetation and land-use. The Study Area for this assessment is located entirely within Landscape Character Unit G: North Mayo Drumlins. Figure 3.8.1 shows a map of the landscape character units in Co. Mayo.

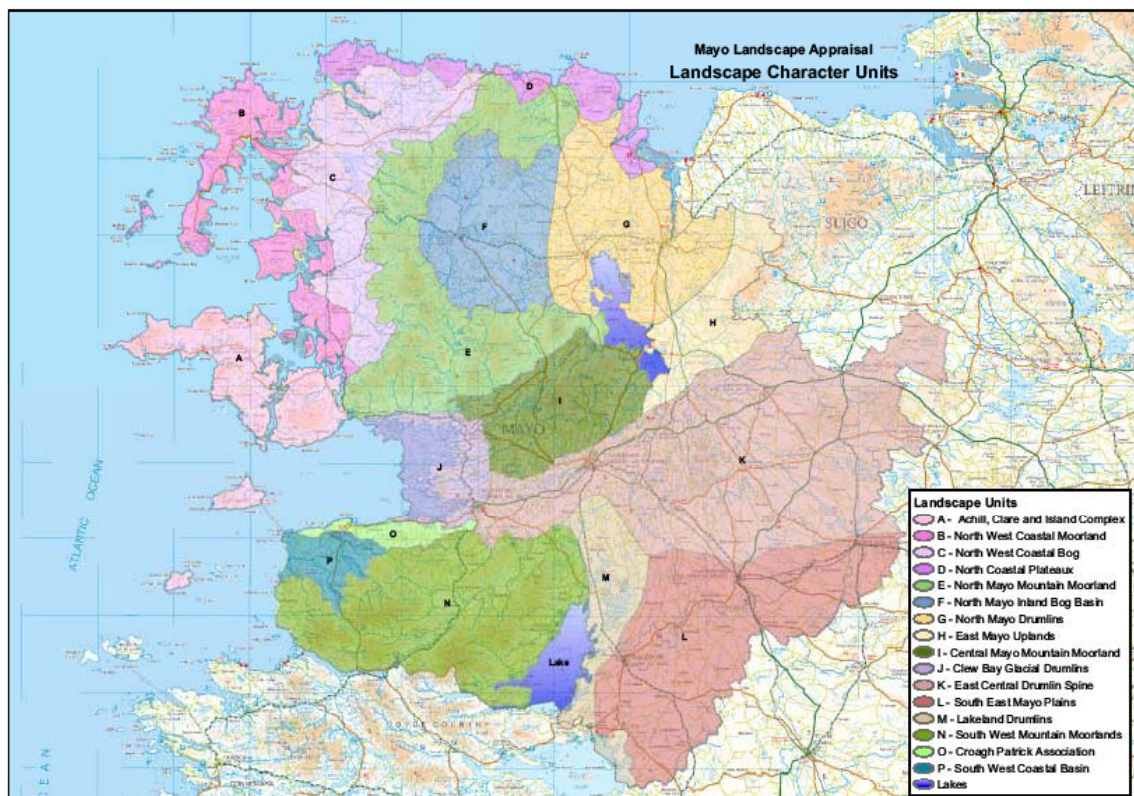


Figure 3.8.1 Landscape Character Units in Co. Mayo

The Landscape Appraisal Report describes this area as follows:

'This area of drumlin topography contains mild low lying lakeland drumlins at the southern end merging into similar coastal topography in the north east surrounding Killala Bay. More severe, steeper drumlins occur around the foothills of the mountains to the north-west and the Ox Mountains to the east. The flood plain of the River Moy is also incorporated within this area. The land cover is dominated by pasture with sporadic areas of moorland and patches of exposed rock in the rugged drumlins to the east. Hedgerows and small patches of scrub and woodland create a patchwork of farmer landscapes in this area.'

The boundary of this Landscape Character Unit is defined to the west by a combination of land cover, geology, soil type, and a progression to flat bog topography. The boundary to the north west, south west and east is marked by the change in slope and topography, while to the north the inland limits of directly draining coastal water sheds form the boundary.

Critical landscape factors, which define Landscape Character Unit G, are listed below:

- Mildly undulating topography represented by glacial drumlins,

- Shelter vegetation,
- Primary ridge lines (visible only against the sky from any prospect) and secondary ridgelines (visible at least from some prospects below a distant primary ridge line) located to the east as part of the Ox Mountains,
- Localised lake vistas of Lough Conn. Due to the low-lying nature of lakeland environments such as this, low prospect vistas are available from the roads of the Lough and its shores.

3.8.2.2 Land Uses

The Landscape Appraisal of County Mayo states that the main agricultural activity in this area (Landscape Character Unit G: North Mayo Drumlins) is livestock production and that the region is dominated by extensive areas of pasture with some pockets of bog. The significant urban settlement of Ballina is included as part of this Landscape Character Unit.

3.8.2.3 Policy Areas

As part of the Landscape Appraisal of the county, character units with similar visual landscape elements were also grouped into the following four Policy Areas:

- Policy Area 1: Montaine Coastal
- Policy Area 2: Lowland Coastal
- Policy Area 3: Uplands, moors, heath or bogs
- Policy Area 4: Drumlins and lowlands

Lakeland Sub-areas are also designated. According to the maps accompanying the Landscape Appraisal, the Study Area for this assessment is located within Policy Area 4A: a Lakeland Sub-area of Policy Area 4 (Drumlins and Inland Lowland), which is described in the Appraisal Report as:

‘This distinctive area of the County comprises the landscapes of policy areas 3 and 4, which bound Lough Mask. It bounds often steep slopes and prominent ridge lines with limited shelter vegetation to the west and undulating areas of pasture, woodland and forest with underlying glacial drumlins to the east.’

However the text describes Lakeland Sub-area 3A in relation to Lough Conn:

‘This distinctive area of the County comprises the landscapes of policy areas 3 and 4, which bound Lough Conn. The environs of this Lough are often slopes and secondary ridgelines with limited shelter vegetation to the south and undulating areas of pasture, woodland and forest with underlying glacial drumlins to the north.’

It would appear that the Crossmolina area fits best within Lakeland Sub-area 3A.

A set of indicative policies relating to the landscape attributes, robustness, and sensitivities of each Policy Area are provided in the Landscape Appraisal Report. These policies were intended to provide the framework and basis for such final landscape policies as required at the time of the development plan review.

The indicative policies for Policy Area 3A are as follows:

- **Policy 18** Encourage only development that will not detract from scenic lake land vistas, as identified in the development plan, and visible from the public realm. Such development must not have a diminishing visual impact due to inappropriate location or scale.
- **Policy 19** Promote only development that will not penetrate distinct linear sections of shorelines when viewed from areas of the public realm.
- **Policy 20** Recognise the value of scenic lake land vistas, as identified in the development plan. Protect areas that have not been subject to recent or prior development by ensuring any new development can be absorbed by the surrounding landscape.

3.8.2.4 Study Area Land Cover

The CORINE land cover data for the Study Area was obtained from the Environmental Protection Agency (EPA). CORINE land cover is a map of the environmental landscape based on the interpretation of satellite images. It provides comparable digital maps of land cover for each country for much of Europe.

The CORINE data for the Study Area shows that pasture is the primary land cover within the Study Area. Pastoral land within and in the vicinity of the Study Area is interspersed with smaller areas of non-irrigated arable land, transitional woodland/scrub, bog and land principally occupied by agriculture with areas of natural vegetation. Continuous urban fabric occurs at the settlement of Crossmolina and Lough Conn is identified as a waterbody. Some broad-leaved forest and inland marsh is found close to the mouth of the Deel River as it debouches into Lough Conn. Areas of complex cultivation patterns are found to the north and south of the study area but are not identified within or adjacent to the Study Area. Figure 3.8.2 shows the CORINE data for the Study Area.

3.8.2.5 Landscape Sensitivity

The Landscape Appraisal of County Mayo designates areas according to the categories used in the CORINE Land Cover Project. Areas may be designated as vulnerable, sensitive, normal, robust or degraded.

According to the Landscape Appraisal of County Mayo areas or features designated as vulnerable '*represent the principal features which create and sustain the character and distinctiveness of the surrounding landscape*'. Certain areas of coastline, shoreline of lakes and rivers, skylines and ridges and promontories and headlands are designated as 'vulnerable' in Landscape Appraisal. Areas or features designated as 'Vulnerable' within or close to the Study Area include the shoreline of Lough Conn and the skyline of Nephin, which is visible from the study area. Policy with regard to vulnerable areas is stated as such in the Appraisal:

'To be considered for permission, development in the environs of these vulnerable areas must be shown not to impinge in any significant way upon its character, integrity or uniformity when viewed from the surroundings. Particular attention should be given to the preservation of the character and distinctiveness of these areas as viewed from scenic routes and the environs of archaeological and historic sites.'

The areas or features designated as sensitive within or close to the Study Area in the Landscape Appraisal include transitional woodland and scrub west of Lough Conn, Broad-leaved Forest west of Lough Conn to the south of the Study Area in the townlands of Prospect, grange, east of Tonabrock and east of the R315 road at Massbrook Lower, inland marshes on the shore of Lough Conn, the waterbody of Lough Conn itself, agricultural land with significant areas of natural vegetation on the western and north-western shores of Lough Conn. Sensitive areas or features are described in the Landscape Appraisal as having a '*distinctive, homogenous character dominated by natural processes*.' Policy relating to such areas is described in the Landscape Appraisal as follows:

'Development in these areas has the potential to create impacts on the appearance and character of an extensive part of the landscape. Applications for development in these areas must demonstrate an awareness of these inherent limitations by having a very high standard of site selection, siting layout, selection of materials and finishes. Applications in these areas may also be required to

consider ecological, archaeological, water quality and noise factors insofar as it affects the preservation of the amenities of the area.'

Considerations with respect to sensitive areas are also listed in the report as follows:

'Where an area has been classified by the CORINE landcover classification system into groupings that are deemed to be indicative of a low potential to absorb significant development without significant change of character, then the area has the potential to be sensitive. These areas are indicative and prone to localised change over time where vegetative cover or agriculture management practices are the principal determinants. Landscape Appraisal for County Mayo CAAS Ltd. Page 49 Report The sensitivity to change may arise from very different sources e.g. woodlands may be sensitive to development that requires tree felling while peat bogs may be sensitive to development that requires tree planting. The principle role in Development Control of landscape sensitivity mapping should be to heighten awareness (and scrutiny) of the potential for additional or disproportionate visual prominence. Project by project evaluation, for development control purposes will be required to ascertain the presence and significance of a sensitivity and its relevance to the specifics of the proposed development (if any).'

3.8.2.6 Scenic Routes and Landscapes

Areas may also be designated as scenic routes and highly scenic vistas. The Landscape Appraisal of County Mayo lists the roads designated as Scenic Routes within the county. The policy of the Planning Authority with regard to Scenic Routes, as set out in the Appraisal Report, is as follows:

"Scenic routes indicate public roads from which views and prospects of areas of natural beauty and interest can be enjoyed. Sightseeing visitors are more likely to be concentrated along these routes. The onus should be on the applicant when applying for permission to develop in the environs of a scenic route, to demonstrate that there will be no obstruction or degradation of the views towards visually vulnerable features nor significant alterations to the appearance or character of sensitive areas."

There are no Scenic Routes located within the Study Area. However there are a number of scenic routes, which are partially within a ten-kilometre radius of the Study Area:

- R297 from Castleconor to Crockets Town

- Local Road from Killala to Moyne Abbey
- R315 Lahardaun to Pontoon, west of Lough Conn
- L134 from Knockmore to north of Ross West (between Lough Conn and Lough Cullin)
- Local road from Beltra to the R315 junction at Lough Conn
- Local road east of Lough Conn from Garrycloonagh to Brackwanshagh

The locations of these routes are shown on the Scenic Routes and Protected Views map in Section 3 of the Landscape Appraisal for County Mayo.

Areas designated as scenic views are also identified in the Landscape Appraisal of County Mayo. None of these designated 'highly scenic vistas' are located within the Study Area. However one of the designated views is situated within a 10 kilometre radius of the Study Area: the view on the R315 from Cuilkillow to Pontoon (looking towards Lough Conn). This view is to the south-east and is therefore not directed towards the Study Area and therefore is unlikely to be affected by the proposed works.

3.8.3 Summary of Key Constraints and Implications for the Proposed Scheme

- The Study Area includes areas and features designated as vulnerable and sensitive in the Landscape Appraisal for County Mayo, which is included as an Appendix to the Mayo County Development Plan (2008-2014). Many of these features are associated with Lough Conn. Although there are no scenic routes or highly scenic vistas within the Study Area, there are a number of scenic routes and one highly scenic vista within 10 kilometres of the Study Area. Appropriate design, siting and mitigation measures are therefore required to integrate the proposed scheme within the landscape. Particular regard should also be had to the potential visual impact on views available from the three stretches of designated Scenic Route and the areas of Scenic Landscape, which are located within the Study Area.