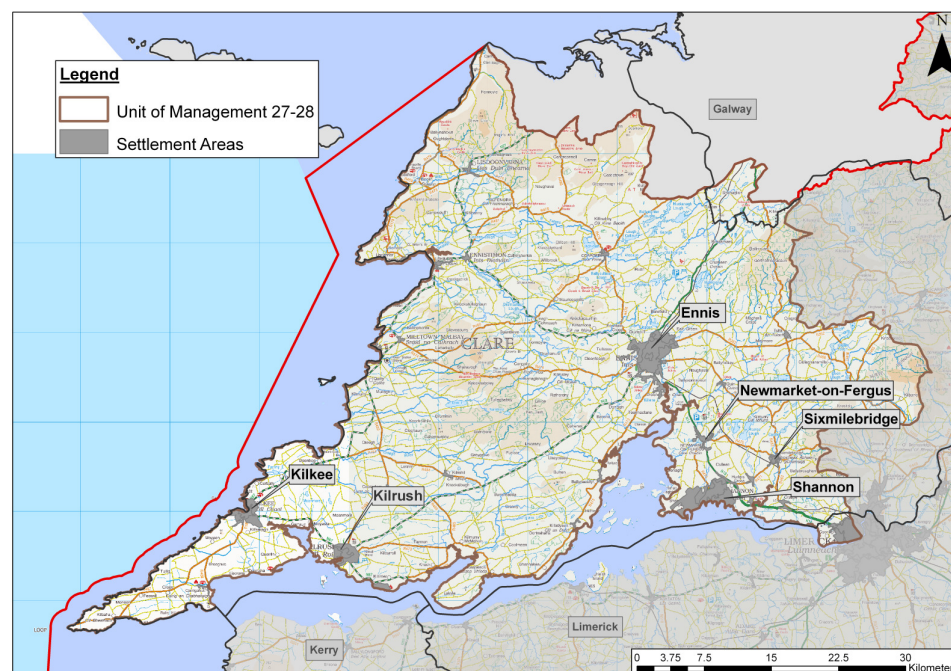




## Strategic Environmental Assessment - Scoping Report [Consultation Draft] - Annex IV

### Unit of Management 27-28: Shannon Estuary North and Mal Bay

### Flood History and Key Environmental Issues










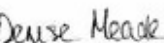

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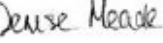
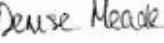

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**1****Introduction****1.1 Background**

As part of the Strategic Environmental Assessment (SEA) process, the Office of Public Works (OPW) invites you to give your views on the development and implementation of a series of Flood Risk Management Plans (FRMPs) in the Shannon River Basin District (RBD).

This Annex represents a key element of the SEA scoping process for the proposed FRMP for the **Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)** by describing the existing and potential future characteristics of the Unit of Management, summarising the history of flooding associated with its coastline and river catchments, and identifying the key social and environmental issues relating to flooding and flood risk management specific to this Unit of Management. This Annex should be read in conjunction with the overarching Shannon River Basin District Environmental Scoping Report which documents all other elements relevant to this scoping process.

Your comments on the information outlined in this Annex, coupled with those on the overarching Shannon RBD Environmental Scoping Report, will assist the scoping of, and the consultation about, the environmental impacts of the Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28) FRMP by initiating the strategic environmental assessment scoping stage.

The preparation of the FRMP for Unit of Management 27-28 will consider the risk of flooding from the rivers, estuaries and coastal waters at various different spatial scales. The locations that are considered to be potentially at risk of flooding, and therefore been identified as Areas for Further Assessment (AFAs) or Individual Risk Receptors (IRRs), will be subject to more detailed consideration in the development of the FRMP for this Unit of Management given their history of flooding, or where such risk might arise through future development or other changes/pressures.

Flood maps indicating where flood risk from river, estuarine or coastal waters exists within AFAs or at IRRs, and along the watercourses connecting AFAs / IRRs will be produced for this Unit of Management.



## 1.2 Consultation

You have an important role to play in helping us identify all the key issues relating to flood risk management, and we are keen to hear what you think. Specific to **Unit of Management 27-28 (Shannon Estuary North and Mal Bay)**, we welcome your comments on the key environmental issues.

It is important to note that the information in this Annex accounts for pre-scoping consultation already undertaken with key organisations, and the following sections present our current understanding of the Shannon Estuary North and Mal Bay Unit of Management. The SEA baseline and framework will develop as the Study progresses, and will be further informed by views and knowledge of stakeholders and the wider public.

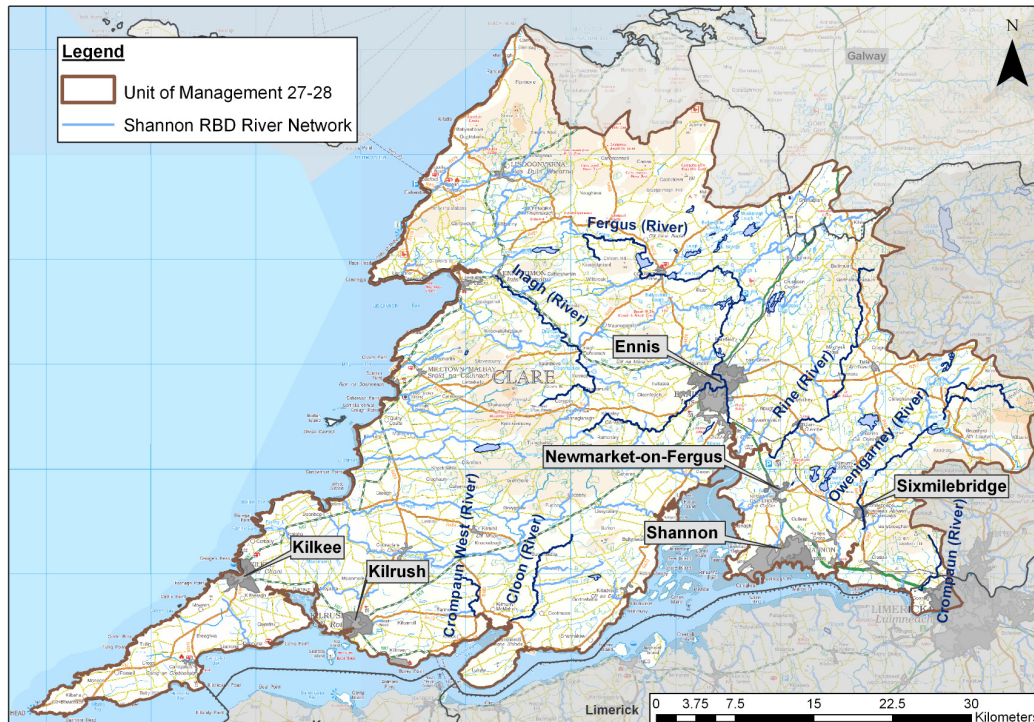
**You can send us your views by email or by post to the details below.**

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<b>Write to</b>	<p>Shannon CFRAM Study</p> <p>Jacobs Engineering Ireland Ltd</p> <p>Merrion House</p> <p>Merrion Road</p> <p>Dublin 4</p>
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<b>Website</b>	<a href="http://www.shannoncframstudy.ie">www.shannoncframstudy.ie</a>

## 2 Unit of Management Characteristics and History of Flooding

### 2.1 Unit of Management Characteristics

The Shannon Estuary North Mal Bay Unit of Management (or UoM 27-28) is shown in Figure 2.1 and is located almost entirely within County Clare, with only a very small part of the Unit of Management within Limerick and Galway.



**Figure 2.1 - UoM 27-28 Shannon Estuary North and Mal Bay Overview**

In addition to the Shannon Estuary forming the southern boundary of Unit of Management 27-28, it is dominated by three main river catchments, which are, from east to west, the Owenagarney (or Ratty) River, the Rine River, and the River Fergus, all of which discharge into the Shannon Estuary (see Figure 2.1). The largest of these is the River Fergus. Further to the west, the rivers are much smaller, with several rivers draining generally southwards into the Shannon Estuary, such as the Crompaun and the Cloon.

The coastline extends along the Shannon Estuary from Limerick City in the east to where it meets the Atlantic Ocean at Loop Head in the far west of County Clare. From Loop Head the coastline extends northeast to Kilkee, along which, the coastline is fully exposed to the Atlantic Ocean. Unit of Management 27-28 is bounded to the east by the Lower Shannon Hydrometric Area (part of UoM 25-26), to the north by the Western RBD.

The far north of Unit of Management 27-28 includes the southern part of The Burren, with its characteristic karst limestone features, and the virtual absence of any surface water features.

## Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)

The southern part of Unit of Management 27-28 is dominated by the tidal influence of the Shannon Estuary, which is reflected in the extensive flood defence assets (typically tidal embankments) located along the low-lying shoreline for much of its length in the eastern part of Unit of Management 27-28.

In the central part of Unit of Management 27-28, the River Fergus dominates, rising northwest of Corrofin near Killinaboy, flowing through Corrofin and then heading east towards the low lying central part of this Unit of Management. It then turns to the south where it is joined by the Castle River which (with its tributaries) drains the northern part of the catchment. The Fergus continues in a broadly southerly direction through the central part of Unit of Management 27-28, where it is dominated by numerous groundwater-fed lakes, heavily influenced by the limestone geology. Just north of Ennis it flows through Ballyallia Lough before splitting into two channels in the northern part of Ennis. The main channel flows through the north-western part of the town and the town centre (where the River Inch joins the Fergus from the west) while the smaller channel flows southeast through the northern part of the town. The two parts of the Fergus rejoin on the eastern side of Ennis.

South of Ennis, the river widens and there is a tidal barrage located at Clarecastle approximately 4km south of the centre of Ennis. The River Rine (or Ardsollus River in its lower reaches) flows into the Fergus 3km south of Clarecastle before entering the Shannon Estuary.

Towards the eastern boundary of Unit of Management 27-28, the Ratty (or Owenogarney) River flows into the Shannon Estuary, draining the eastern part of the catchment, and separated from the Lower Shannon catchment (part of Unit of Management 25-26) by the Slieve Bearnagh Mountains.

The 'Mal Bay' to the far west of this Unit of Management is bounded to the west by the Atlantic Ocean. The boundary to the east is the topographic divide between those rivers and streams that eventually flow into the Shannon Estuary and those which flow to the west discharging to the Atlantic Coast. This area is variable in nature comprising:

- The upland limestone area in the western part of The Burren in the north;
- The lowland area drained by the Inagh (or Cullenagh) River and the upland area between Ennis and Milltown Malbay in the centre; and
- Low lying land towards the south.

The western area is characterised by numerous small to medium sized catchments, with the rivers flowing predominantly east to west. The largest rivers in this Unit of Management, all discharging to the Atlantic Ocean, are:

- The Aille River - discharging near Doolin;
- the Aughyvackeen River and the Inagh (Cullenagh) River – discharging between Lehinch and Liscannor; and
- The Doonbeg River – discharging at Doonbeg.

The coastal reach within this area is variable, including rocky steep, high cliffs as well as extensive sand dune systems and natural shingle ridges. Some inland areas behind the natural coastal defences are low lying, with extensive land drainage networks which can be tidally influenced.

## Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)

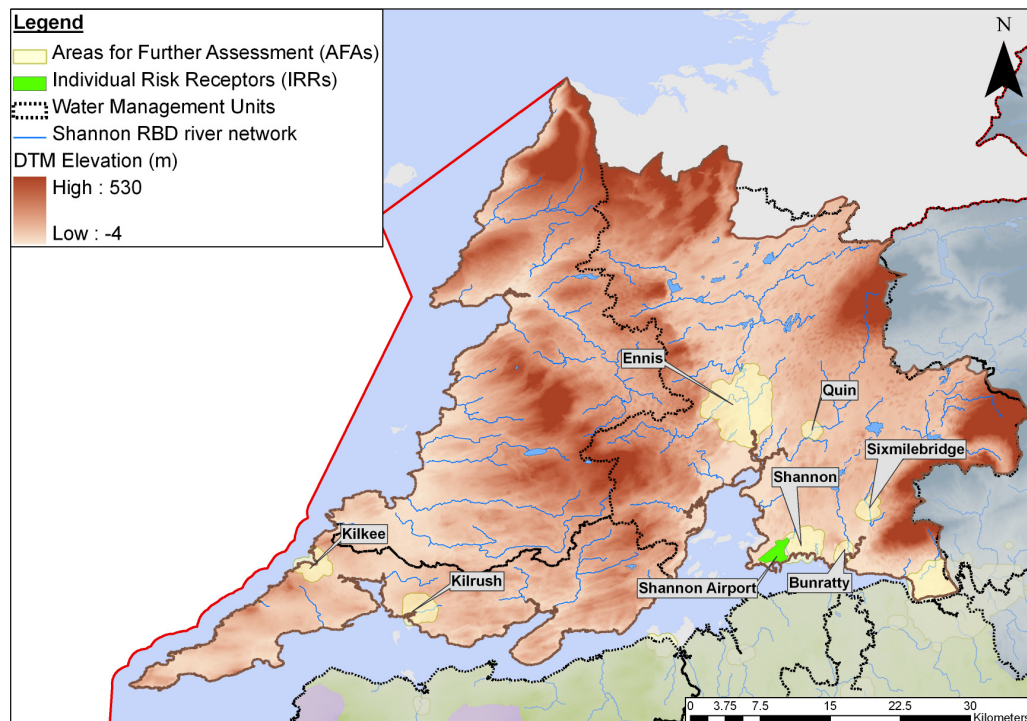
### Spatial Scales of Assessment

There are three Water Management Units (WMUs) within Unit of Management 27-28. These consist of the South Clare/Shannon Estuary, Fergus and the Inagh.

Table 2.1 and Figure 2.2 illustrate the AFAs and IRRs identified for Unit of Management 27-28, all of which may be subject to changes as the CFRAM Study develops.

**Table 2.1: UoM 27-28 Spatial Scales of Assessment**

County	WMU	AFA/IRR Name
<b>Areas for further Assessment</b>		
Clare	South Clare/Shannon Estuary	Kilkee
Clare	South Clare/Shannon Estuary	Kilrush
Clare	Fergus	Quin
Clare	Fergus	Bunratty
Clare	Fergus	Shannon
Clare	Fergus	Sixmilebridge
Clare	Fergus	Ennis
<b>Individual Risk Receptor</b>		
Clare	Fergus	Shannon Airport



**Figure 2.2 - UoM 27-28 Spatial Scales of Assessment**

The full extent of the AFA defined for Limerick City lies within three Units of Management (including UoM 27-28) and includes all of the developed land within the contiguous urban area of Limerick, and all lands zoned for development in or adjacent to Limerick City (including areas that may be outside of the Limerick City Council jurisdictional boundary). For the purpose of this Study, this AFA will be assessed as part of Unit of Management 25-26 (Annex III). Any flood risk

## Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)

management options proposed for this AFA will therefore be documented within the FRMP for Unit of Management 25-26.

### 2.2 History of Flooding

Within Unit of Management 27-28 there are records of significant flooding has that occurred throughout the South Clare/Shannon Estuary and Fergus WMUs from 1986 to 2009, affecting a number of towns and villages. The major source of flooding, based on the available records, appears to be fluvial and tidal.

Tables 2.3 and 2.4 show the reported flood events for the AFAs and IRR within the Unit of Management 27-28 WMUs. This historical flooding information has been gathered using the OPW National Flood Hazard Mapping website ([www.floodmaps.ie](http://www.floodmaps.ie)), and the National Preliminary Flood Risk Assessment (PFRA) Report (August 2011) produced by the OPW. The known main flood mechanism is not recorded for all flood events and is assumed for some records in the tables below (these are shown in *italics*).

**Table 2.3: Summary of historical flood events within the South Clare/Shannon Estuary WMU**

SOUTH CLARE/SHANNON ESTUARY WMU		
Flood Event	Main Flood Mechanism	Description of Flood Event
<b>(a) Kilkee</b>		
Feb 1990	Fluvial & tidal	County Clare experienced serious flooding with about 200 houses and many roads affected. Kilkee was one of the most seriously affected areas. Roads damaged in County Clare from Galway Bay to Loop Head and up to Carrigaholt in the Shannon Estuary.
Jan 1965	Tidal	The town was in complete darkness. Promenade wall collapsed causing flooding to houses (610mm deep) along the front of the wall. Widespread damage from Loop Head to Black Head.
Oct 1961	Tidal	A golf pavilion was blown away in Kilkee. Windows on the seafront and a number of shop windows were smashed by flying slates. No flooding details available.
Dec 1954	Fluvial	Large tract of land and low lying roads at Kilkee and other parts of West Clare flooded.
Oct 1954	Fluvial	Low lying roads and lands flooded.
Oct 1949	<i>Tidal</i>	No flooding details available.
Aug 1946	<i>Tidal</i>	No flooding details available.
Recurring	Fluvial & exacerbated by tidal	Church Street and Well Road car park flooded. Road impassable and car park closed. 4 to 5 houses flooded.
<b>(b) Kilrush</b>		
Jan 2005	Fluvial & pluvial	Land and R483 road flooded. Road impassable (maximum of 500mm deep).
Aug 1986	<i>Tidal</i>	No flooding details available.
Jan 1969	<i>Tidal</i>	No flooding details available.
Dec 1968	<i>Tidal</i>	No flooding details available.



# Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)

SOUTH CLARE/SHANNON ESTUARY WMU		
Flood Event	Main Flood Mechanism	Description of Flood Event
Jan 1965	Tidal	No flooding details available.
Oct 1961	Tidal	An individual was surrounded by water up waist level at a mudflat near Moyasta.
Oct 1949	<i>Tidal</i>	No flooding details available.
Dec 1924	<i>Tidal</i>	No flooding details available.
Oct 1886	<i>Tidal</i>	No flooding details available.
Recurring	Fluvial & exacerbated by tidal	R483 on Kilrush Road flooded but passable. R473 on Cappagh side of the Creek Lodge Hotel flooded and impassable (1200mm deep).

**Table 2.4: Summary of historical flood events within the Fergus WMU**

FERGUS WMU		
Flood Event	Main Flood Mechanism	Description of Flood Event
<b>(a) Bunratty</b>		
Jan 2005	Fluvial, tidal & pluvial	L3040 to Bunratty flooded (400mm deep) due to surface water from the surrounding land and streams.
Feb 2002	Tidal	Land flooded at Moyhill area near Bunratty.
Feb 1997	Tidal	A dwelling at Moyhill was threatened with flooding. A stretch of wall was washed away.
Jan 1995	Tidal	The lowest level in Bunratty Castle flooded.
Jan 1965	<i>Tidal</i>	No flooding details available.
Recurring	Pluvial	Road at Deerpark Housing Estate flooded (maximum depth of about 100mm) once in two years.
<b>(b) Ennis</b>		
Nov 2009	Fluvial, tidal & pluvial	Extensive flooding in Ennis. Approximately 112 residential properties & some non residential properties flooded.
Dec 2006	<i>Fluvial &amp; tidal</i>	No flooding details available.
Feb 2002	Fluvial & tidal	Road and two properties flooded.
Dec 1999	Fluvial coincident with tidal	Properties and roads at various locations in Ennis flooded. No houses in Fergus Park flooded.
1998	<i>Tidal</i>	No flooding details available.
Jan/Feb 1995	Fluvial & tidal	Severe flooding in Ennis town centre and Fergus Park. Houses in Fergus Park flooded.
1993	<i>Tidal</i>	Serious flooding in Ennis.
1989/1990	<i>Tidal</i>	Serious flooding in Ennis.
Dec 1959	Fluvial, tidal & pluvial	Flooding in Ennis and surrounding areas with 100 residential and commercial premises and vast area of land flooded. Road flooding between Ennis and Gort Road. St Flannan's College grounds and adjacent main road flooded.
Dec 1968	<i>Fluvial</i>	No flooding details available.
1955	Fluvial & tidal	Houses in many principal streets flooded.



# Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)

FERGUS WMU		
Flood Event	Main Flood Mechanism	Description of Flood Event
1947	Fluvial & tidal	Similar flooding as 1959 event.
Recurring	Fluvial & tidal	Mill road a serious flooding black spot in Ennis town. Doora North Newpark flooded several times per year. No roads or houses affected.
<b>(c) Shannon</b>		
Jan 2005	Pluvial	Road L3169 flooded. Water flowed around a house but not flooded.
Recurring circa 2000	Tidal	L7174 flooded.
<b>(d) Shannon Airport</b>		
Jan 2005	Pluvial	Road L3169 flooded. Water flowed around a house but not flooded.
Dec 1999	Tidal	Two houses flooded.
Recurring circa 2000	Tidal	L7174 flooded.
<b>(e) Sixmilebridge</b>		
Nov 2009	Fluvial	Roads at Sixmilebridge flooded and impassable. Several commercial properties affected by flooding according to Clare County Council.
Jan 2005	Fluvial & pluvial	Road from Setrights Cross to Sixmilebridge (R462) and Rossmannagher Bridge flooded and impassable. R462 at junction with L7046 also flooded. Road and surrounding land at Bradford Road flooded.
Jan 1995	Fluvial & pluvial	Flood lasted for fourteen days and affected fourteen houses (six flooded & eight at immediate risk) and sewage treatment works.
1994	Fluvial	Severe flooding of houses in Sixmilebridge.
1991	Fluvial	Severe flooding in Sixmilebridge.
Dec 1959	Fluvial	No flooding details available.
Jan–Feb 1946	Fluvial	No flooding details available.
<b>(f) Quin</b>		
Recurring	Fluvial	The L8180 floods over a length of 1km on average twice per year. Land is also flooded south of this area and right down to South of Quin.

### **3 Key Environmental Issues in Unit of Management 27-28**

#### **3.1 Introduction**

The following sections provide a preliminary discussion of the environmental baseline for Unit of Management 27-28.

Both the existing and potential future environmental characteristics of the Unit of Management are summarised. These characteristics can influence the risk and repercussions of flooding and can constrain or provide opportunities for the implementation of strategic flood risk management options.

On developing the scope of the SEA for the Shannon CFRAM Study, and following consultation with stakeholders, the key social and environmental issues relating to flooding and flood risk management within Unit of Management 27-28 have been identified, and these are documented in the following sections.

Potential interactions between the different aspects of the environment are outlined within Section 5 of the overarching Shannon RBD Environmental Scoping Report. These interactions will be further considered and documented during the later stages of the SEA process.

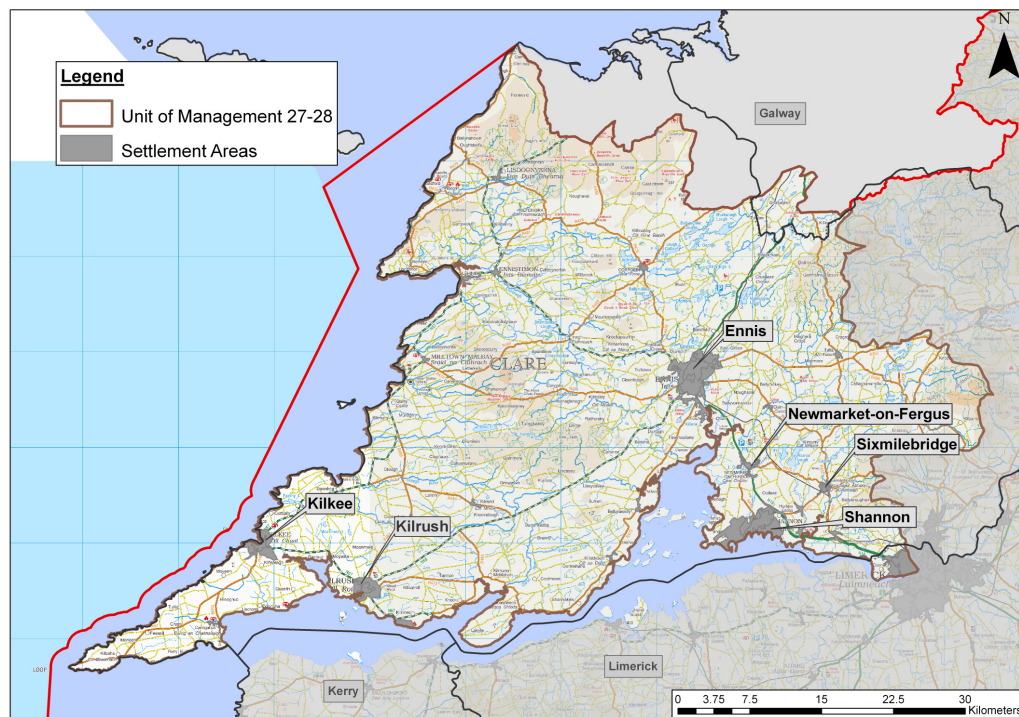
## 3.2 Population and Human Health

### 3.2.1 Current Conditions

#### Population

The population of Ireland was over 4.2 million in 2006 and provisional numbers from the 2011 census indicate that population figures have increased by approximately 8.1% to 4.5 million. Ireland has experienced increasing population growth since 1961, however the past two years has seen a decrease in the demand for development, and increased unemployment within this Unit of Management is a trend seen across the entire country.

The provisional 2011 census population figures currently available from the Central Statistics Office (CSO) do not segregate city populations from rural population, but these are due to be published in April 2012 and will be considered as appropriate in the following stages of the SEA. Settlement patterns within this Unit of Management are illustrated in Figure 3.2.1.



**Figure 3.2.1 - Settlement patterns within UoM 27-28**

Population figures reported in the 2006 census for the town boundaries of each AFA within this Unit of Management are outlined in Table 3.2.1. As noted in Section 2.1 above, Limerick City AFA will be assessed as part of Unit of Management 25-26, and therefore is not considered further within this report.

## Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)

**Table 3.2.1: Population figures within the Areas for Further Assessment**  
(source: CSO)

Town (AFAs)	Population 2002	Population 2006
Bunratty	-	-
Shannon	8,228	8,481
Sixmilebridge	1,327	1,659
Quin	427	565
Ennis	18,830	20,142
Kilrush	2,699	2,657
Kilkee	1,260	1,325

All of the AFA within this Unit of Management have experienced an increase in population with the exception of Kilrush which has seen a slight decline. Ennis by some magnitude has the highest population within this Unit of Management.

Transport 21, the Government's development programme for the network of national roads over the period 2006 to 2015 does not include developments which may influence population distribution within this Unit of Management. Transport 21 will however be superseded by the new National Development Plan from 2012, and this will be reviewed for relevance to this Unit of Management.

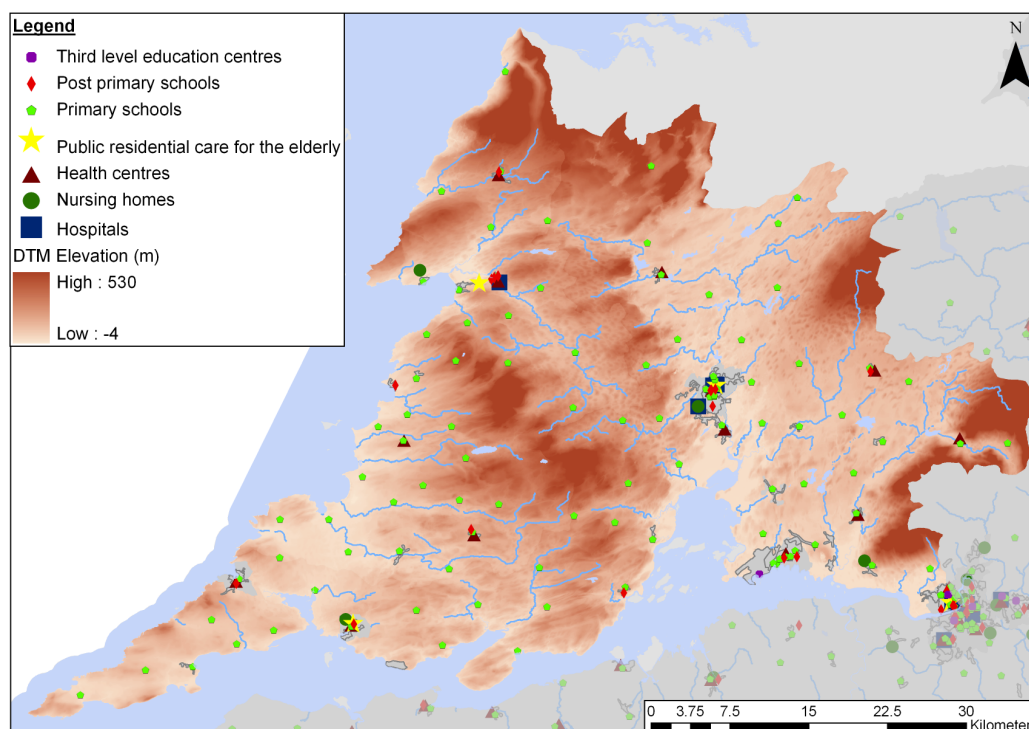
### Human Health

Hospitals, health service centres, nursing homes and schools, as well as their ancillary services and roads, are recognised as vulnerable receptors to flooding. The distribution of these receptor groups throughout this Unit of Management is illustrated by Figure 3.2.2.

The major hospital servicing this Unit of Management is the regional hospital located in Ennis.

Details regarding the existing and future characteristics of this Unit of Management associated with pollution risks to human health are outlined in Section 3.4 of this Annex.

## Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)



**Figure 3.2.2 - Critical human health receptors within UoM 27-28 (source: OPW, HSE)**

### 3.2.2 Future Trends

#### Housing and Economic Development Planning

The Planning and Development (Amendment) Act 2010 (and subsequently the Regional Planning Guidelines) includes new provisions for Development Plans, requiring the introduction of a 'core strategy that shall show that the development objectives in the Development Plan are consistent, as far as practicable, with national and regional development objectives set out in the National Spatial Strategy and Regional Planning Guidelines'. The Core Strategy of each plan must provide a transparent evidence-based rationale for the amount of land proposed to be zoned for residential and allied mixed-use zonings in the relevant Development Plan and associated compliance with relevant EU Directives. The implementation of core strategies (which is being monitored by the Mid-west Regional Authority for this Unit of Management) within the Development Plans is likely to result in de-zoning, re-zoning and phasing of development of lands

Local Authorities with AFAs/IRRs within this Unit of Management, which include Clare and Galway County Councils, have incorporated Core Strategies into their Development Plans. Each Council are now required to integrate these Strategies into the relevant Local Area Plans. The implementation of these strategies may result in re-zoning or de-zoning of land within this Unit of Management, influencing population distribution and development. Core Strategies outlined in the Clare (2011 – 2017) and Galway (2009 – 2015) County Development Plans emphasise the need for sustainable development and appropriately zoned land, in addition to a strong link to enforcement of planning regulations for sustainable development into the future. These county-level strategies, as well as Local Area Plans and any

## Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)

Town/City Plan strategies relevant to the AFAs will be examined further in the next stage of the SEA process. In addition, consultation with relevant Regional Planning Authority for this Unit of Management will continue.

There is a requirement for planning authorities to have regard to the Planning System and Flood Risk Management Guidelines (Department of Environmental Heritage and Local Government<sup>1</sup> and the OPW, 2009) in carrying out their functions under the Planning Acts. This is to ensure that 'where relevant, flood risk is a key consideration in preparing Development Plans and Local Area Plans and in the assessment of planning applications'. These guidelines aim to help revise and strengthen planning policy on development and flood risk across Ireland, and will therefore have a significant influence on future population and development growth and distribution across the Unit of Management.

The preparation of a Strategic Integrated Framework Plan (SIFP) and its associated SEA and AA for the Shannon Estuary has recently commenced. This Plan aims to identify the nature and location of future development, economic growth and employment that can be sustainable accommodated within the estuary whilst ensuring that the habitat status of the Natura 2000 and other environmentally sensitive sites would not be reduced as a result of the impacts of such developments (for further information, refer to Section 3.9.2).

### Regional Planning Guidelines – Population Targets

Population targets are outlined in the respective Regional Planning Guidelines to assist planning authorities to decide on the extent of land to be zoned for development (particularly residential development). Population targets indicate the minimum population numbers for these locations to be used in determining future development land requirements for the region, setting the context for city and county Development Plans and Local Area Plans. While zoning should have regard to these population targets, the Guidelines note that additional development may be permitted where there is a clear need. The targets outlined in Table 3.2.2 below provide an indication of future population distribution in this Unit of Management.

**Table 3.2.2: Population targets set out in the Mid-West Regional Planning Guidelines for regions within UoM 27-28.**

Area / Region	2006 (Census)	2016	2022	Predicted Increase 2016-2022
Clare County	110,950	131,321	141,600	10279
Galway County*	159,256	185,860	198,500	12640

<sup>1</sup> Now the Department of the Environment, Community and Local Government.



**Box 3.2: Population and Human Health – Key strategic issues relating to flood risk management**

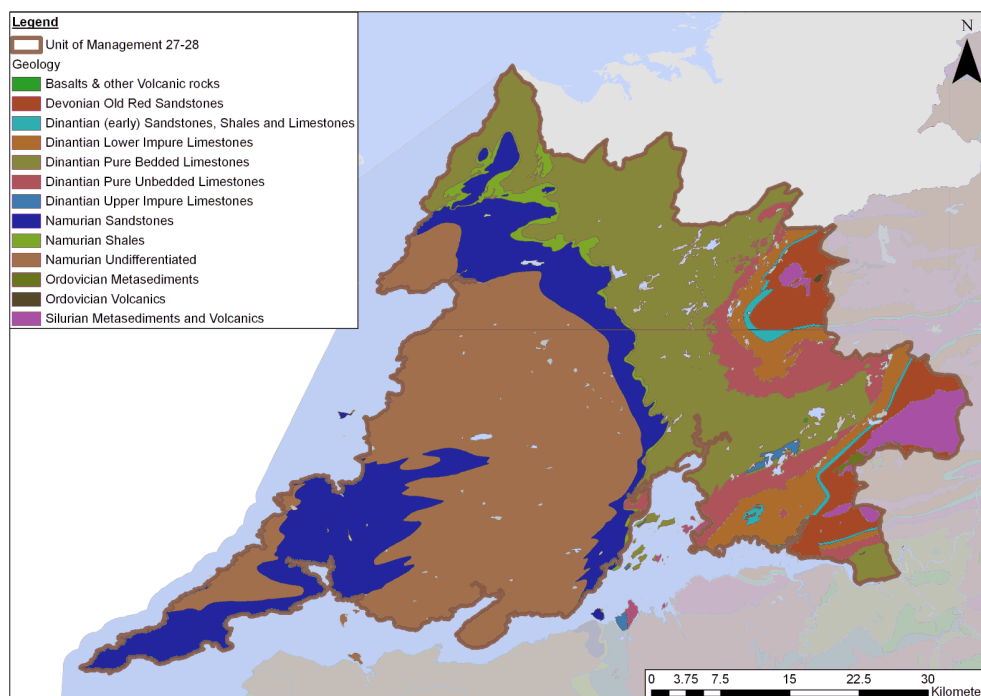
- Population and development growth will potentially increase the number of people at risk from flooding;
- Recent and emerging changes to planning and development regulations/guidance and their associated influences on the distribution of both existing and future population and development, can provide opportunities for the avoidance or mitigation of flood risk if appropriately enforced;
- Flooding can have significant social and socio-economic effects, such as increased stress and anxiety for individuals and communities as well as monetary impacts associated with ‘clean-up’ activities;
- Increased levels of resilience and resistance of infrastructure protecting or managing human health to flooding is important to support emergency planning and response e.g. hospitals, nursing homes, health care facilities, etc;
- Access to healthcare and emergency services should be maintained during flood events;
- Failure to protect or manage potential ‘at risk’ areas, can influence property insurance policies and may also restrict development potential;
- Publication of nationally / regionally consistent information relating to flood risk will help towards standardising planning, development and insurance policies;
- Good public access to information relating to flood risk can support ongoing community and business resilience, which in turn can provide opportunities for facilitating or enhancing the sustainability of flood risk management; and
- It is acknowledged that local authorities are legally required to undertake emergency planning and therefore this will not be proposed as a flood risk management option by the CFRAM Study. However, other aspects of strategic flood risk management can enhance business and community emergency planning and continuity frameworks, e.g. linking emergency planning frameworks with flood forecasting, to provide flood warning.

## Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)

### 3.3 Geology, Soils and Land Use

#### 3.3.1 Existing Conditions

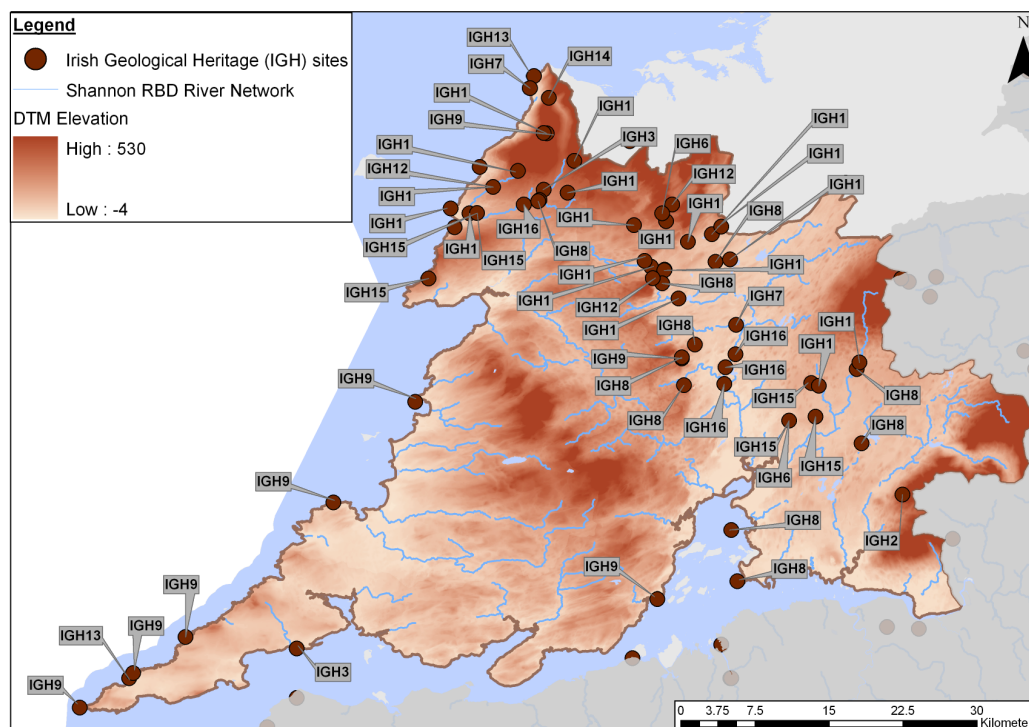
Underlying this Unit of Management is a sedimentary **geology** of shale, sandstone, and limestone, see Figure 3.3.1.



**Figure 3.3.1 - Geology within UoM 27-28 (source: GSI)**

As part of the Irish Geological Heritage (IGH) Programme, a partnership between Geological Survey of Ireland (GSI) and the National Parks and Wildlife Service (NPWS), the GSI have identified important geological and geomorphological sites which could be conserved as Natural Heritage Areas (NHAs). Until designation is confirmed, these sites are classified as Irish Geological Heritage Sites (IGHs). There are 56 IGHs classified within this Unit of Management (refer to Figure 3.3.2 and Table 3.3.1).

**Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)**



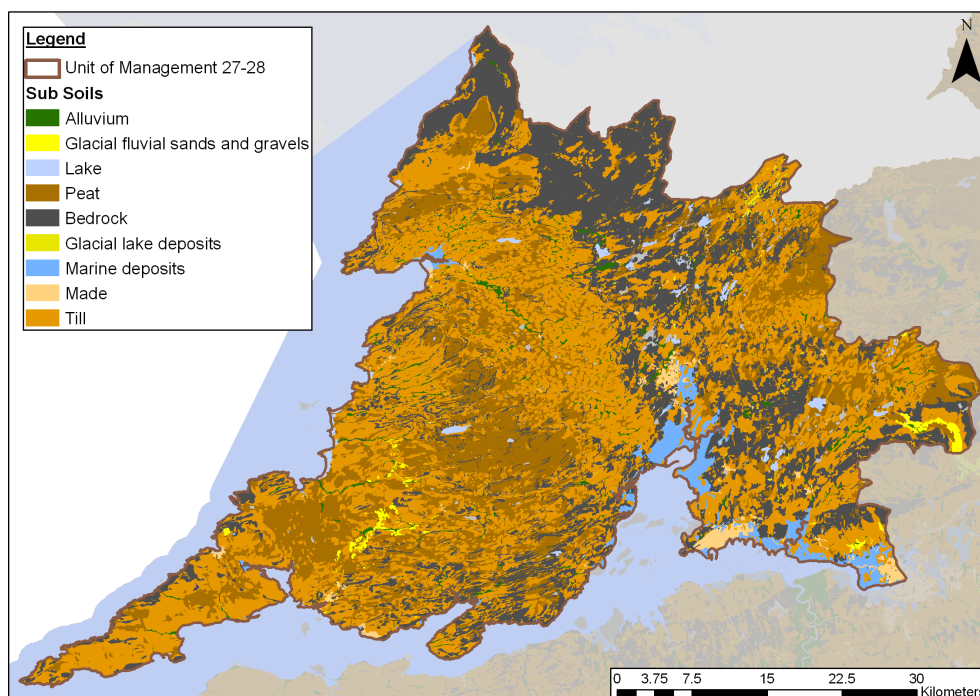
**Figure 3.3.3 - Irish Geological Heritage Sites within UoM 27-28 (source: GSI)**

**Table 3.3.1: Description of the IGH within UoM 27-28**

Theme No(s).	Theme Type	No of Sites
IGH1	Karst	15
IGH2	Precambrian - Devonian Palaeontology	1
IGH3	Carboniferous - Pliocene Palaeontology	3
IGH6	Mineralogy	1
IGH7	Quaternary	2
IGH8	Lower Carboniferous	8
IGH9	Upper Carboniferous	6
IGH14	Fluvial/Lacustrine Geomorphology	1
IGH15	Economic Geology	3
IGH16	Hydrogeology	4
Various	Various	12

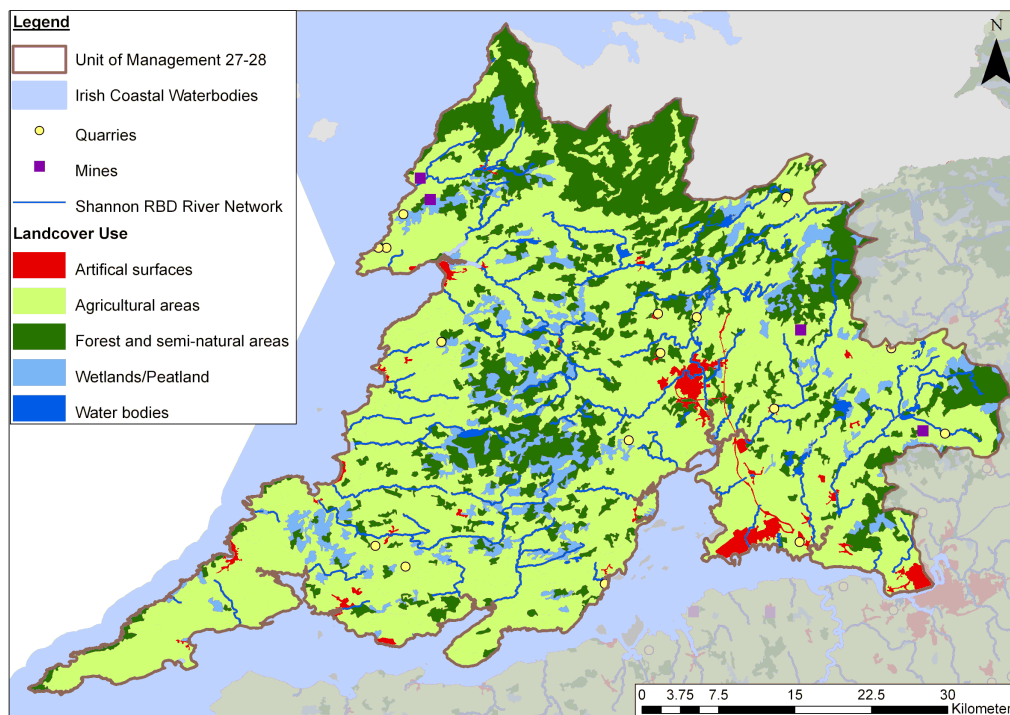
The **soils** are generally a mixture of gley, acid brown earths/podzolics and peaty gley soils. The sub-soil consists of primarily of shale and sandstone till and peat. Figure 3.3.3 shows the type of sub-soils within this Unit of Management derived for the underlying geology.

**Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)**



**Figure 3.3.3 - Sub-soils within UoM 27-28 (source: Teagasc)**

**Land use** within this Unit of Management is shown on Figure 3.3.4. Based on data from 2006, agricultural land is the dominate land cover type within this Unit of Management, accounting for 68% of land-cover (EPA Corine 2006).



**Figure 3.3.4 - Land use within UoM 27-28 (source: EPA Corine land cover database 2006)**

## **Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)**

The remaining land cover types consist of forestry and semi-natural areas (21%), wetland, including peat bog (8%) and built land (2%). There are also four mines and thirteen quarries located within this Unit of Management.

The reform of the EU Common Agricultural Policy (CAP) provided the incentive for the formulation of the Rural Environment Protection Scheme (REPS). The overarching principle of the REPS was to reward farmers for undertaking farming practices in an environmentally friendly manner. The uptake of the REPS throughout Ireland is based on a percentage uptake per county with the highest uptake being 30-35%. Within County Clare (the dominant county of this Unit of Management) the uptake is 25-30% and in County Galway is 30-35% (EPA EnviroMapper). The Forest Environmental Scheme (FEPS) which is an 'add on' to REPS, provided incentives to farmers within REPS to plant woodland with emphasis on environmental gain, rather than solely for economic gain. The percentage FEPS (forest as a % of county area) for this Unit of Management is 15-20% based on County Clare figures (EPA).

In 2009 the REP Scheme ended, and 2014 will see the last of the REPS payments. In 2010, the Agri-Environmental Options Scheme (AEOS) was rolled out, which targets three environmental challenges; loss of biodiversity, improvement of water quality and combating climate change. This scheme also runs for five years, and early REPS<sup>2</sup> farmers can avail of this scheme. In 2011/12 an AEOS2 is being offered for a period of five years, or until CAP reform in 2013. The CAP 2013 reform is still in process, but 'aims to maintain income stability for farmers, while farming with respect to environmental, food safety and animal welfare standards'.

Farms within this Unit of Management are required to comply with Ireland's (second) Nitrates Action Programme which was given effect through a series of Regulations<sup>3</sup>. This includes the implementation of Fertilisation Plans. These Regulations support the protection of waters against pollution from agricultural sources, e.g. by phosphorus and nitrogen.

Figure 3.3.5 illustrates the recorded forestry cover in this Unit of Management which consists of mainly commercial plantation of conifers, owned by Collite. These tend to be located on poor soils of the uplands, harvested on a rotational period of 40 years (WRBD, 2008<sup>4</sup>). Forestry on the lowlands is dominated by small privately owned forest plots. All forestry operations are required to be carried out in compliance with the principles of Sustainable Forest Management (SFM), as outlined in the Code of Forest Practice<sup>5</sup> to promote sustainable forestry and to meet high environmental, economic and social standard.

<sup>2</sup> REPS1, REPS2 and REPS3

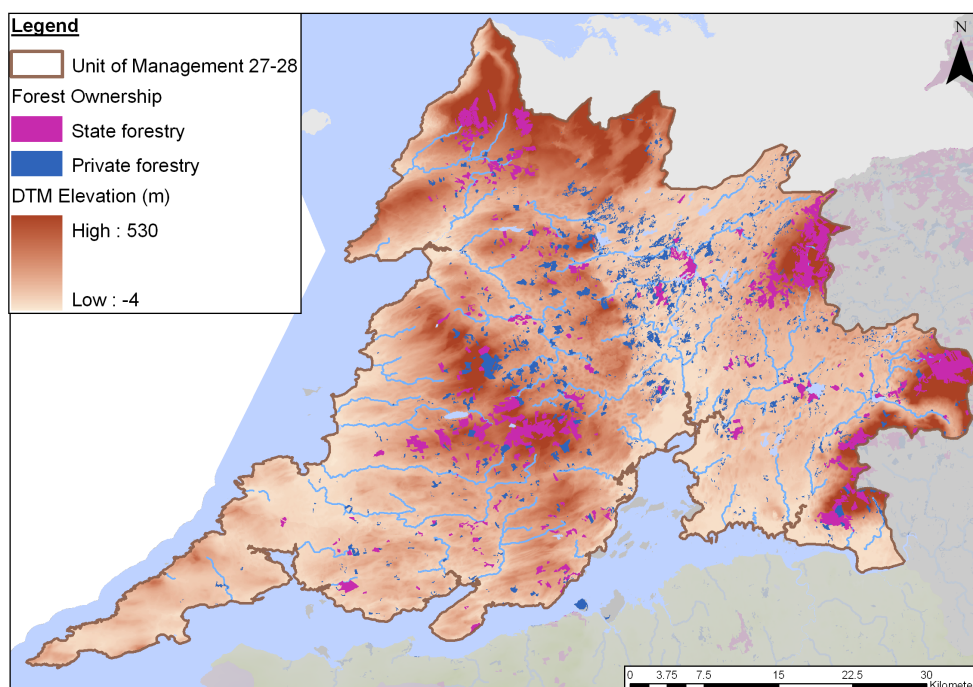
<sup>3</sup> The most recent being the European Communities (Good Agricultural Practice for the Protection of Waters) (Amendment) Regulations 2011.

<sup>4</sup> Western River Basin District (2008), Programme of Measures and Standards for Forest and Water

<sup>5</sup> Forestry Service (2000) Code of Best Forest Practice – Ireland.



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**Figure 3.3.5 - Forest ownership within UoM 27-28 (source: Forest Service)**

Previous flood relief programmes run by the OPW under the Arterial Drainage Acts 1945 and 1995, have shaped some the landscape within this Unit of Management. Originally implemented to protect agricultural land from flooding, this programme was updated in 1995 to include urban areas. The OPW maintain all embankment, weirs and bridges that were constructed under this programme.

There are large areas of bog, which are predominately blanket bog, throughout this Unit of Management particularly in the south western section. There are no Bord na Móna bogs present within this Unit of Management. However a potential issue raised at the stakeholder workshops, is that conventionally, peat harvesting of areas <50 hectares were not licensed, and therefore records of harvesting activities may not represent the full extent of activity at a particular bog.

The GSI have recorded up to three landslides within this Unit of Management; one which dates back to the 1900's and two more recent in 2005 and 2009 involving material from embankments (GSI, 2006<sup>6</sup>). Landslides can result in increased silt deposition in water courses and reduce conveyance. As noted in Section 2.1 of the Environmental Scoping Report, the CFRAM Studies will not include the assessment of areas subject to natural erosion processes unless such processes are predicted to pose significant flood risk by eroding existing flood defence structures (natural or engineered).

Historical contamination of soils resulting from past and present land use may present significant pollutions risks. Data on the location of known contaminated sites is held by Local Authorities and continued consultation with the relevant Local Authorities during the next stages of this SEA will identify those most relevant to this Unit of Management.

<sup>6</sup> Geological Survey Ireland Irish Landslides Working Group (2006) Landslides in Ireland.



**Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)**

There are approximately seven landfills and five licensed waste transfer stations within this Unit of Management (refer to Figure 3.4.6 in Section 3.4 of this report for the location of these facilities).

Sites with concrete plants, desilting ponds, leachate lagoons, disused quarries, holding tanks under cattle houses (slurry tanks) may also be considered as potentially contaminated sites, and will be investigated further during the risk assessment of potential flood risk management options.

Onsite waste water treatment systems (OSWTS)<sup>7</sup> such as septic tanks can present a significant pollution risks between surface and groundwater. OSWTS have been identified nationally as part of the Programme of Measures Unsewered Wastewater Treatment Systems National Study 2008. The EPA is in the process of mapping OSWTS, and this data will be made available to the CFRAM Study in the coming months.

Flooding has the potential to impacts on the supply from water treatment plants (WTP). There are seven water supply treatment plants within this Unit of Management and these are detailed further in Section 3.4 of this report.

### **3.3.2 Future trends**

The IGH sites referred to above are in the process of being reviewed by the NPWS to determine which sites shall be designated as NHAs, and therefore afforded statutory protection.

In 2006, the European Commission adopted a proposal for a Soil Framework Directive, to provide soil statutory protection and to recognise soil as an invaluable natural resource. This is likely to influence land cover and land use practices. As of 2012, this Directive is still in the decision-making process within the European Council.

Into the future, agriculture land-use within this Unit of Management is likely to remain dominant; although the pattern and trends of this use will change to reflect the reform of the CAP in 2013 ('the CAP towards 2020'), compliance with the Nitrates Regulations (Ireland's Nitrates Action Programme is due to be reviewed for a third time in 2013) and abolishment of the EU Milk Quotas<sup>8</sup> in April 2015.

One objective of this CAP 2013 reform is to make agriculture competitive on the world market; similarly the abolishment of the EU Milk Quotas is likely to make the dairy industry more competitive in Ireland. This is in line with the Food Harvest Report 2020 recommendations, which aim to increase Irish agri-food export by 2020.

Coillte forests within this Unit of Management have individual management plans that are derived from the Coillte Forestry Services District Strategic Plan 2011-2015. This Unit of Management lies within the Clare South Galway District (SW1) management plan area, for which both environmental and economic objectives are set for the management of the forests at local level for the next five years. Within this management plan, Coillte recognise forests as being an important resource in the role of moderating flooding at times of high rainfall. Water quality is also

<sup>7</sup> OSWTS are defined as areas not connected to sewerage systems and that discharge treated wastewater into the ground by percolation

<sup>8</sup> S.I. No. 94/2000 — European Communities (Milk Quota) Regulations, 2000

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addressed; as 'drainage and cultivation practices in Coillte forests are designed to minimise their impact on local water'. Water protection areas (buffer zones) are also being established in plantations at present.

The Government has made a commitment to increase the forest area to 17% of the total land area in Ireland by 2030<sup>9</sup>, which is likely to include areas within this Unit of Management. As referred to in Section 3.3.1, all new forestry is managed in line with the SFM principals, including a guideline of development of a buffer of natural riparian vegetation along rivers and streams (Forestry Service 2000).

The Forestry Service have produced a Geographical Information System (GIS) based Forest Inventory Planning System (FIPS) to act as an aid in the long term spatial planning of national forest, and to provide guidance to forestry grants. This data provides further detail to that provided by the CORINE database, such as tree species.

With regards private turf-cutting for domestic use, this is now prohibited on raised bogs designated as Special Areas of Conservation (SACs) in the absence of Ministerial consent.

The EPA has published a series of Codes of Practice and Advice Notes, the implementation of which can influence geology, soils and land use in this Unit of Management. Those of relevance in this context are:

- Code of Practice for Wastewater Treatment and Disposal Systems Serving Single Houses (population equivalent < 10);
- The EPA Code of Practice: Environmental Risk Assessment for Unregulated Waste Disposal Sites; and
- Advice Note No.6, Version 1; Restoring Public Water Supplies Affected by Flooding.

<sup>9</sup> CAP Rural Development Division Rural Development Programme Ireland, 2007-2013.

**Box 3.3: Geology, Soils and Land Use – Key issues relating to flood risk management**

- Flooding and flood risk management measure/options can potentially adversely affect the productivity of agricultural land, and can lead to changes/abandonment of land use;
- Agricultural practices can have both negative and positive effects on flooding and flood risk management, for example:
  - Negative: reduction in soil infiltration rates and available soil water storage capacities, and increasing rapid runoff in the form of overland flow;
  - Positive: agricultural lands may help manage runoff and provide natural storage areas whilst also providing opportunities for biodiversity and potentially supporting agri-environmental schemes.
- Forestry-related land use practices (afforestation and deforestation), and associated land drainage schemes can influence the conveyance of water within the catchments;
- Changes of land use from agriculture to urban/semi-urban behind OPW arterial drainage scheme embankments (originally constructed to protect agricultural land) has increased flood risk in these areas; and
- Upland forestry practices can include significant drainage systems resulting in sudden water losses for the area.

### 3.4 Water

#### 3.4.1 Existing conditions

The EU Water Framework Directive (2000/60/EC) establishes a framework for the protection of both surface and ground waters. Transposing legislation outlines the water protection and water management measures required in Ireland to maintain high status of waters where it exists, prevent any deterioration in existing water status and achieve at least 'good' status for all waters by 2015. This is currently being achieved through the implementation of River Basin Management Plans (RBMPs). The Shannon RBMP 2009-2015 was adopted in June 2009 and includes Water Management Unit (WMU) Action Plans<sup>10</sup> and a programme of measures required to facilitate the achievement of the WFD objectives.

#### Surface Water

The surface water bodies within this Unit of Management are primarily associated with the River Fergus and the River Inagh catchments as well as transitional (estuarine) and a coastal water bodies.

#### Rivers & Lakes

The Fergus WMU Action Plan states that 44% of the rivers within its catchment achieved good status or higher, with the remaining water bodies failing to achieve the WFD objectives. The South Clare Shannon Estuary WMU Action Plan summarises that just 21% of the rivers within its catchment achieved good status or higher. The West Coast Clare WMU Action Plan records the highest percentage of water bodies achieving the WFD objectives, summarises that 65% of the rivers within its catchment are classified as achieving good status or higher.

The Fergus WMU Action Plan classifies 15% of the lakes within its catchment as high status and 29% as good status, with the remaining lake water bodies failing to achieve the WFD objectives. Lakes within both the South Clare Shannon Estuary and West Coast Clare WMUs are all recorded as moderate status.

The WMU Action Plans associate the following anthropogenic pressures/activities with the current failure of the surface water bodies to achieve the WFD objectives:

- Nutrient sources: Total Phosphorous predominantly from diffuse sources (agricultural, unsewered properties, forestry and waste water treatment plants (WWTPs));
- Point source pressures: such as WWTPs, integrated pollution and prevention control (IPPC) facility discharges, Section 4 discharges (trade or sewage effluent), waste facilities and water treatment plants;
- Quarries, mines and landfills;
- On site waste water treatment systems (OSWTS);
- Physical alterations (morphological pressures) - Fergus WMU only; and
- Abstractions.

<sup>10</sup> WFD Ireland Document Store - [http://www.wfdireland.ie/docs/1\\_River%20Basin%20Management%20Plans%202009%20-%202015/ShIRBD%20RBMP%202010/](http://www.wfdireland.ie/docs/1_River%20Basin%20Management%20Plans%202009%20-%202015/ShIRBD%20RBMP%202010/)

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Each Action Plan outlines a programme of measures to be implemented in the catchment areas, and in some instances at a regional or national level. Those of relevance to flood risk assessment and management include:

- Point sources: WWTP upgrades, review of the current terms of discharge authorisations;
- Diffuse sources: inspection / enforcement of the Good Agricultural Practice Regulations and inspection programme of 'at risk' septic tanks; and
- Morphological pressures: Investigation of channelisation to establish if supplementary measures are required to address water quality issues associated with morphology. Channel enhancement measures to assist recovery from this pressure are to be considered.

Implementation of these measures is now progressing so as to achieve the WFD objectives and inform the next RBMPs (2015 – 2021). Some measures responding to the WFD requirements were implemented prior to the completion of the RBMPs, for example, the EPA are progressing with a revised WWTP licensing regime implemented under the Waste Water Discharge (Authorisation) Regulations 2007.

### Transitional (estuarine) and Coastal Waters

The Shannon RBMP reports that the Fergus Estuary and Lower Shannon Estuary water bodies are achieving moderate status. The Upper Shannon Estuary and Shannon Airport Lagoon transitional water bodies are reported to be at good status. The Mouth of the Shannon coastal water body is reported as achieving high status however, recent monitoring since the publication of the Shannon RBD Transitional and Coastal Waters Action Programme reports the status of this water body as moderate<sup>11</sup>.

The Shannon RBD Transitional and Coastal Waters Action Programme associates the following anthropogenic pressures/activities with the current failure of the surface water bodies to achieve the WFD objectives:

- Land based pressures - point source such as WWTPs, IPPC licensed facilities, combined sewer and treatment plant overflows, Section 4 licensed discharges, and also diffuse sources such as nutrient inputs: and
- Marine Pressures – Morphological alterations and aquaculture licences (Lower Shannon Estuary).

The Shannon RBD Transitional and Coastal Waters Action Programme outlined a programme of measures to be implemented in the catchment areas, and in some instances at a regional or national level. Those of relevance to flood risk assessment and management include:

- Morphology (Controls on Physical Modifications): The Action Programme notes that the DECLG are considering the introduction of new regulations to control physical modifications in surface waters which may involve an authorisation system where low risk activities may simply be registered and higher risk works would be subject to more detailed assessment and more prescriptive licences. Consultation with the DECLG has confirmed that they are currently in the process of reviewing water legislation on a number of fronts, including controls on physical modifications however it may be some

<sup>11</sup> <http://gis.epa.ie/betazone/envision/>

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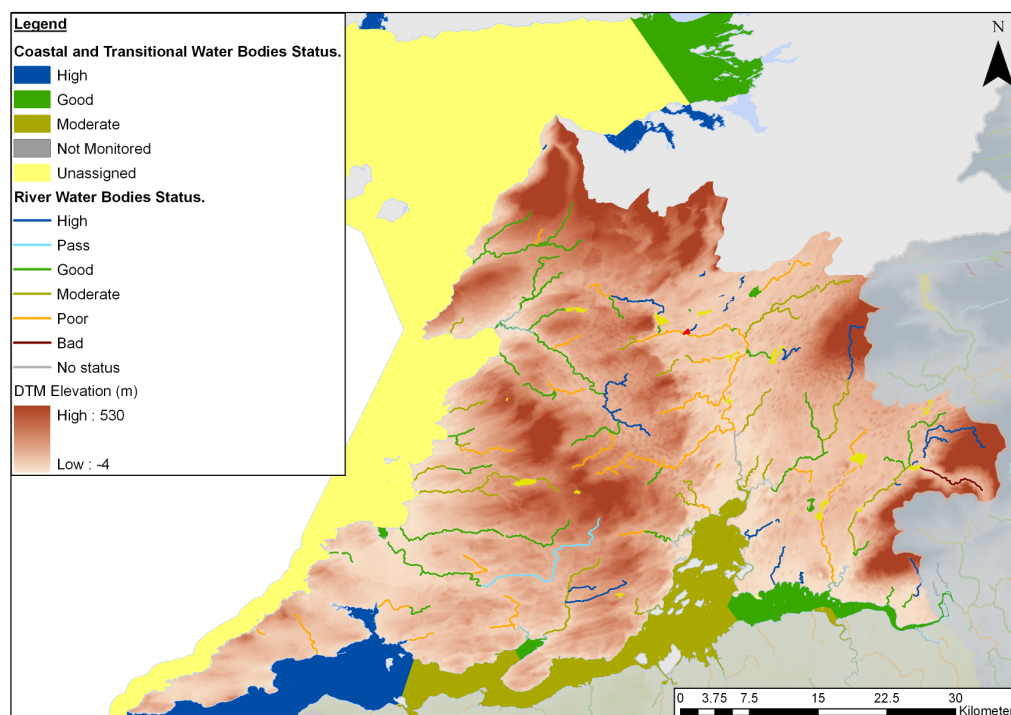
time before the regulation concerning controls on physical modifications are implemented;

- Implementation of the Shellfish Waters Pollution Reduction Programmes (there are three relevant to this Unit of Management: West Shannon Carrigaholt, West Shannon Rinevella and West Shannon Poulmasherry Bay Pollution Reduction Programmes (DECLG, 2010-12)); and
- Full implementation of existing legislation including the Bathing Water Quality Regulations (including the development of Bathing Water Management Plans), Water Pollution Acts, Water Services Act, IPPC regulations, Urban Wastewater Treatment regulations, the Foreshore Acts and the Birds and Habitats Directives (particularly the Appropriate Assessment process).

The pressures/activities and measures outlined in the river catchment WMU Action Plans referred to under the 'River and Lake' section above are also relevant to the transitional and coastal water bodies within this Unit of Management.

### Overall Status

Figure 3.4.1 presents the current reported status of surface water bodies as provided by the EPA November 2011. All water body classification results are currently being reviewed and updated with more recent monitoring data as part of the 2015–2021 river basin management cycle. These will be reviewed in consultation with the EPA as the SEA process developments.



**Figure 3.4.1 - Classification of surface water bodies under the WFD within UoM 27-28 (source: EPA)<sup>13</sup>**

<sup>12</sup> Pollution Reduction Programmes: <http://www.environ.ie/en/Environment/Water/WaterQuality/ShellfishWaterDirective/ShellfishWatersFinalCharacterisationReportsandPRPs/Clare-Kerry/>

<sup>13</sup> Water bodies classified as 'pass' are recorded as achieving good status, however prior to further monitoring, the confidence in the data is not at the adequate level to classify these as 'good' status.



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As defined by the EPA the Biotic Indices or Quality (Q) Values is 'a biological water quality index based on the composition and abundance of macroinvertebrate communities e.g. mayflies, stone flies, shrimps, snails, bivalves etc. present in rivers, and their varying sensitivities to increasing levels of pollution'. There are 206 Q Value monitoring stations within this Unit of Management. The Q Values recorded at these stations are summarised in Table 3.4.1 below.

**Table 3.4.1: Q Value and equivalent WFD Status recorded at the EPA Monitoring stations within UoM 27-28**

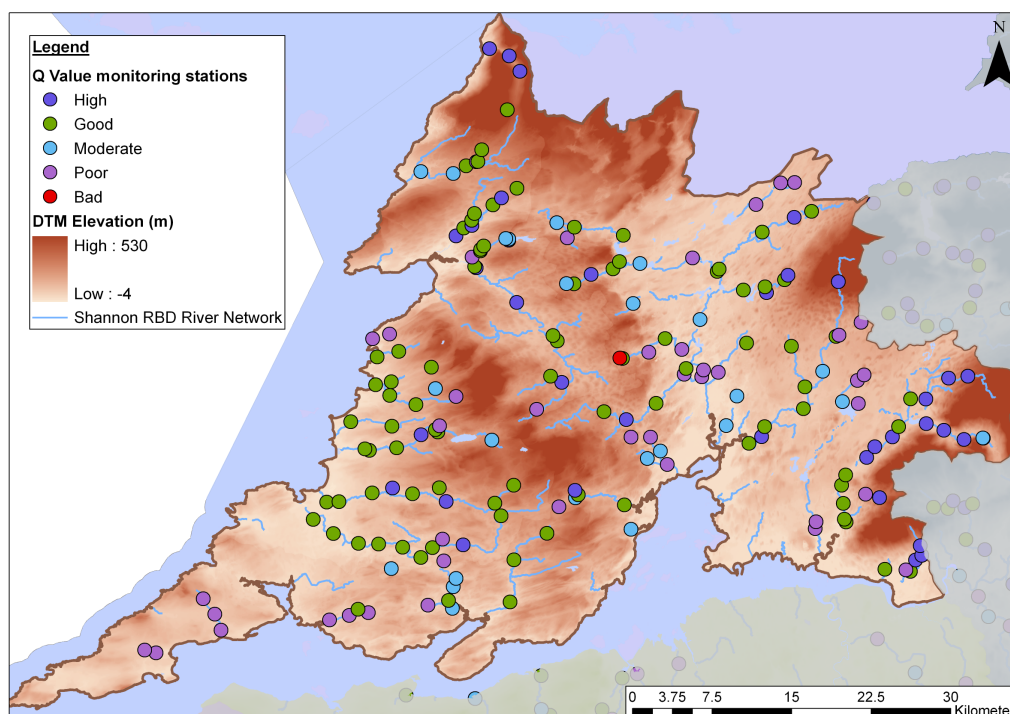
Q Value*	WFD Status	Pollution Status	Condition**	No. of UoM 27-28 Stations
Q5, Q4-5	High	Unpolluted	Satisfactory	36
Q4	Good	Unpolluted	Satisfactory	87
Q3-4	Moderate	Slightly polluted	Unsatisfactory	24
Q3, Q2-3	Poor	Moderately polluted	Unsatisfactory	42
Q2, Q1-2, Q1	Bad	Seriously polluted	Unsatisfactory	1
Un-determined	-	-	-	16

\* These values are based primarily on the relative proportions of pollution sensitive to tolerant macroinvertebrates (the young stages of insects primarily but also snails, worms, shrimps etc.) resident at a river site (EPA<sup>14</sup>).

\*\* 'Condition' refers to the likelihood of interference with beneficial or potential beneficial uses (EPA).

Note: One station in this Unit of Management was 'unclassified'.

Figure 3.4.2 presents the location of the EPA Q Values monitoring stations and the pollution status recorded at each.



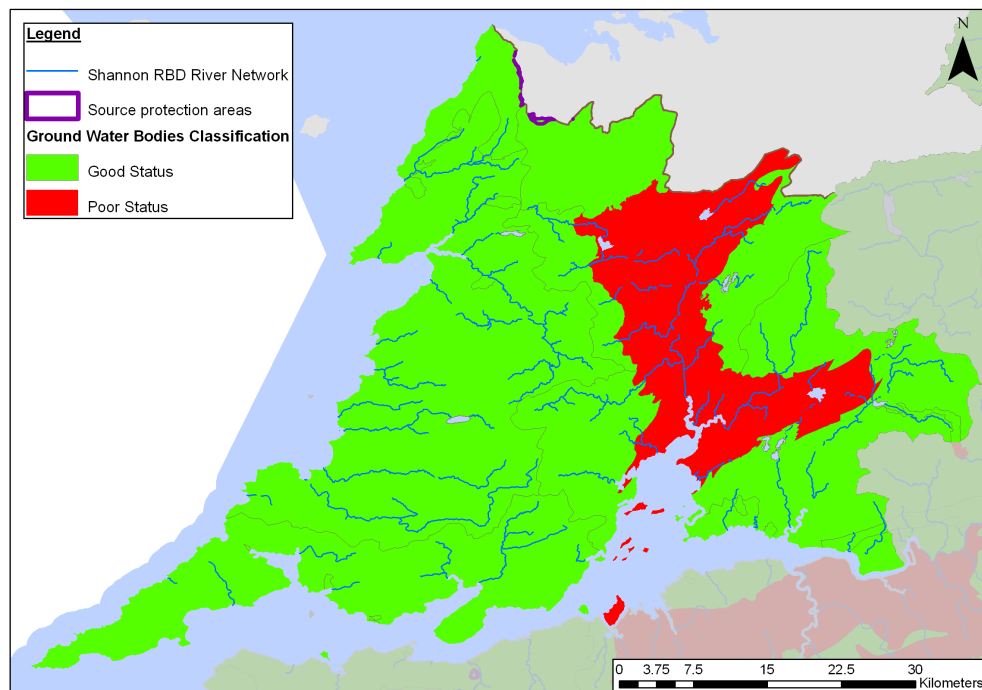
**Figure 3.4.2 -EPA Q Value Monitoring Stations within UoM 27-28 (source: EPA)**

14 EPA (2007) River Quality Surveys: Biological (<http://www.epa.ie/qvalue/webusers/>)

## Groundwater

The Shannon CFRAM Study is not assessing groundwater flood risk; however, the potential for groundwater flood risk to contribute to flood flows is recognised.

Groundwater status within this Unit of Management is classified predominately as good, however there is a large area through the centre of this Unit of Management currently classified as failing to achieve good status. Figure 3.4.3 below presents the current status of groundwater bodies classified for the purpose of the WFD and also the location of an area of source protection for drinking water. Groundwater Protection Schemes are county-based projects that are undertaken jointly between the GSI and the respective Local Authorities. The aim of these schemes is to preserve the quality of groundwater, particularly for drinking water abstraction purposes.



**Figure 3.4.3 - Classification of groundwater bodies under the WFD and Source Protection Zone within UoM 27-28 (source: EPA)**

The Shannon RBD Groundwater Action Plan associates the following anthropogenic pressures/activities with the current failure of groundwater bodies to achieve the WFD objectives:

- Point source pressures: Existing landfills and old dump sites (illegal landfill sites), mines, contaminated land, and abstractions; and
- Diffuse source pressures: agriculture (nutrient loading), and OSWTS (septic tanks in areas of high or extreme vulnerability or systems located at unsuitable sites).

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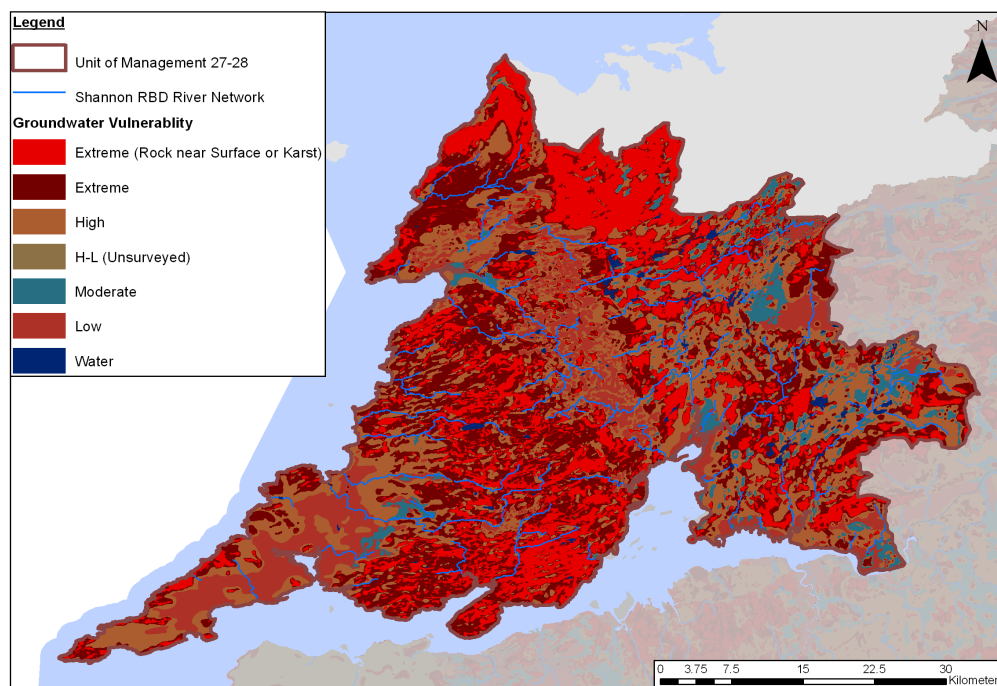
The Shannon RBD Groundwater Action Plan outlines a programme of measures to be implemented in the catchment areas as follows:

- Nitrate Action Plan – Implementation of the Nitrates Action Plan and Code of Good Agricultural Practices to reduce the level of pressure from diffuse nutrient sources;
- IPPC Licensing – Remediation of contaminated land at IPPC licensed sites; and
- OSWTS – Implement the EPA Code of Practice for Wastewater Treatment and Disposal Systems Serving Single Houses (population equivalent  $\leq 10$ )<sup>15</sup>.

Though not highlighted within the Shannon RBD Groundwater Action Plan, it is also recognised that the EPA licensing regime for WWTPs is a programme that could aid in the achievement of the WFD objectives for groundwater bodies.

All the groundwater bodies in this Unit of Management (and within the Shannon RBD) are designated as drinking water protected areas.

In terms of vulnerability (the likelihood of contamination if a contamination event occurs), there are also areas of extreme vulnerability within this Unit of Management, amounting to approximately 30% of the land area. In addition approximately 25% of the land area is identified as rock near surface or karst. These areas can be very vulnerable to infiltration and transportation of pollutants. Figure 3.4.4 illustrates the groundwater vulnerability within this Unit of Management.



**Figure 3.4.4 - Groundwater Vulnerability in UoM 27-28 (source: GSI)**

<sup>15</sup> EPA 2000 Guidance is now replaced by EPA (2010) Code of Practice for Wastewater Treatment and Disposal Systems Serving Single Houses.

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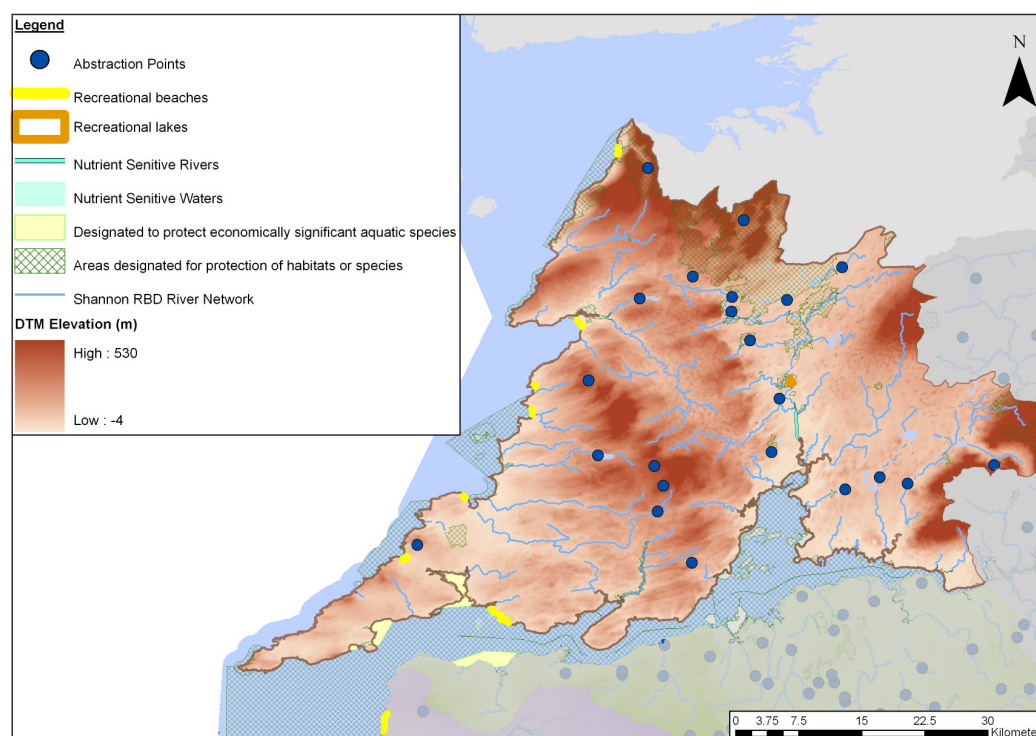
The Shannon RBD Groundwater Action Plan identifies one groundwater-dependant terrestrial ecosystem (GWDTE) within this Unit of Management, Lough Gash Turlough SAC (site code: 000051)

## Registered Protected Areas

In accordance with the WFD, a Register of Protected Areas has been compiled for the Shannon RBD. These areas are identified as those requiring special protection under existing national or European legislation:

- Waters used for the abstraction of drinking water;
- Areas designated to protect economically significant aquatic species - These are protected areas established under earlier EC directives aimed at protecting shellfish (79/923/EEC) and freshwater fish (78/659/EEC);
- Recreational waters (there are seven recreational beaches and one recreational lake within this Unit of Management);
- Nutrient Sensitive Areas (River Fergus); and
- Areas designated for the protection of habitats or species (refer to Section 3.6 for details).

The locations of the Registered Protected Sites currently recorded for this Unit of Management are illustrated in Figure 3.4.5.



**Figure 3.4.5 - Registered Protection Areas within UoM 27-28 (source: EPA)**

## Activities / Pressures

Figure 3.4.6 illustrates the distribution of various activities within this Unit of Management which can both influence and be influenced by the quality of water. The majority of this data was collated for the purpose of the WFD (and reported within the RBMPs 2009-2015) and is currently being updated by the EPA and Local

## Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)

Authorities. Further information relating to these activities will be considered where relevant in the next stages of the SEA.

A total of 24 facilities within this Unit of Management currently hold IPPC licences. IPPC licences aim to prevent or reduce emissions to air, water and land, reduce waste and use energy/resources efficiently.

There are five waste transfer stations which are licensed by the EPA, and a total of seven landfills located within this Unit of Management.

Data supplied by the EPA indicated that there are 38 WWTPs within this Unit of Management. The EPA report 'Focus on Urban Waste Water Discharges in Ireland' (February 2012), includes a review of the operation of urban waste water treatment plants (UWWTP) that are the subject of an EPA waste water discharge licence application. Within the Unit of Management the status of these UWWT varies from pass, fail to undetermined.

The majority of this Unit of Management is unsewered, with private sewerage systems/septic tanks installed. There are a number of sewered areas within this unit of Management as indicated in Figure 3.4.6 including the following areas<sup>16</sup>:

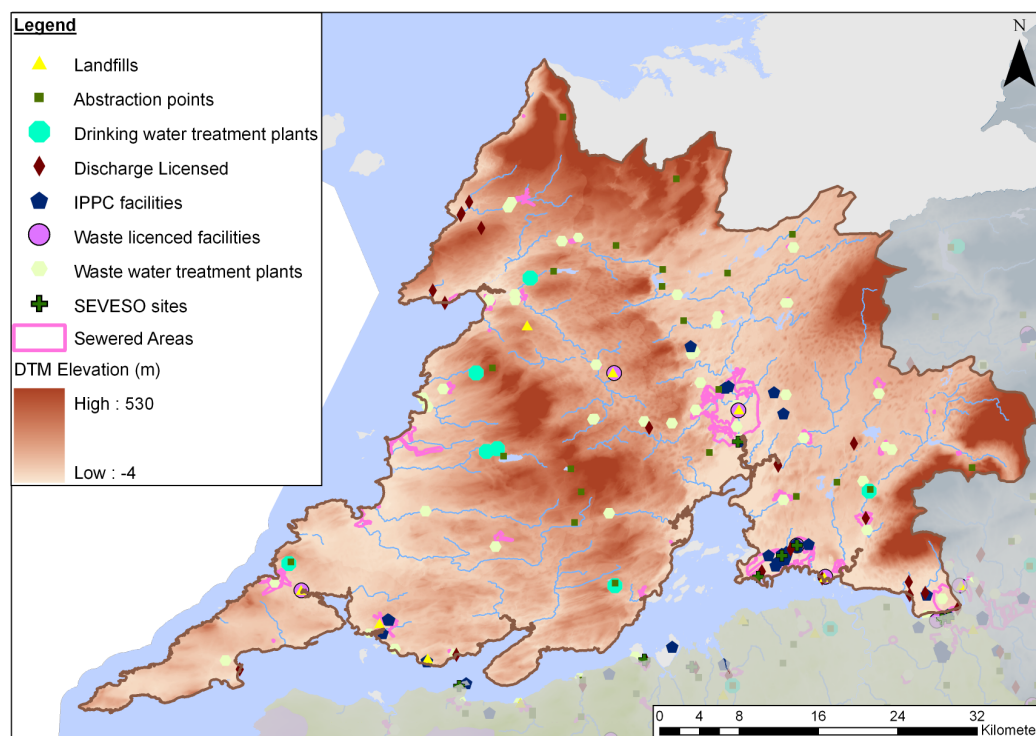
- Ennis/Clarecastle (two areas);
- Ennistymon;
- Kilkee;
- Kilrush;
- Lahinch;
- Lisdoonvarna; and
- Newmarket-on- Fergus.

Water Pollution Discharge Licences are issued under Section 4 of the Local Government (Water Pollution) Act 1977 as amended in 1990 and refer to the discharge of trade or sewage effluent to waters. There are 21 such discharges within this Unit of Management.

<sup>16</sup> This does not include any sewerage network connected to a sewage treatment plant with less than 500 p.e. as this was the threshold for inclusion in WFD risk assessments.



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**Figure 3.4.6 - Estimated locations of licensed abstractions (as of 2008), IPPC and waste licenced facilities, landfills, urban waste water treatment, waste water treatment plants, sewerred areas and SEVESO sites (source: EPA, GSI and Clare/ Galway/ Limerick County Council)**

There are seven water supply treatment plants within this Unit of Management, one of which is within the Fergus WMU, two in the South Clare/ Shannon WMU and four in the West Coast Clare WMU. Water supply treatment plants are most likely to be located on the banks of rivers, and the EPA have published guidance<sup>17</sup> on post-flooding checks for Local Authorities to implement at such plants.

The Control of Major Accident Hazards Involving Dangerous Substances Regulations, 2006 (SEVESO Regulations) deal with dangerous substances in industry, covering both industrial activities as well as the storage of dangerous chemicals. There are two tiers to the legislation; Lower Tier for smaller facilities using or storing hazard material, which requires a Major Accident Prevention Policy, general duties and notification to relevant authorities, and an Upper Tier for large facilities, requiring additional plans such as internal emergency plans and notifications to the public. Within this Unit of Management there are four facilities listed as SEVESO sites one Upper located at Shannon Airport and three Lower located at Shannon Industrial Estate, Smithstown Industrial Estate and Clarecastle.

### Hydromorphology

The WFD requires that hydromorphological elements are considered when defining, maintaining and improving water status. Physical (morphological) alterations water can include alterations to facilitate certain uses such as navigation, flood defence/protection schemes, agricultural drainage schemes, etc.

<sup>17</sup> Advice Note No.6, Version 1; Restoring Public Water Supplies Affected by Flooding, EPA (November, 2009)



## Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)

In accordance with the WFD, the Fergus Spancelhill, Fergus Main Lower and Doo Lough water bodies have been designated as Heavily Modified Water Bodies (HMWBs). A HMWB is defined as 'a body of surface water which as a result of physical alterations by human activity is substantially changed in character'. The WFD requires that these water bodies meet the objectives of maximum or good ecological potential.

There are no AWBs present within this Unit of Management. An AWB is defined as 'a body of surface water created by human activity'.

### 3.4.2 Future trends

The implementation of the programme of measures identified to meet the requirements of the WFD for this Unit of Management and the wider Shannon RBD aim to drive improvements and maintenance of the water quality in the short term and provide a basis for the continued maintenance of good status in the future. The EPA are continuing to monitor the status of surface and ground water bodies, and work will soon commence on the Shannon RBMP for the 2016 – 2021 cycle.

Proposed future development must meet the requirements of the WFD and transposing regulations. Derogations relating to new physical modifications and new sustainable developments are provided for in this legislation<sup>18</sup>; however, strict conditions for the application of such exemption provisions apply and must be demonstrated if these are to be considered for future development.

Future physical alterations to water bodies within this Unit of Management are likely to include flood relief measures (modifications).

At present a Strategic Integrated Framework Plan for the Shannon Estuary is in preparation along with its associated SEA and AA. It aims to produce Development Plans, identifying key locations, for environmentally sustainable development while outlining multiple uses for the Shannon Estuary.

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<sup>18</sup> Articles 32 – 34 of S.I. No. 272 of 2009 European Communities Environmental Objectives (Surface Waters) Regulations 2009

**Box 3.4: Water – Key strategic issues relating to flood risk management**

- Proposed future development must meet the requirements of the WFD and transposing regulations;
- There may be opportunities for flood risk management measures/options which can present both flood risk benefits and ensure the environmental objectives of the WFD are met;
- The WFD programmes of measures include the modification or maintenance / removal of obsolete structures, including flood defence structures and also requirements for enhancing river morphological development and flood storage. This can offer opportunities and constraints for flood risk management;
- Physical modifications of water bodies can affect natural sediment processes and biodiversity; and
- FRMPs have the potential to help inform appropriate and sustainable planning / operation of water services, e.g. Water Safety Plans in accordance with EPA Guidance (Advice Note No. 8 Developing Drinking Water Safety Plans; EPA, 2011).

### 3.5 Air and Climate

**Air quality** in Ireland is of good quality, and remains among the best in Europe<sup>19</sup>. The EPA have established an air quality monitoring network throughout the country with two permanent stations located within this Unit of Management, in Ennis and Shannon Town, at which the current air quality is described as 'good'. This ongoing monitoring programme is a prerequisite of the transposed CAFE Directive<sup>20</sup>.

Air quality will not be influenced or affected by the recommendations of the strategic flood risk assessment and management study for this Unit of Management or by the wider Shannon CFRAMS Study. Any specific issues relating to air quality will be considered as part of the environmental impact assessment of any detailed projects arising from the FRMP. Therefore, air quality will not be considered further in the SEA process as air quality will not be affected by CFRAM process.

Future changes in **climate** and associated impacts on sea level, rainfall patterns/intensity and river flow will influence flooding frequency and extent in the future. The FRMPs will help Ireland adapt to some impacts of climate change. In addition to using best available data, policy and research documents will be referred to on considering these changes and determining the likely future influence of climate change on flood risk in this Unit of Management. The consideration of climatic factors in the development of the FRMP will assist the Local Authorities in compliance with the Regional Planning Guidelines requirements to adopt sustainable flood risk strategies in areas likely to be at risk of flooding in the future in the context of climate change and changing weather patterns.

Stakeholder consultation undertaken to date has identified flood forecasting as a key aspect of flood risk assessment and management in Ireland. Rainfall prediction is a difficult factor to quantify (and is outside the scope of this Study); however, further development of elements of the OPW's national pluvial flood risk screening study<sup>21</sup> is considered essential to develop the quality of flood warnings.

<sup>19</sup> Environmental Protection Agency (2010) Air Quality in Ireland Report.

<sup>20</sup> Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive, transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011).

<sup>21</sup> Office of Public Works (2010) Flood Risk Assessment and Management Programme National Pluvial Screening Project for Ireland. HR Wallingford Ltd.

**Box 3.5: Climate – Key strategic issues relating to flood risk management**

- Some flexibility and adaptability within the FRMPs is likely to be required to allow the FRMPs to adapt to unforeseen climate change and associated impacts;
- Flood risk management measures may provide opportunities of renewable energy through small-scale (or micro) hydropower, e.g. on tidal barrages or locks. However, these are considered as 'bolt-on' measures to be assessed/progressed at detailed project level; and
- Green infrastructure (such as networks of peatland, parks or drainage ditches) in the context of flood risk management can reduce, if not avoid, emissions from more engineering-based solutions.

### **3.6 Biodiversity, Flora and Fauna**

#### **3.6.1 Existing conditions**

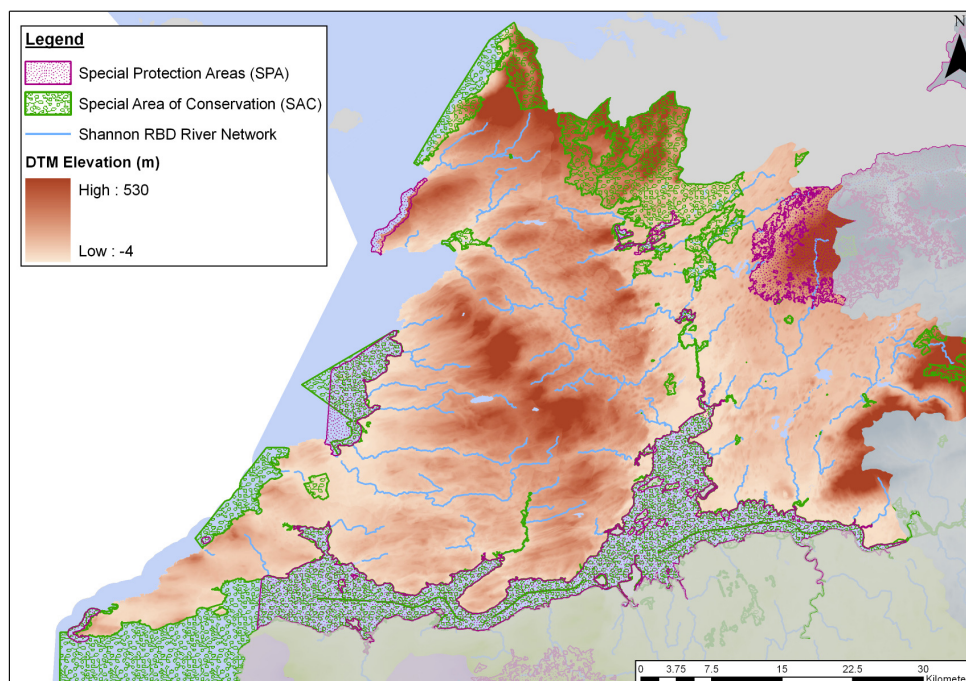
This Unit of Management contains a variety of terrestrial, wetland, freshwater, estuarine and coastal habitats which support a range of species, some of which are of particular conservation concern. Associated with these habitats and species are a number of National and European designated nature conservation sites (Natura 2000 sites). Consideration of potential impacts on these sites needs to meet the requirements of the European Habitats Directive (92/43/EEC) and Birds Directive (79/409/EEC). Specific assessment of the potential impacts of the FRMPs on these sites will be documented separately as part of the Appropriate Assessment (AA) process (required by Article 6 of the Habitats Directive).

The designated European and National nature conservation sites present within this Unit of Management are illustrated in Figures 3.6.1 and 3.6.2 and described in Tables 3.6.1 and 3.6.2.

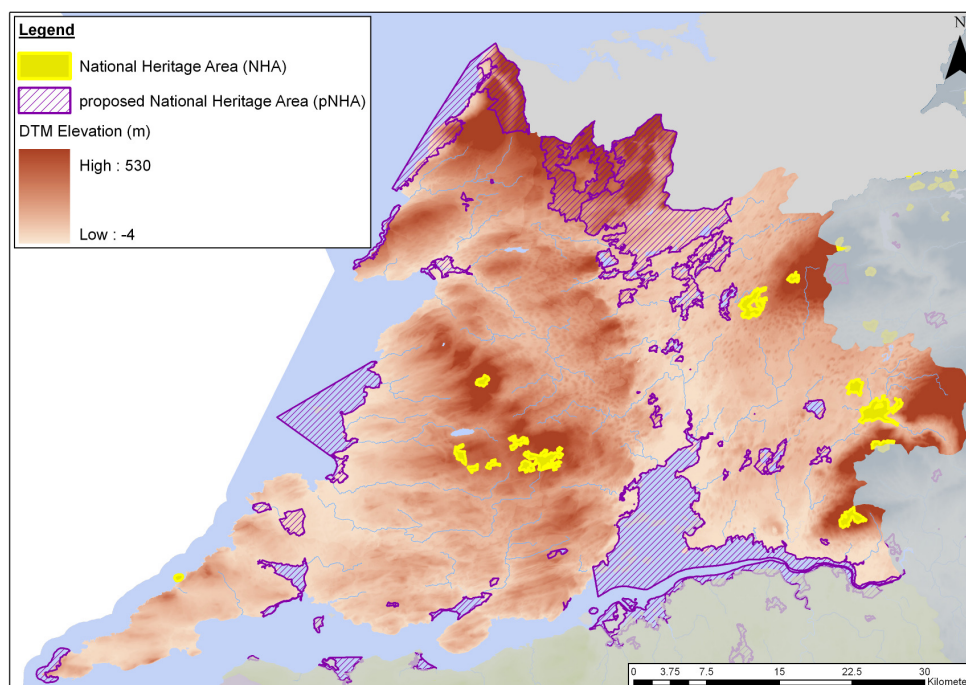
This Unit of Management contains 25 sites designated under the EU Habitats and Birds Directive; 23 of which are designated as candidate Special Areas of Conservation (cSACs), and 2 designated as Special Protection Areas (SPAs).

There are nine nationally designated National Heritage Areas (NHAs) which are protected under the Wildlife Act 1976 (as amended 2000), as well as 33 proposed Natural Heritage Sites (pNHAs) which were published on a non-statutory basis in 1995, but have yet to be statutorily proposed or designated. To date, the only sites to have received full NHA status are water dependant bog habitats, as reflected with the nine designated NHA within this Unit of Management. Some pNHAs have been designated within Natura 2000 sites, and this affords them some statutory protection under the EU Habitat and Birds Directives. However, it is acknowledged that this may not be specific to the listed pNHA interests.

**Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)**



**Figure 3.6.1 - European designated nature conservation sites within UoM 27-28 (source: NPWS)**



**Figure 3.6.2 - Nationally designated nature conservation sites within UoM 27-28 (source: NPWS)**

The special features for each Natura 2000 site have been compiled from NPWS records for use in the Appropriate Assessment Screening process, however, due to the extensive number of designated sites, these details are not provided within this report. This and other information, such as conservation objectives, on the



## Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)

designated sites will be detailed for the AA Screening and next stage of the SEA as required. Some of the key habitats and species associated with the sites relevant to this Unit of Management are:

- The Burren Complex SAC contains twelve habitats that are listed on Annex I of the EU Habitats Directive and three species of plant and animal listed on Annex II of this Directive;
- Lesser Horseshoe Bat (*Rhinolophus hipposideros*), a species listed on Annex II of the EU Habitats Directive is known to occur in a number of SACs e.g. Danes Hole (Poulnalecka), Pouladatig Cave and Lough Cutra;
- *Vertigo angustior*, a species of snail that is listed on Annex II of this directive is known in the Carrowmore Dunes SAC; and
- Slieve Aughty Mountains SPA hosts Hen Harrier and Merlin populations.

**Table 3.6.1: European designated nature conservation sites within UoM 27-28 (Natura 2000 Sites)**

Name	Site Code	Name	Site Code
SACs			
Ballyallia Lake	000014	Ballycullinan, old domestic Building	002246
Ballycullinan Lake	000016	Toonagh Estate	002247
Ballyogan Lough	000019	Carrowmore Dunes	002250
Danes Hole, Poulnalecka	000030	Rylane, old domestic buildings	002314
Dromore Woods and Loughs	000032	Ratty River Cave	002316
Pouladatig Cave	000037	Cregg House Stables, Crusheen	002317
Lough Gash Turlough	000051	Knockanira House	002318
Moyree River System	000057	Kilkishen House	002319
Poulnagordon Cave (Quin)	000064	Tullaheer Lough and Bog	002343
Lough Cutra	000299	Newhall and Edenvale Complex	002091
Ballyteige (Clare)	000994	Newgrove House	002157
East Burren Complex	001926	Ballymacrogan old farm buildings	002245
Keevagh old domestic building	002010		
SPAs			
Ballyallia Lough	004041	Slieve Aughty Mountains	004168

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**Table 3.6.2: Nationally designated nature conservation sites within UoM 27-28**

Name	Site Code	Name	Site Code
NHAs			
Doon Lough	000337	Woodcock Hill Bog	002402
Cloonloun More Bog	002307	Lough Acrow Bogs	002421
Lough Naminna Bog	002367	Oysterman'S Marsh	002439
Slievecallan Mountain Bog	002397	Maghera Mountain Bogs	002442
Cragnashingaun Bogs	002400		
pNHAs			
Ballyallia Lake	000014	Tullaheer Lough and Bog	000070
Ballycar Lough	000015	Castle Lake	000239
Ballycullinan Lake	000016	Ballyteige (Clare)	000994
Ballyogan Lough	000019	Cahircalla Wood	001001
Danes Hole, Poulmalecka	000030	Cloonsnaghta Lough	001004
Dromore Woods and Loughs	000032	Dromoland Lough	001008
Durra Castle	000033	Fin Lough (Clare)	001010
Fort Fergus (Ballynacally)	000035	Garrannon Wood	001012
Pouladatig Cave	000037	Gortglass Lough	001015
Inchicronan Lough	000038	Lough Cullaunyheeda	001017
Lough Goller	000048	Caherkinallia Wood	001024
Derrygeeha Lough	000050	St.Senan's Lough	001025
Lough Gash Turlough	000051	Lough Cleggan	001331
Moyree River System	000057	Old Domestic Building (Keavagh)	002010
Newpark House (Ennis)	000061	Rosroe Lough	002054
Paradise House (Ballynacally)	000062	Newhall and Edenvale Complex	002091
Poulnagordon Cave (Quin)	000064		

Many of the designated sites within this Unit of Management have water dependant and wetland habitats associated with them. The DECLG have published draft Guidance for Planning Authorities on Drainage and Reclamation of Wetlands for consultation which contains a listing of habitat types associated with wetlands. This Guidance will be consulted and specific habitat types associated with water dependant and wetland habitat will be detailed where relevant during the AA process.

Additionally Ireland's coastline, including the Shannon Estuary, extending seawards, is designated as an OSPAR region. OSPAR is a Convention to protect marine environment of the North East Atlantic, Ireland has committed to establishing marine protected areas, however no legislation is currently used in Ireland to protect these sites.

There is one known protected population of Freshwater Pearl Mussels (Annex II species) within this Unit of Management at Cloon in the Shannon Estuary.

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There are up to four Wildfowl Sanctuaries<sup>22</sup>, four Statutory Nature Reserves<sup>23</sup> and two RAMSAR<sup>24</sup> sites within this Unit of Management.

Actions for Biodiversity, Ireland's National Biodiversity Plan 2011 -2016, recognises the role natural floodplains play in flood water retention, in addition to seeing possible biodiversity gain from wetland and/or flood plain retention or restoration in Flood Risk Management Plans. Additionally a target of this plan is 'optimised benefits for biodiversity in Flood Risk Management Planning'<sup>25</sup>

The first National Biodiversity Plan (2002), identified the importance of inland waterways, and the threats associated with these ecosystems. Adhering to NBP Limerick, Cork and Kerry Development Plans, highlight hedgerows, rivers, streams, lakes as well as associated riparian zones, canals, coastal and freshwater wetlands as being of particular biodiversity value, inside or outside of protected areas. These features can also act as important ecological corridors as outlined in Article 10 of the Habitats Directive which refers to 'stepping stones and corridors' of wildlife areas which make the Natura 2000 network a coherent ecological network.

The introduction or spread of invasive species can have a significant negative effect on wildlife and habitats (as well as the economy), and the significance of this is reflected in Ireland's second National Biodiversity Plan (2010 – 2015) and recent EC (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011). Giant Hogweed (*Heracleum mantegazzianum*) has become naturalised particularly along river banks within this Unit of Management, posing a risk to human health and the environment. Other terrestrial alien species found within this Unit of Management include Giant Rhubarb (*Gunnera tinctoria*), Himalayan Balsam (*Impatiens glandulifera*), Japanese Knotweed (*Fallopia japonica*) and Rhododendron (*Rhododendron ponticum*), all which have a negative effect on native species.

### 3.6.2 Future trends

Increasing land-use change such as urbanisation, afforestation and its associated management and changing agricultural practices are likely to continue to pose risks to the quality and distribution of aquatic and terrestrial habitats and species, both within and outside protected sites. However, the continued implementation of measures required to achieve the WFD objectives is likely to benefit protected sites and the wider aquatic environment. In addition, the Conservation Management Plans and conservation objectives which are currently being developed by the NPWS for all Natura 2000 sites, as well as other management plans for declining species (e.g. Species Management Plans) will help protect and enhance biodiversity. It should be noted that the development of these Conservation Management Plans and site specific conservation objectives are unlikely to be developed for all of Natura 2000 site in this Unit of Management, but the NPWS will continue to be consulted in this context as a stakeholder of this CFRAM Study.

<sup>22</sup> Wildfowl Sanctuaries are areas that have been excluded from the 'Open Season Order' so that game birds can rest and feed.

<sup>23</sup> Statutory Nature Reserve is an area of importance to wildlife, which is protected under Ministerial order.

<sup>24</sup> RAMSAR is the Convention on Wetlands, which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources

<sup>25</sup> DAHG (2001), Action for Biodiversity 2011-2016, Ireland's National Biodiversity Plan.

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Agri-environmental schemes, such as REPS and AEOS, with individual environmental farm plans, will continue to influence farming practices to become more environmentally friendly and sustainable (refer to Section 3.3.1).

In addition to existing guidelines and legislation on Environmental Impact Assessment (EIA), in September 2011, the revision of the Planning and Development Regulations prompted Draft Guidance for Planning Authorities on Drainage and Reclamation of Wetlands, which sets new provisions for the control of drainage and/or reclamation of wetlands, providing thresholds to trigger requirements for mandatory EIA. Of relevance to the FRMPs is the threshold of 2ha for reclamation and/or drainage of wetland on agricultural land.

The EPA's report on alien invasive species in Irish water bodies<sup>26</sup> and the continuing development of the Biological Data Centre National Invasive Species Database will aid in the documentation of the distribution of invasive species in Ireland. These reports and datasets will go towards preparing Ireland for the forthcoming European legislation on halting the spread of invasive species.

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<sup>26</sup> EPA (2011) Alien Invasive Species in Irish Water Bodies. Synthesis Report for the STRIVE-funded project: 2007-W-MS-2-S1

**Box 3.6: Biodiversity – Key strategic issues relating to flood risk management**

- Coastal squeeze associated with construction and maintenances of coastal flood defences maybe result in habitat loss;
- Requirement for ecological protection can pose restrictions on existing/future maintenance of flood defences;
- Floodplains and coastal lagoons have an important role for biodiversity, as they help remove nutrients, provide wetted habitats as well as acting as key aspects in many species' food chain. Currently, the spatial definition of floodplains is unclear, exacerbated by development, farming practices and drainage schemes;
- Wetlands may provide some level of natural flood protection (green infrastructure);
- Flood risk management options may affect winter flooding, which can be essential for some protected bird species;
- Consideration of potential impacts on Natura 2000 sites and protected species outside these designated sites will be required;
- Consideration of non-designated biodiversity features e.g. habitats along watercourses and coastal areas, and locally important habitats and species;
- Flood measures can contribute to habitat fragmentation and impact on ecological corridors / networks e.g. riparian habitat and wetted areas;
- Flood storage options can enhance both biodiversity and recreational/tourism value of an area;
- Activities associated with the implementation of flood risk management plans should not result in the spreading or introduction of invasive species;
- Changes to flood regimes may adversely affect water quality resulting in changes in the balance of aquatic ecosystems and eutrophication of water bodies; and
- Flood risk management measures can pose barriers to fish migration. The maintenance and retention of bridges, bridge sills and fish passes is important to fish passage.

## 3.7 Fisheries, Aquaculture and Angling

### 3.7.1 Existing conditions

#### Fisheries

Fish are an important indicator species of water quality. Within this Unit of Management the main rivers support, and are capable of supporting salmonid species such as the salmon and brown trout. Four watercourses within this Unit of Management were monitored / surveyed to help determine the draft fish ecological status for the purpose of the WFD, the results of which are outlined in Table 3.7.1.

**Table 3.7.1 – WFD fish monitoring / survey results recorded for UoM 27-28<sup>27</sup>**

Water body	Draft Fish Ecological Status	Species Present
<b>Rivers</b>		
Caher River Bridge 2 km d/s Formoyle (28C010200)	Good	Brown trout; European eel
River Fergus Poplar Bridge (27F010100)	Good	Brown trout; European eel; Perch; Pike; three spined stickleback
Moyree River Bridge u/s Fergus River (27M020700)	Moderate	Brown trout; European eel; Lamprey; Perch; Pike; Salmon
River Fergus Bridge near Clonroad House (27F010700)	Moderate	Brown trout; European eel; Flounder; Lamprey; Perch; Pike; Salmon; three spined stickleback
Broadford River Bridge u/s Doon Lough (27B020800)	Good	Brown trout; European eel; Gudgeon; Salmon; three spined stickleback
Broadford River Just u/s South Branch confluence (7B020300)	Good	Brown trout; European eel; Salmon; three spined stickleback
Gourna River Bridge u/s Owenogarney River confluence (7G020600)	Good	Brown trout; European eel; Lamprey; Salmon; three spined stickleback; Stone loach
Glendine River (Clare) Knockloskeraun Bridge (28G020200)	Good	Brown trout; European eel; Salmon

<sup>27</sup> Inland Fisheries Ireland <http://www.ifigis.ie/WFDFishMap/>



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Water body	Draft Fish Ecological Status	Species Present
Creegh River <i>Bridge at Creegh</i> (28C021400)	Good	Brown trout; European eel; Flounder; Salmon; three spined stickleback
<b>Transitional (estuarine)</b>		
Lower Shannon Estuary	Good	Ballan wrasse; Black goby; Cod; Common goby; Common sole; Conger eel; Corkwing wrasse; Cuckoo wrasse; Dab; Dragonet sp.; European eel; European seabass; spined stickleback; bearded rockling; Flounder; Greater pipefish; Gunnel (Butterfish); Lesser spotted dogfish; Nilsson's pipefish; Plaice; Pogge; Pollack; Poor cod; Sand goby; Sand smelt; Short-spined sea scorpion; Snake pipefish; Sprat; Thick-lipped grey mullet; Three-spined stickleback; Two-spotted goby

The Fergus River is the only river within this Unit of Management designated as a Salmonid River under the European Communities (Quality of Salmonid Waters) Regulations, 1988.

In 2012 the Standing Scientific Committee (SSC) of the IFI published their assessment of salmonid rivers throughout Ireland and advised that a number of the rivers should be 'closed' to salmon fishing as there was 'no surplus of fish available for harvesting'. The Fergus River was identified for closure and is now legally closed under the Conservation of Salmon and Sea Trout (Closed Rivers) Bye-Law No. C.S. 309, 2011.

There are no IFI fish farms located within this Unit of Management.

There is currently no commercial eel fishing in this Unit of Management. In 2008 the Department of Communications, Energy and Natural Resources (DCENR) published their National Eel Stock Recovery Plan in 2008 which contained the following objectives:

- An immediate cessation of the commercial eel fishery and closure of the market;
- Mitigation of the impact of hydropower, including a comprehensive silver eel trap and transport plan;
- Ensuring upstream migration of juvenile eel at barriers; and
- The improvement of water quality in eel habitats.

Prior to this cessation of commercial eel fishing an Eel Management Plan was established for the Shannon RBD and included areas on the Fergus where eel fishing took place.

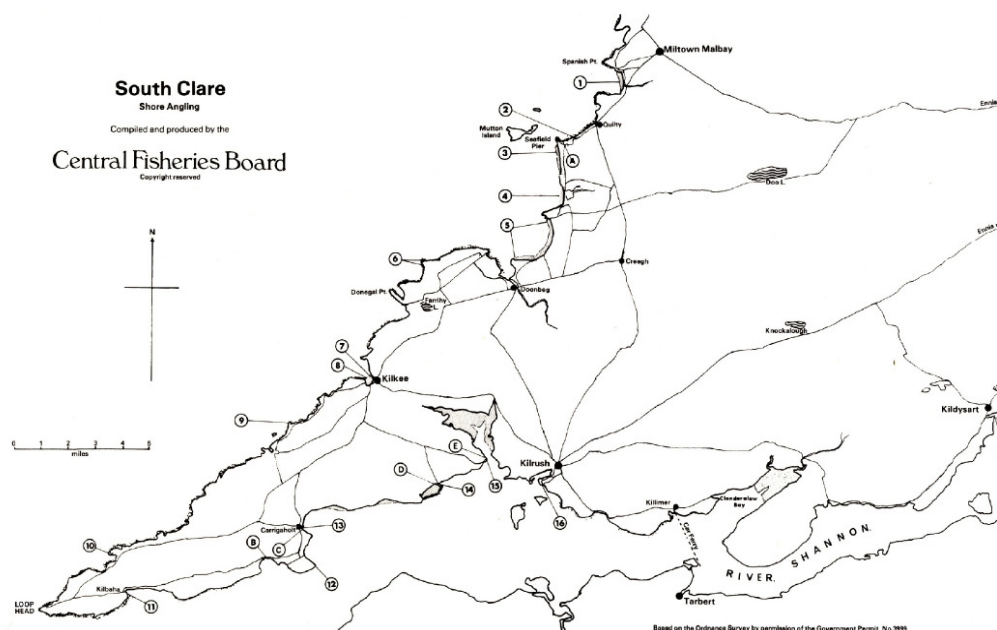
The IFI provides mapped locations of easy access angling points for boats and family access to support recreation and tourism in the area. There are three of these access locations within this Unit of Management<sup>28</sup> (Lough Bridget, Kilgory Lake and Cloondorney Lough).

<sup>28</sup> Inland Fisheries Ireland <http://www.ifigis.ie/AccessibleAnglingMap/>

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A series of shore angling maps were developed by the IFI in the 1980's including one for the South Clare illustrating the angling 'hot spots'. An extract of this map illustrating the location of shore angling spots within Unit of Management is presented in Figure 3.8.1 and includes:

- Spanish Point (No.1);
- Quilty (No.2);
- Seafield (No.3);
- Lough Donnell (No.4);
- Doughmore Strand (No.5);
- Ballyward (No.6);
- Kilkee Pier (No.7);
- Kilkee (No.8);
- Castle Point (No.9);
- Bridge Of Ross (No.10);
- Kilbaha (No.11);
- Kilcreedaun Point (No.12);
- Carrigaholt Pier (No.13);
- Querrin (No.14);
- Mouth of Poulnasherry Bay (No.15);
- Cappagh Pier (Kilrush) (No.16); and
- Kildysart Pier (No.17).



**Figure 3.7.1 – Shore Angling Locations within UoM 27-28 (source: IFI)**

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There are three designated shellfish area within this Unit of Management<sup>29</sup>:

- West Shannon Poulmasherry Bay;
- West Shannon Carrigaholt; and
- West Shannon Rinevella.

The bulk of the shellfish production in the western Shannon Estuary comprises bag and trestle cultured Pacific Oysters. In accordance with Article 5 of the Shellfish Directive (2006/113/EC) and Section 6 of the S.I. No. 268 of 2006, the DECLG has established a Pollution Reduction Programme (PRP) for this shellfish designated area in order to protect and improve water quality in this area.

These PRP have identified the following key and secondary pressures associated with the designated shellfish area:

- West Shannon Poulmasherry Bay – no key or secondary pressures;
- West Shannon Carrigaholt – OSWWTS and Agriculture; and
- West Shannon Rinevella - no key or secondary pressures.

The PRPs also include a number of measures required for the conservation of these areas.

There are large areas within the Shannon Estuary used for the aquaculture. Two of the most significant stretches for oyster are the northern section of the estuary between Kilrush and Doonaha, and the area of the estuary between Foynes and Tarbert (the latter of which is more relevant to Unit of Management 24).

### 3.7.2 Future trends

The implementation of the WFD programme of measures in addition to ongoing programmes and studies such as the Shellfish Pollution Reduction Programme and the National Salmon Monitoring Programme will positively influence the quality of the aquatic environment, and this will in turn improve the quality of aquatic resources for angling, aquaculture and commercial fisheries. These measures are also likely to have indirect beneficial impacts on recreation and tourism.

The IFI are currently in the process of undertaking their Atlantic Aquatic Resource Conservation (AARC) project. The aim of AARC is increase our understanding of the factors causing salmon population to decline in the River Shannon and how they might be addressed by using new developments from the study of restoration ecology. This project outlines a number of objectives including:

- Identify and relieve access issues; and
- Assess locations for re-establishment of populations.

The final project report is due to be published in the last quarter of 2012 and any potential interaction with the FRMP will be further investigated at the next stage of the SEA process.

The closer of the River Fergus to salmon fishing may in the future result in fisheries / conservation management plans for these watercourses as this closure reflects their failure to achieve a surplus stock above their calculated conservation limit, and they now require efforts to rebuild the salmon stocks.

<sup>29</sup> Designated under the EC (Quality of Shellfish Waters) Regulations S.I. No. 268 of 2006 and S.I. No 55 of 2009

**Box 3.7: Fisheries, Aquaculture and Angling – Key strategic issues relating to flood risk management**

- Flooding and flood risk management measures can result in changes to morphological features and associated habitat supporting fisheries;
- Flooding may result in the introduction of pollutants and/or nutrient loads to waters supporting fisheries;
- Waterside access and variety of water depths are important features for anglers;
- Flood risk management options may present the potential for enhancement opportunities for commercial fisheries, aquaculture and/or angling, but can also pose restrictions to the current operation and/or expansion of these activities; and
- Sea level rise can adversely impact on fishing harbours and their local communities.

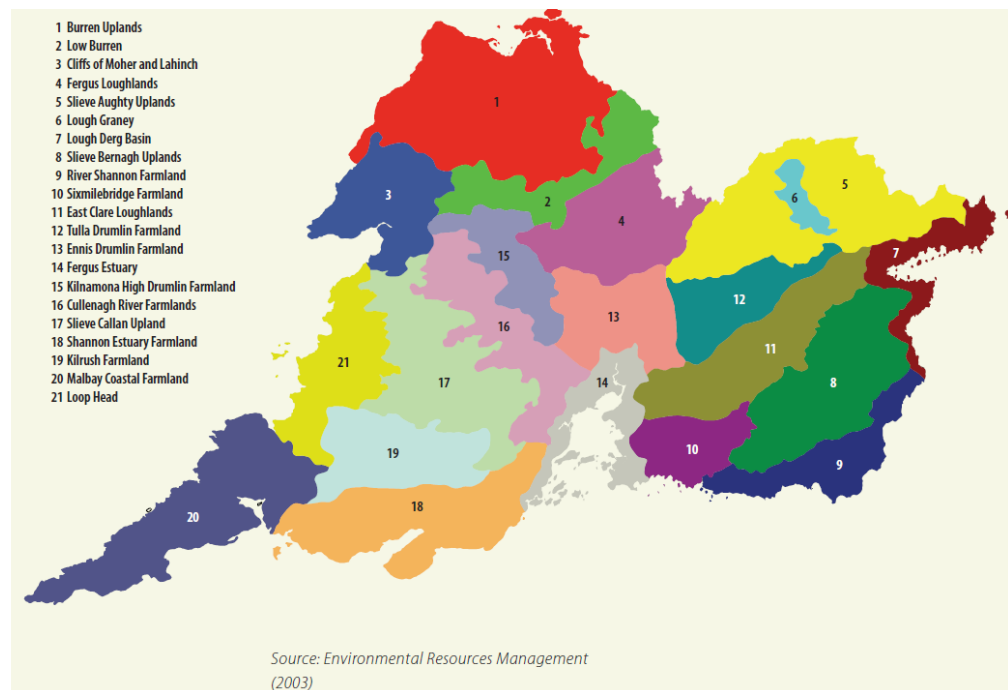
### 3.8 Landscape and Visual Amenity

#### 3.8.1 Existing conditions

The landscape within this Unit of Management is very diverse with areas such as the Burren, Cliffs of Moher, the Atlantic Coast, Lough Derg, the Shannon Estuary, and upland areas such as the Slieve Aughty Mountains. The importance of the landscape and visual amenity has intrinsic value in addition to natural beauty, which is a resource used both by residents and visitors, and important in terms of recreation and tourism.

The Planning and Development Act 2010 requires all Local Authorities to identify Landscape Character Areas (LCA) within their Development Plans to ensure that defining features are protected and managed. There is no national classification system for LCAs as these are geographically specific and have their own distinctive character based on its location and surrounding environment. Figure 3.8.1 illustrates the LCAs defined by Clare County Council.

In addition, Clare County Council has identified twelve seascapes including the River Fergus, River Shannon and Lower Shannon.



**Figure 3.8.1 - Landscape character areas within Clare only (source: Clare County Development Plan)**

Local Authorities have also incorporated landscape designation into their Development Plans in the form of view, prospects, landscape conservation areas and scenic routes. Similarly to LCAs, there is no national standardised approach for designating these landscape features/sites.

Data relating to the various landscape designations is being collated in consultation with Local Authorities, and these sites/features will be considered further during the next stages of the SEA process.

The National Scenic Landscapes Map Drafted by Bord Fáilte in 1994 identifies two draft national scenic landscapes within this Unit of Management: the Burren and Lough Derg

## 3.8.2 Future Trends

In September 2011 the DAHG published a strategic issues paper for consultation on 'A National Landscape Strategy for Ireland'. This is in line with Ireland's ratification of the European Landscape Convention (2000). One main aim of this strategy is the sustainable management of change affecting landscape, and is relevant to both terrestrial and aquatic environments.

As part of the Heritage Council 2010 report Proposals for Ireland's Landscapes they recommended the introduction of a Landscape Ireland Act. This has been included as an objective in the recent Heritage Council Strategic Plan 2012-2016.

The existing landscape is not expected to change significantly in the immediate future. Landscape protection has been recognised in the County Development Plans, but as noted above, the classification for areas of scenic landscapes, scenic routes, views and prospects etc differ between counties. Relating to this, Fáilte Ireland has produced a feasibility study<sup>30</sup> which provides a framework for the development of a national landscape map for the whole country.

### Box 3.8: Landscape and Visual Amenity - Key strategic issues relating to flood risk management

- Flood risk management options can have positive and negative effects on visual amenity;
- Development pressures around lakeshore and floodplains can deteriorate landscape;
- Future planning restrictions on development within areas at risk from flooding such as river valleys, estuaries and coastlines could help to protect the landscape character as well as the view within and from, such important landscapes;
- Failure to protect or manage flood risk areas may lead to short-term or medium-term harm to landscape and visual amenity of areas surround flood risk centre (e.g. abandonment of buildings); and
- Flood risk management can provide opportunities to enhance landscape and visual amenity by restoring more natural river forms and links between watercourses and their flood plains. Opportunities for reed-bed / wetland retention and/or enhancement can be considered.

<sup>30</sup> Fáilte Ireland Scenic Landscape Feasibility Study 2007



### **3.9 Material Assets (economic), Development and Infrastructure**

#### **3.9.1 Existing Conditions**

Industry associated with urban areas in this Unit of Management is predominately located in the Shannon Industrial Estate and along the River Fergus. These industries comprise primarily of chemical, glass and metal processing/manufacturing.

This Unit of Management is serviced by two main National Primary Routes: the M18/N18 Galway-Limerick and the N19 which branches off the N18 towards Shannon Airport. National Secondary Routes provide medium distance through-routes connecting main towns. The National Secondary Routes in Clare consist of the N85 Ennis-Inagh-Ennistymon, N67 Killimer-Kilrush-Lahinch-Ballyvaughan and N68 Kilrush-Ennis. Many of the existing roads, including the national roads are located close to and along river valleys, and have a history of flooding (refer to Section 2.2). Significant improvements have been made to the road network in the past decade but the proposed developments are uncertain at present.

Rail services in this Unit of Management are provided by a branch off the Limerick line which serves Ennis and Sixmilebridge.

There are no navigation canals within this Unit of Management.

Section 3.4 of this Annex details the number of important infrastructure types such as wastewater and water treatment plants.

Shannon International Airport is located within this Unit of Management. This airport caters for over two million passengers per annum. It is recognised that the airport maintains and operates assets such as embankments, walls and two pumping stations. Shannon Airport is identified as an IRR within this Unit of Management, and consultation will continue with the airport authority during the CFRAM Study programme.

Shannon Free Zone (Industrial Estate) is located to the south of this Unit of Management. This business and technology park is a 243 hectare International Business Park adjacent to Shannon International Airport. Since its establishment in 1959, Shannon Development report that over 100 overseas companies have chosen to invest in Shannon Ireland and that the Shannon Free Zone is Ireland's largest cluster of North American investments.

The generation of renewable energy has been increasing over the past ten years, with a growth in the number of wind farms arising around the country. There are two wind farms currently operational within this Unit of Management<sup>31</sup>.

Within this Unit of Management, agriculture has an important role to play in the regions economy, and is acknowledged as a material asset (68% of land-cover defined as agriculture). Like much of the Shannon RBD, this Unit of Management has many quality scenic landscapes such as the Burren and Cliffs of Moher and offers great opportunities for recreation and tourism (including ecotourism).

<sup>31</sup> Irish Wind Energy Association: <http://www.iwea.com/index.cfm/page/windfarmsinireland>

**Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)****3.9.2 Future trends**

County Development Plans present economic development policies which respond to the economic downturn and recognise the importance of taking advantage of emerging and likely future trends and economic opportunities.

There are over 20 prospecting mining licences in this Unit of Management which are granted by the DCENR. Mining prospects within this Unit of Management are generally concentrated on base metals, barites and silver.

The preparation of a Strategic Integrated Framework Plan (SIFP) for the Shannon Estuary has recently commenced (incorporating jurisdictions of Clare, Kerry and Limerick County Councils, Shannon Foynes Port Company and Shannon Development). The reported aim is to identify the nature and location of future sustainable development, economic growth and employment within the Shannon Estuary whilst ensuring the habitat status of Natura 2000 and other environmentally sensitive sites would not be reduced as a result of the short-term or long-term impact of developments. The following are examples of the developments that may be considered by this plan and initiated within or adjacent to this Unit of Management:

- Port functions;
- Shipment;
- Aquaculture/mariculture;
- Leisure;
- Industry;
- Energy generation;
- Aviation; and
- Agriculture.

Shannon Foynes Port Company (which includes Foynes, Tarbert and Aughinish ports) has statutory jurisdiction over all marine activities in a 500 km<sup>2</sup> area on the Shannon Estuary. The Shannon Foynes Port Master Plan 'vision to 2041' is currently being compiled, and may include some key areas for growth in this Unit of Management.

The National Road Authority (NRA) report that planned road upgrades and infrastructure for this region are in the 'planning' stage, however in November 2011, the Irish Government suspended large scale infrastructure spending. It is unknown at this stage if this suspension will significantly affect this Unit of Management. However the design of the Limerick Northern Distributor Road north west of Limerick City to the R445 (Dublin Road/old N7) is being progressed.

The Government has recently announced plans to separate Shannon Airport from the Dublin Airport Authority, and bring it together with elements of Shannon Development into a new State-owned entity with a commercial mandate to drive tourism and economic growth in the area.

There are a number of national strategies and plans in place for Ireland's energy needs with specific plans developed regarding renewable energy. One of the most recent is the government publication of the DECNR Offshore Renewable Energy Development Plan (public consultation, 2010). EirGrid have undertaken a number of studies on the development of electricity grid in Ireland including GRID 25, EirGrid's strategy for the development of Ireland's transmission grid. This strategy proposes to support economic growth and provide the infrastructure to enable Ireland to

## Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)

realise its renewable potential and achieve the challenging 2020 target of having 40% of our electricity generated from renewable sources. This strategy includes proposals for projects to be developed within this Unit of Management.

The Sustainable Energy Authority Ireland (SEAI) Strategic Plan 2010-2015 promotes renewable energy both on a large commercial scale and as micro-generation. In addition Clare County Development Plan outlines the distribution of significant wind energy developments granted permission as well as other potential wind energy development areas which will be further detailed as required in the next stage of the SEA process.

County Clare are in the process of developing a Renewable Energy Strategy which will be finalised late in 2012. The purpose of which is to facilitate and guide the development of domestic, community, commercial and industrial renewable energy projects and ancillary developments within County Clare and therefore this Unit of Management.

The Government has recently proposed reforms of the water sector which include the establishment of a State-led utility and a water metering programme (private wells will remain un-levied). This will inevitably influence the prospects for and management of water-related infrastructure.

A Limerick & Clare Joint Sports and Physical Recreation Strategy is currently being developed this will result in a set of goals and objectives for the provision and utilisation of sporting and physical recreation facilities in the area, which relate to sustainable development including linkages to smarter travel options.

### **Box 3.9: Development, Infrastructure and Material Assets – Key strategic issues relating to flood risk management**

- Vulnerability of material assets to existing and future flood risk can result in adverse effects to human health, economy safety, water status etc.
- Future development including ancillary infrastructure such as access bridges can offer opportunities and constraints for flood risk management; and
- Construction of renewable energy options including those outside flood plains e.g. wind farms can influence changes to morphology and run-off characteristics of a catchment.

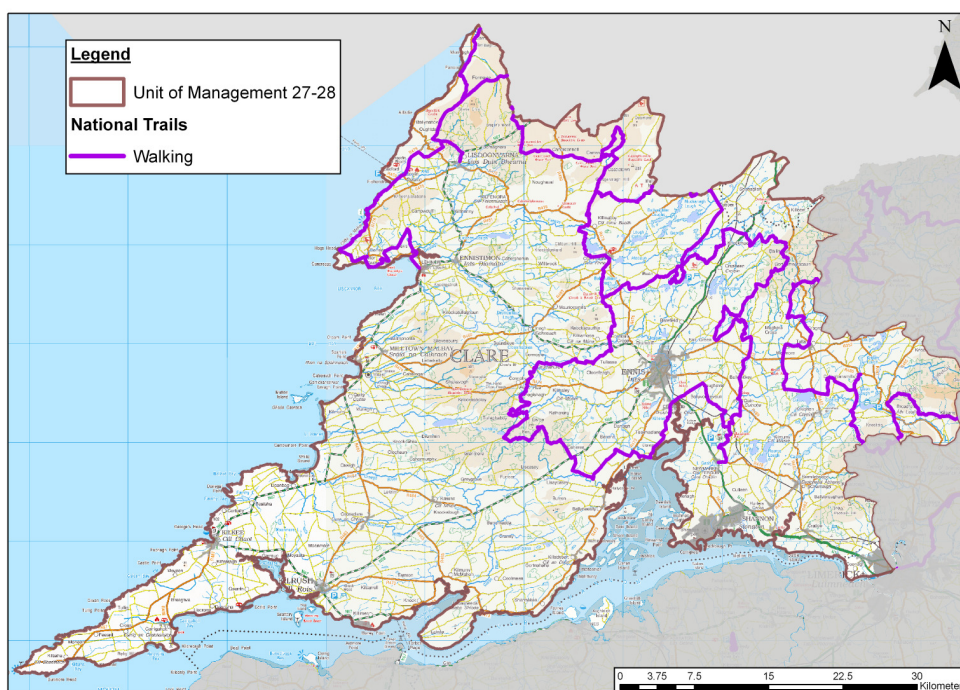
### 3.10 Tourism and Recreation

#### 3.10.1 Existing conditions

The Clare County Development Plan (2010 – 2016) reports that tourism growth continues to play a major role in the future development of the County.

The natural heritage in this Unit of Management are characterised by a range of scenic landscapes which offer tourism and recreational opportunities such as walking, beaches, equestrian, golfing as well as water-based activities such as fishing, watersports and boating.

The National Trails Office promotes the use of recreational trails in Ireland. Those defined for this Unit of Management are illustrated in Figure 3.10.1.



**Figure 3.10.1 - National Trails within UoM 27-28 (source: National Trails Office)**

The regional economic development agency, Shannon Development, also promotes trails suitable for walking, cycling horse riding, canoeing, surfing, driving etc within the Shannon Region<sup>32</sup>, and the County Development Plans detail the infrastructure, facilities and amenities in respect of tourism and recreation. These features will be identified and assessed as required during the next stage of the SEA process.

There are five blue flag beaches located within this Unit of Management: Cappagh Pier; Kilkee; Doonbeg; White Strand; and Lahinch.

Cultural Heritage sites in this Unit of Management also support heritage-related tourism and recreation. This is discussed further in Section 3.11 of this Annex, but a specific example is Bunratty Castle and Folk Park.

<sup>32</sup> <http://www.shannonregiontrails.ie/>

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Shannon International Airport plays an important role for the international tourist industry in this Unit of Management.

The Burren National Park, the Cliffs of Moher and beaches are notable natural assets within this Unit of Management which attract many resident and international tourists to this area.

River and lake cruising and boating are important recreational and tourism activities on the Shannon (throughout Unit of Management 25) but are limited within this Unit of Management where most boating is undertaken off the coast. Fishing resources, including angling is discussed in Section 3.7 of this Annex.

### 3.10.2 Future trends

The National Development Plan 2007 – 2013 (NDP) outlines the Government policy's to significantly increase revenue from overseas and domestic tourism and achieve a wider distribution of tourists within this period. This NDP policy is supported by policies and objectives in the Clare County Development Plan.

As noted in Section 3.9.2, the Government' has recently announced plans to merge Shannon Airport with elements of Shannon Development to form a new State-owned entity with a commercial mandate to drive tourism and economic growth in the area.

A Limerick & Clare Joint Sports and Physical Recreation Strategy is currently being developed this will result in a set of goals and objectives for the provision and utilisation of sporting and physical recreation facilities in the area.

Complimenting the role Failte Ireland and Tourism Ireland to market and promote Irish tourism, Shannon Development commit to initiating and supporting tourism development as a 'key element in the achievement of overall economic growth throughout the Shannon region'<sup>33</sup>. 'Ireland's Shannon Region Tourism Plan Summary 2011' outlines a set of key targets which are likely influence tourism in the coming years throughout this Unit of Management.

#### **Box 3.10: Tourism and Recreation – Key strategic issues relating to flood risk management**

- Flood risk management options could contribute to the protection of existing tourist attractions and facilities currently at risk from flooding as well as providing opportunities to enhance/create related activities;
- Flooding may restrict, or reduce the quality of resources important for recreation and/or tourism;
- Flood risk management options may affect angling facilities, boating activities and/or associated resources;
- Flood storage options can potentially provide opportunities for enhancing/creating recreational areas; and
- Access to waterways is an important issue to consider e.g. access to rivers for anglers.

<sup>33</sup> <http://www.shannondevelopment.ie/Tourism/>



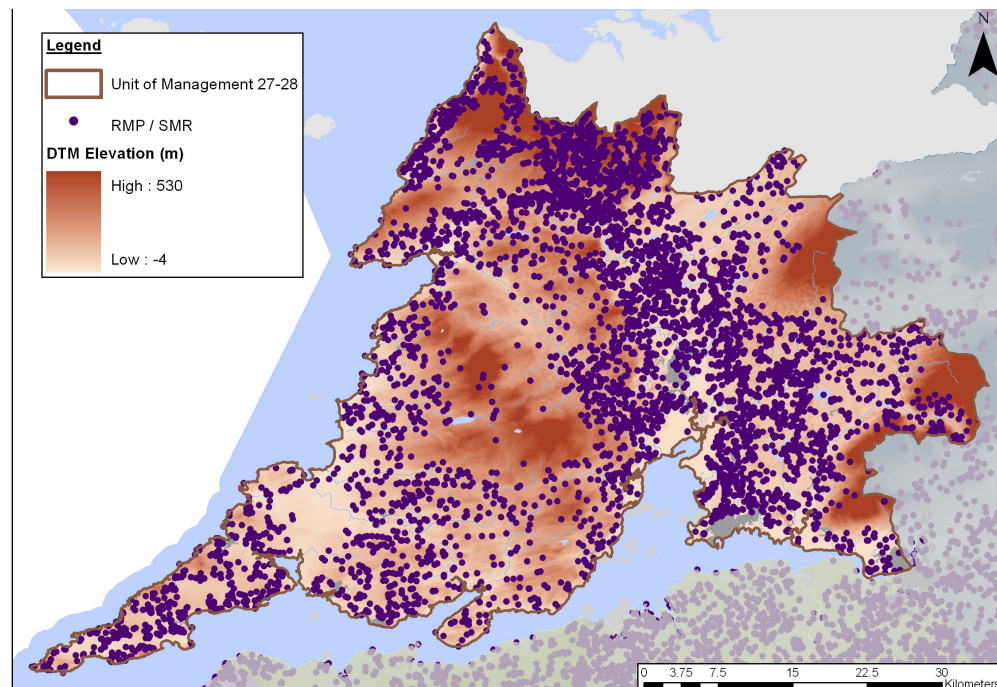
### 3.11 Archaeology and Cultural Heritage

#### 3.11.1 Existing Conditions

Archaeological sites are legally protected by the provisions of the National Monuments Acts, the National Cultural Institutions Act 1997 and the Planning and Development Acts. The National Record of Monument & Places (RMP) (formerly the Sites and Monuments Record (SMR)) is a statutory list of all known archaeological monuments provided for in the National Monuments Acts. There are over 5,800 archaeological, architectural and cultural heritage sites within this Unit of Management, recorded in the RMP. The records contain details of the site, including location, description and unique identification number. Many of the sites are located adjacent to watercourses, with some present within the watercourses. This Unit of Management contains a wide range of monuments types including:

- Ringforts;
- Standing Stones;
- Earthworks
- Ritual site - holy well;
- Churches;
- Burial Grounds;
- Bridges;
- Prison; and
- Castles.

The locations of the known archaeological, architectural and cultural heritage sites within this Unit of Management are presented in Figure 3.11.1.



**Figure 3.11.1 - Record of Monuments and Places / Sites and Monuments Record within UoM 27-28 (source: NMS)**



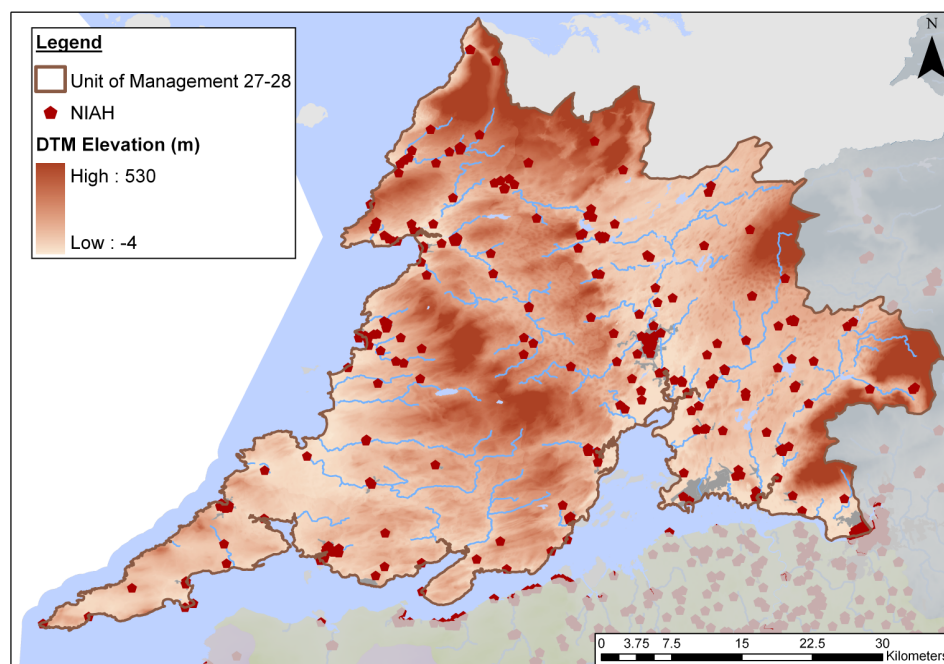
## Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)

As some monuments and structures are located within and close to watercourses, the Underwater Archaeology Unit records and the Register of Battle sites held by the DAHG will be consulted to establish any zones of potential archaeological importance in the next stages of the Study.

The National Inventory of Architectural Heritage (NIAH) was established on a statutory basis under the provisions of the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999. The purpose of the NIAH is to identify, record, and evaluate the post-1700 heritage of Ireland. There are almost 3500 listings on the NIAH within this Unit of Management.

Architectural Conservation Areas (ACAs) are designated under Section 81 of the Planning & Development Act 2000-2010 (as amended) for the protection of areas for their special characteristics and distinctive features. There are a number of ACAs within this Unit of Management and these are detailed in the County and Local Area Development Plans (some of which are pending designation). Consultation with the relevant Local Authorities will continue during the next stage of SEA process to obtain further details of these ACAs.

The Planning & Development Act 2000 introduced legislation and methods for protecting the Architectural Heritage and introduced the Record of Protected Structures (RPS). These are listed in the County Development Plans, but are not available as yet in digital map format. This Unit of Management primarily falls primarily within the county Clare boundary in which there are over 650 Protected Structures (Clare County Development Plan). Following consultation with the DAHG, it is acknowledged that the register of protected structures documented County Development Plans may not represent all Ministerial recommended sites/structures (which are included in the NIAH). The locations of NIAH sites recorded within this Unit of Management are presented in Figure 3.11.2.



**Figure 3.11.2 - National Inventory of Architectural Heritage within UoM 27-28**  
(source: NMS)

## Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)

There are no designated UNESCO World Heritage Sites within this Unit of Management. However, a Tentative List of sites for Ireland submitted to UNESCO includes tentative sites within this Unit of Management: Burren and Western Stone Forts at Cahercommaun.

The draft Preliminary Flood Risk Assessment report (OPW, 2011) presented a methodology for classifying the vulnerability of National Monuments from flooding in Ireland. The report classifies each monument type with a 'vulnerability' rating (low to extreme) based on the monuments importance and the potential damage that could occur due to flooding. This rating will inform the SEA process for the FRMPs with regards to archaeological monuments and sites.

### 3.11.2 Future trends

The archaeological, architectural and cultural heritage of this Unit of Management is a finite resource, and protection of this resource from flooding and flood risk management related development will continue to be required. There also remains the possibility for the presence of unknown, undesignated archaeological and architectural remains to be discovered within this Unit of Management during any future developments.

Linking with the climatic factors discussed in Section 3.5 of this Annex, the Heritage Council and Fáilte Ireland commissioned a review of research carried out in relation to the potential impacts of climate change on Ireland's maritime and inland waterways heritage<sup>34</sup>. River and coastal flooding exacerbated by climate changes are reported to present serious consequences for heritage (and socio-economic activity).

#### **Box 3.11: Archaeology and Cultural Heritage – Key strategic issues relating to flood risk management**

- Some structures are located within and adjacent to water courses. These can act as a hydraulic restriction within a watercourse and/or constrain flood risk management at a location;
- Existing management plans may require bridges to be repaired/maintained using traditional methods/materials and therefore restrict options for flood risk management;
- Flood risk management options can be constrained by the need to protect the character of areas of existing archaeological and architectural value e.g. ACAs, Protected Structures, National Monuments and RMPs;
- Flood risk management options can potentially reduce the risk from flooding to existing archaeological and architectural features;
- The development of flood risk management options will need to consider the potential for unknown archaeological discoveries, above and below water level (and across flood plains).

<sup>34</sup> Heritage Council and Fáilte Ireland (2009). Climate Change, Heritage and Tourism: Implications for Ireland's Coast and Inland Waterways.

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### 3.12 Conclusion

This scoping exercise has identified that impacts on air quality can be scoped out of the SEA for the Shannon CFRAM Study, as it will not influence or be affected by the recommendations of this study. All of the remaining topics including climate are relevant to the next stage of the SEA and Unit of Management 27-28.

## References

- Clare County Council (2011), Clare County Development Plan 2011-2017
- Department of Agriculture, Fisheries and Food (2007), Ireland Rural Development Programme 2007-2013
- Department of Arts, Heritage and the Gaeltacht (2011), A National Landscape Strategy for Ireland
- Department of Arts, Heritage and the Gaeltacht (2011), Actions For Biodiversity 2011-2016, Ireland's National Biodiversity Plan
- Department of Arts, Heritage, Gaeltacht and the Islands (1999), Framework and Principles for the Protection of the Archaeological Heritage
- Department of Communications, Energy and Natural Resources - Inland Fisheries Division (2008), National Report for Ireland on Eel Stock Recovery Plan - Including River Basin District Eel Management Plans
- Department of Communications, Marine and Natural Resources, Government White Paper (2007), Delivering a Sustainable Energy Future for Ireland - The Energy Policy Framework 2007-2020
- Department of Environment, Heritage and Local Government (2004), Architectural Heritage Protection – Guidelines for Planning Authorities
- Department of Environment, Heritage and Local Government (2008), Programme of Measures Unsewered Wastewater Treatment Systems National Study
- Department of Finance (2007), National Development Plan (NDP) 2007-2013
- Department of the Environment (1997), Sustainable Development - A Strategy for Ireland
- Department of The Environment and Local Government (2002), Making Ireland's Development Sustainable - Review, Assessment and Future
- Department of Transport (2008), Shannon Airport Catchment Area Economic & Tourism Development Plan
- Eirgrid (2008), (Draft) Transmission Development Plan 2008-2012
- Environmental Protection Agency (EPA) (2009), Advice Note No.6, Version 1- Restoring Public Water Supplies Affected by Flooding
- Environmental Protection Agency (EPA) (2009), Code of Practice - Wastewater Treatment and Disposal System Serving Single Houses
- Environmental Protection Agency (EPA) (2010), Air Quality in Ireland Report
- Environmental Protection Agency (EPA) (2011), Alien Invasive Species in Irish Water Bodies. Synthesis Report for the STRIVE-funded project, 2007-W-MS-2-S1
- Environmental Protection Agency (EPA) (2012), Focus on Urban Waste Water Discharge in Ireland
- Failte Ireland (2007), Scenic Landscape Feasibility Study

**Annex IV - Shannon Estuary North and Mal Bay Unit of Management (UoM 27-28)**

- Fire Services and Emergency Planning (2006), Department of Environment, Heritage and Local Government - Working Draft Guidance Document 11 - A Guide To Flood Emergencies A Framework For Major Emergency Management,
- Forest Service (2000) - Department of the Marine and Natural Resources - Code of Best Forest Practice - Ireland
- Galway County Council (2009), Galway County Development Plan 2009-2015
- Geological Survey Ireland (2006), Irish Landslides Working Group Landslides in Ireland
- Heritage Council and Fáilte Ireland (2009), Climate Change, Heritage and Tourism: Implications for Ireland's Coast and Inland Waterways
- Irish Peatland Conservation Council (2009), Ireland's Peatland Conservation Action Plan 2020 - Halting the Loss of Peatland Biodiversity
- Limerick City County Council (2010), Limerick City Council Development Plan 2010-2016
- Mid-West Regional Authority (2009), Mid-West Regional Planning Guidelines 2010-2022
- North Tipperary County Council (2010), North Tipperary County Development Plan 2010-2016
- Office of Public Works (OPW) (2010), Flood Risk Assessment and Management Programme National Pluvial Screening Project for Ireland. HR Wallingford Ltd.
- South West Regional Authority (2009), South West Bioenergy Plan 2009-2020
- South-West Regional Authority (2009), South-West Regional Planning Guidelines 2010-2022
- The Sustainable Energy Authority of Ireland (SEAI) (2010), 5 Year Strategic Plan 2010-2015

## Websites

- Central Statistics Office - <http://www.cso.ie>
- Environmental Protection Agency - <http://www.epa.ie>
- EPA (2007) River Quality Surveys, Biological - <http://www.epa.ie/qvalue/webusers/>
- EPA GeoPortal - <http://gis.epa.ie>
- Floodmaps - <http://floodmaps.ie/>
- Geological Survey of Ireland - <http://www.GSI.ie>
- Health Service Executive - <http://www.hse.ie>
- Inland Fisheries Ireland (Shannon Regional Fisheries Board) Game Angling Guide - River Deel & Lakes, Co Limerick - <http://www.shannon-fishery-board.ie/guides/game/river-deel.htm>
- Inland Fisheries Ireland - <http://www.ifigis.ie/AccessibleAnglingMap/>
- Inland Fisheries Ireland - <http://www.ifigis.ie/WDFishMap/>
- Irish Wind Energy Association - <http://www.iwea.com/index.cfm/page/windfarmsinireland>
- National Monument Service - <http://www.archaeology.ie/>
- National Parks and Wildlife Service - <http://www.npws.ie>
- National Trails Office - <http://www.irishtrails.ie>
- Pollution Reduction Programmes, Characterisation Reports and Maps - <http://www.environ.ie/en/Environment/Water/WaterQuality/ShellfishWaterDirective/ShellfishWatersFinalCharacterisationReportsandPRPs/Clare-Kerry/>
- Shannon Development - <http://www.shannondevelopment.ie>
- Shannon Region Trails - <http://www.shannonregiontrails.ie/>
- The Inland Waterways Association of Ireland - <http://www.iwai.ie/org/aboutIWAI.html>
- Transport 21 - <http://www.transport21.ie>
- WFD Ireland Document Store - [http://www.wfdireland.ie/docs/1\\_River%20Basin%20Management%20Plans%202009%20-%202015/ShIRBD%20RBMP%202010/](http://www.wfdireland.ie/docs/1_River%20Basin%20Management%20Plans%202009%20-%202015/ShIRBD%20RBMP%202010/)