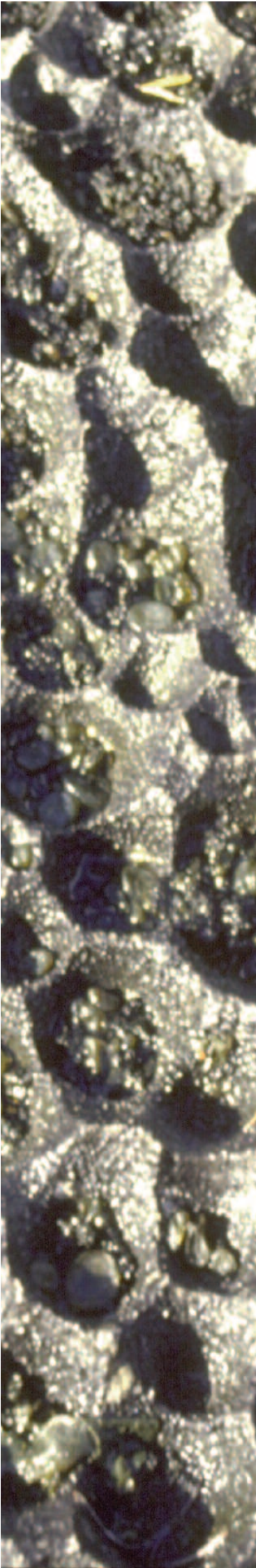

The County Clare Wetlands Survey

2008 - Desk Survey & GIS Preparation

Report for Clare County Council, Clare Biodiversity Forum and The Heritage Council

Prepared on behalf of Wetland Surveys by:
Dr Patrick Crushell & Dr Peter Foss **November 2008**

An Action of the County Clare Heritage Plan

Clare Biodiversity

Forám Oidhreachta an Chláir
Clare Heritage Forum

An Chomhairle Oidhreachta
The Heritage Council

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wetlandsurveys ireland

by

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An Action of the County Clare Heritage Plan

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Report cover images:
Left: Solution cups in limestone pavement, Fisherstreet, Co Clare
Top: Limestone pavement and lakeshore communities, Lough Mask, Co. Mayo
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2 Executive Summary

1. County Clare contains a wide range of wetlands of high international and national importance (An Foras Forbartha 1981; Anonymous 2008c; NPWS 2008 *inter alia*). Due to the varying topography, hydrology, climate, coastline and soils present it has wetland habitats ranging from raised bogs, blanket bogs, fens, marshes, coastal lagoons, large riverine systems, variety of lakes, springs, wet woodlands and many more. Clare is likely to contain some of the finest examples of calcareous fens, springs and turloughs that occur in Ireland and Northwest Europe.

2. The aim of the County Clare Wetlands Survey (CWS) was to prepare a GIS map data layer and associated database of all known freshwater wetland sites in County Clare. The wetland sites were identified following an extensive review of literature and third party data sources. Information stored on these sites included details of previous surveys and general site characteristics. In addition to the known wetland sites, a GIS dataset was established to record all mapped wetland habitat within the county by incorporating map data provided from third parties along with wetland identified by an analysis of aerial photography of all wetland habitat within the county. Together these datasets facilitated an assessment of the wetland resource of the entire county. Wetland habitats on sites were classified according to the Guide to Habitats published by the Heritage Council (Fossitt 2000). For the purposes of this study, 34 different habitat types are regarded as wetland habitats, as listed below.

3. This study addressed the following main research objectives:

- collect and amalgamate data on known wetland sites within County Clare from data sources following consultation with State authorities, third party research groups and individuals;
- produce a map and associated database of all wetland sites to include key data on each site, including the specific wetland habitat type(s) present; the extent of each wetland type; and compile an inventory of available published and survey information on each site;
- undertake an aerial photography wetland survey of the county to identify sites of potential interest occurring outside of existing data sources and surveys;
- evaluate each site in terms of its conservation status, known habitat and area information, known survey information and threats;
- identify the main information gaps and make recommendations to guide future policy and research priorities towards the conservation of the wetland resource in County Clare.

4. The present study focused on the identification of 34 wetland types (22 of which are listed in Annex 1 of the EU Habitats Directive, and nine of these are priority habitats) in County Clare, plus one generic wetland type entitled CWS Unknown wetland type, where the specific wetland habitat present could not be assigned with certainty to one of the recognised habitat types. The 34 Fossitt freshwater wetland types recorded during the CWS include:

Fossitt Level 3 Habitat Code and Name	**Fossitt Level 3 Habitat Code and Name**
FL1 Dystrophic lakes *	HH3 Wet heath *
FL2 Acid oligotrophic lakes *	PB1 Raised bogs **
FL3 Limestone/marl lakes	PB2 Upland blanket bog **
FL4 Mesotrophic lakes	PB3 Lowland blanket bog **
FL5 Eutrophic lakes *	PB4 Cutover bog *
FL6 Turloughs **	PB5 Eroding blanket bog
FL7 Reservoirs	PF1 Rich fen and flush **
FL8 Other artificial lakes and ponds	PF2 Poor fen and flush
FW1 Eroding/upland rivers *	PF3 Transition mire and quaking bog *
FW2 Depositing/lowland rivers *	WN4 Wet pedunculate oak-ash woodland **
FW3 Canals	WN5 Riparian woodland
FW4 Drainage ditches	WN6 Wet willow-alder-ash woodland
FP1 Calcareous springs **	WN7 Bog woodland **
FP2 Non-Calcareous springs	WS1 Scrub *
FS1 Reed and large sedge swamps	CW1 Lagoons and saline lakes **
FS2 Tall herb swamps *	CD5 Dune slacks *
GS4 Wet grassland *	
GM1 Marsh *	*CWS Unknown wetland type*

** EU Habitats Directive listed Annex 1 habitat; ** EU Habitats Directive Priority habitat*

5. In relation to the individual wetland habitat types recognised within the County Clare Wetlands Survey, the following number of sites and estimated area (ha) or Length (km) of habitats have been recorded:

Habitat Code and Name	Number of Sites recorded in CWS Site Database	Number of discrete habitat areas mapped in CWS GIS	Total area (ha) or Length (km) of habitat types recorded in CWS*	Percentage of County Clare covered by CWS habitat
FL Lakes & Ponds	**165**	**557**	**8204**	**2.57**
FL1 Dystrophic lakes	13	15	45.4	**0.01**
FL2 Acid oligotrophic lakes	16	216	1650.2	**0.51**
FL3 Limestone/marl lakes	23	211	6032	**1.89**
FL4 Mesotrophic lakes	15	73	204.2	**0.06**
FL5 Eutrophic lakes	8	18	2.2	**-**
FL6 Turloughs	50	19	267.7	**0.08**
FL7 Reservoirs	3	0	0	-
FL8 Other artificial lakes and ponds	3	4	3.4	-
FW Watercourses	**119**	**2834**	**5740.5 km**	
FW1 Eroding/upland rivers	28			
FW2 Depositing/lowland rivers	40			
FW3 Canals	3			
FW4 Drainage ditches	79	76	2.5 km	
FP Springs	**23**	**137**		
FP1 Calcareous springs	20	58	NA	
FP2 Non-Calcareous springs	0		NA	
FS Swamps	**115**	**110**		
FS1 Reed and large sedge swamps	99	108	309	**0.10**
FS2 Tall herb swamps	28	2	3.7	-
G Grassland & Marsh	**150**	**627**	**2658**	**0.83**
GS4 Wet grassland	103	596	2586	**0.81**
GM1 Marsh	62	31	70.7	**0.02**
HH3 Wet heath	26	42	1935	**0.61**
PB Bogs	**96**	**364**	**6097**	**1.91**
PB1 Raised bogs	21	28	551.4	**0.17**
PB2 Upland blanket bog	19	198	1555	**0.49**
PB3 Lowland blanket bog	11	28	167.8	**0.05**
PB4 Cutover bog	60	104	3796	**1.19**
PB5 Eroding blanket bog	1	0	0	-
PF Fens & Flushes	**117**	**115**	**483**	**0.15**
PF1 Rich fen and flush	81	51	182	**0.06**
PF2 Poor fen and flush	19	40	142.5	**0.05**
PF3 Transition mire and quaking bog	26	24	158.4	**0.05**
WN Semi-natural woodland	**88**	**45**	**155**	**0.05**
WN4 Wet pedunculate oak-ash	1	1	2.9	-
WN5 Riparian woodland	4	9	4.1	**-**
WN6 Wet willow-alder-ash woodland	32	21	105.7	**0.03**
WN7 Bog woodland	19	14	42.2	**0.01**
WS1 Scrub	91	13	7.2	**-**
CW1 Lagoons and saline lakes	19	4	32.1	**0.01**
CD5 Dune slacks	4	2	0.2	**-**
Non-Fossitt Mosaic Habitat Types		**98**		
HH_PB Heath - bog mosaic	NA	10	143.1	**0.05**
PB4_HH3 Cutover bog - Wet heath	NA	1	1.2	**-**
PB_HH Bog - Heath mosaic	NA	3	0.8	**-**
HH3_PB3 Wet heath - Blanket bog	NA	14	72.2	**0.02**
HH3_GS4 Wet heath - Wet grassland	NA	2	0.2	**-**
HH1_HH3 - Dry - wet Heath mosaic	NA	30	211	**0.07**
CWS Unknown wetland type	**NA**	**131**	**3127**	**0.98**

**The area / length of habitat should be regarded as being a best minimal estimate, as many wetland habitats within sites were not mapped due to an absence of reliable information on their distribution and extent.*

6. These wetland habitat types can be found as discrete communities in their own right, or in association with (or within) larger semi-natural complexes such as blanket bog, raised bog, turlough, dune slack, machair, wet heathland, wet grassland, woodland, karst areas, lacustrine and riverine habitats and systems.

7. A variety of data sources (reports, publications, databases and inventory lists), groups and individuals were consulted in the compilation of information of the CWS database, over a 3 month period in 2008. Those contacted, are listed in Appendix 2, while published research and GIS data sources provided and consulted in the CWS are listed in Appendix 1 and referenced in full in the Bibliography.

8. The total wetland area in County Clare has been estimated at **23,440 ha** based on this study, which represents **7.4 % of the entire county** (this should be interpreted as a minimum area as wetland habitats within many sites were not mapped due to information deficit). A total of 2069 discrete wetland habitat units have been collated and mapped within the county in the CWS GIS dataset, while information on 300 wetland sites and sub-sites is held in the CWS site database.

In terms of the main habitat types in County Clare the results suggest that on a county basis, the 23,440 ha of wetland recorded, cover the following percentage of the county: lakes 2.57% , bogs and wet heaths 2.52%, fens & flushes, marsh, reedbeds and wet grassland cover 1%, while the remaining 1% has been assigned to the CWS unknown wetland type.

9. It is very probable that additional wetland sites exist outside of the sites which have been identified in the present County Clare Wetlands Survey (see Results section 6.1 for further clarification).

10. In relation to the 2069 wetland habitat units identified in the CWS, one key result to emerge is that significant gaps exist in relation to our knowledge of this resource, due primarily to a lack of detailed habitat surveys. Specifically, the following issues have been identified:

Wetland type identification: our knowledge in relation to the specific wetland habitat type(s) present, is considered lacking or inadequate (confusion over one or more types) of many sites identified in the present CWS.

Wetland type distribution: it is clear from our results that information is lacking on many important wetland habitats that occur throughout the county. Apart from raised bogs, blanket bogs, and lagoons, few other wetland habitats have been systematically surveyed in Clare. Without a full appreciation of the extent and condition of these wetland habitats it is not possible to set realistic conservation objectives or make informed decisions on their relative importance in relation to biodiversity and in the provision of other ecosystem services.

Exact extent of wetland types: our knowledge in relation to the extent of wetland type(s) present on sites, is considered lacking or inadequate for many sites identified in the CWS.

11. One of the key findings to emerge from a conservation evaluation of wetland sites recognised in the CWS is that 152 site records or 50% of the sites listed (300 sites in total) have no protection although their conservation value has been recognised or proposed by third parties.

12. Based on the results of this analysis of wetlands, the following habitat types within the county should be prioritised as part of any future CWS Field Surveys: **Turloughs, Fens, Lakes, Tall Herb Swamp, Springs and Wet Grassland *inter alia*.**

13. Sites identified during the CWS which could not be assigned to a Fossitt category should be included in any future wetland survey.

14. Based on the results of this survey the following geographic areas within the county should be surveyed for potential wetland sites:

- South western part of the county – the area between Inagh, Cooraclare and Kilmurry
- Eastern part of the county – area between Tulla, Broadford and Scarriff

15. Our incomplete knowledge of many of the wetland areas in County Clare makes **a systematic survey of existing and newly recorded sites a priority**, if conservation worthy sites are to be identified and the best examples put forward for conservation under County conservation programmes such as the Clare Biodiversity Programme, or the NPWS national Natural Heritage Area (NHA) or European Habitats Directive Natura 2000 (SAC) network.

16. Other recommendations from the study included:

- The habitat mapping and research methodology developed during the Clare Wetland Survey, should be formalised by the Heritage Council, and a standard Phase I desk based wetland survey manual should be prepared, and made available to other local authorities so that similar wetland habitat inventories can be undertaken in their counties following standard guidelines.
- Extra resources should be put towards enforcing regulations preventing damage to wetland sites throughout Clare;
- A public awareness campaign should be run to inform the people of the county of the diverse wetland resource of the county and the value of this resource through amongst other things the provision of important ecosystem services (see section 4.3).

3 Project Aims

3.1 Background

In July of 2008 Clare County Council commissioned the production of a map and associated database holding information on all freshwater wetlands in County Clare. This study has been part-funded by the Heritage Council and forms an important element of the County Clare Heritage Plan (Anonymous 2003).

Prior to this project no complete inventory of wetland areas existed for County Clare, although the county is exceptionally rich in wetland types, with over 48 fen sites and 500 lakes alone reported for the county (Foss 2007), as well as being recognised as the headquarters for certain important wetland types such as turloughs. The wetlands of the county are not only important from a biodiversity perspective but also provide many important ecosystem services such as flood prevention, provision of clean water and carbon storage.

The lack of a county wetland inventory has resulted in an incomplete picture of the distribution and extent of wetlands in Clare. The lack of data on wetlands, their distribution and extent when taken together with the threat faced by these habitats from infilling and drainage may lead to the future loss of sites which have a county, national or even international value for biodiversity protection, and makes the development of wetland conservation programmes at a County level difficult.

3.2 Mains aims of project

To overcome the information deficit, the main aim of the County Clare Wetlands Survey (CWS) was to prepare a GIS data layer and associated site database of all previously recorded freshwater wetland sites in County Clare. The wetland habitats to be mapped included lakes and ponds, watercourse, springs, freshwater swamps, wet grassland, freshwater marsh, lagoons, peat bogs, fens and flushes, wet oak-ash woodland, wet willow-alder-ash woodland, riparian woodland and bog woodland.

The sites identified were characterised and mapped as far as possible in terms of the wetland habitat(s) present. This allowed an assessment of the extent of each habitat type(s) within the county.

Wetland habitats on sites were to be classified according to the Guide to Habitats published by the Heritage Council (Fossitt 2000) to at least Level 2 and Level 3 where information was available that made such classification possible.

No field survey was undertaken in relation to this proposed data gathering and amalgamation project, which aimed to consolidate all known information on wetlands in Clare, based on GIS and published information held by Government and State agencies, non-governmental organisations and private individuals, and published in previous reports and surveys. In addition, other as yet unidentified wetlands recognised from an aerial photographic survey of the county were also to be mapped, so as to produce a GIS wetland data set and associated map(s) for County Clare which was as complete as possible based on our current knowledge.

The final report from the first phase of the County Clare Wetlands Survey (CWS), makes recommendations on priorities for future surveys based on critical or endangered habitats and geographical areas within the county where site data is particularly lacking, based on the findings from the 2008 CWS desk study.

The methodologies developed and employed in the survey are documented in this report, together with a description of the importance of wetlands, the main wetland habitats present in County Clare and key findings from the current study.

Finally it was envisaged that the methodologies developed during this project, would provide a valuable blueprint to other counties where identification and mapping of the wetland resource and wetland surveys are also required.

4 Importance of Wetlands in County Clare

4.1 Definition

Wetland is a collective term for ecosystems (habitats and their associated species) whose formation has been dominated by water, and whose processes and characteristics are largely controlled by water. A wetland is a place that has been wet enough for a long enough time to develop specially adapted vegetation and other organisms (Maltby 1986).

Wetlands are areas where water is the primary factor controlling the environment, local processes and the associated plant and animal life that occur there. They occur where the water table is at or near the surface of the land, or where the land is covered by a layer of shallow water, for some or all of the year.

The 1971 Ramsar Convention on Wetlands of International Importance defines wetland as:

"areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters".

In addition, for the purpose of protecting coherent sites, Article 2.1 of the Ramsar Convention, to which Ireland is a signatory, provides that wetland sites be included in the Ramsar List of internationally important wetlands:

"may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six meters at low tide lying within the wetlands".

Five major wetland types are generally recognized:
- **marine** (coastal wetlands including coastal lagoons, rocky shores, and coral reefs);
- **estuarine** (including deltas, tidal marshes, and mangrove swamps);
- **lacustrine** (wetlands associated with lakes);
- **riverine** (wetlands along rivers and streams); and
- **palustrine** (meaning "marshy" – wet grassland, marshes, swamps and bogs).

In addition to naturally occurring wetlands produced as a result of natural environmental processes, there are artificial wetlands such as fish ponds, farm ponds, irrigated agricultural land, reservoirs, gravel pits, sewage farms, treatment facilities, drainage ditches and canals (see Chapter 5 for additional details on wetland types).

Even in certain, so called "natural" wetland systems, human-kind has played a major factor in wetland formation since pre-historic times. In Ireland, forest clearance in the uplands helped trigger soil and vegetation changes, which altered the hydrology and led in some places to bog formation. And today, since some of these bogs have been harvested for fuel and their peat deposits removed, the flooding of the abandoned peat diggings has created new shallow lakes, with marginal fens and marsh areas.

In contrast to some other habitat types (e.g. woodlands), wetlands are therefore often young and dynamic ecosystems, changing in a relatively short period of time as vegetation changes, sediments are laid down, and local hydrological conditions are altered.

One other concept that should be born in mind when considering wetlands is that a specific wetland area is often composed of many different wetland types, which form a mosaic. So a cutover bog wetland, may in fact be composed of small regenerating fen and bog communities, pools, drainage ditches, and even deeper water pools or small lakes.

In the classification system of wetlands used in the context of CWS, which is outlined in the next chapter, these wetland mosaic elements are defined in greater detail based on the habitat classification system of the Heritage Council (Fossitt 2000).

On a global scale wetlands occur everywhere, from the tundra to the tropics. How much of the earth's surface is presently composed of wetlands is not known exactly. The UNEP-World Conservation

Monitoring Centre has suggested an estimate of about 570 million hectares (5.7 million km^2) of wetland – roughly 6% of the Earth's land surface – of which 2% are lakes, 30% bogs, 26% fens, 20% swamps, and 15% floodplains.

In the context of the County Clare Wetlands Survey the project focused on the occurrence of freshwater wetlands within the county, which preliminary results suggest cover a minimum of some 7.4 % of the county, both of natural and artificial in origin, with the additional inclusion of coastal lagoons which may have a variable degree of both salt and freshwater influence.

Of the 7.4% (or 23,440 ha) of the land area of the county covered by wetlands, lakes comprise 35% , bogs and wet heaths 36%, fens & flushes, marsh, reedbeds and wet grassland cover 15%, wet woodlands cover 1% while the remaining 13% has been assigned to the CWS unknown wetland type.

4.2 Why conserve wetlands?

As with many other natural environments humanity has generally looked on wetlands as an economic resource to be used for short term economic gain, and has often not recognised the long terms gains (both economic and non-economic) of functioning wetlands (Anonymous 2008d). Three examples of such actions in Ireland include:

- the national and local drainage schemes, or the embankment of rivers which can result in catastrophic floods during high rainfall periods when the drained land results in rapid surface water run-off;
- past afforestation schemes on bogs, which often did not produce the timber crop envisaged at the start of the afforestation project;
- overgrazing of blanket bogs which continues to have a detrimental effect on the western blanket bog habitats and is unsustainable.

Functional wetlands are among the world's most productive environments. They are cradles of biological diversity, providing the water and primary productivity upon which countless species of plants and animals depend for survival. They support high concentrations and diversity of birds, mammals, reptiles, amphibians, fish and especially invertebrates. Wetlands are also important storehouses of plant genetic material.

The multiple roles of wetland ecosystems and their value to humanity have been increasingly understood and documented in recent years, as in the Irish Government report on the Economic & Social Aspects of Biodiversity (Anonymous 2008). Internationally, this has led to large expenditures to restore the lost or degraded hydrological and biological functions of wetlands. But it is not enough – the race is on to improve practices on a significant global scale as the world's leaders try to cope with the accelerating water crisis and the effects of climate change. And this at a time when the world's population is likely to increase by 70 million every year for the next 20 years (Anonymous 2008d).

Global freshwater consumption rose six fold between 1900 and 1995 – more than double the rate of population growth. One third of the world's population today lives in countries already experiencing moderate to high water stress. By 2025, two out of every three people on Earth may well face life in water stressed conditions.

The ability of wetlands to adapt to changing conditions, and to accelerating rates of change, will be crucial to human communities and wildlife everywhere as the full impact of climate change on our environment is felt. Small wonder that there is a worldwide focus on wetlands and their services to us.

In addition, wetlands are important, and sometimes essential, for the health, welfare and safety of people who live in or near them. They are amongst the world's most productive environments and provide a wide array of benefits (Ramsar website).

4.3 Wetland values

Wetlands range from ponds to rivers, reedbeds to bogs, and are home to a large diversity of plants and animals and are a haven for wildlife lovers. However, they are not just important for biodiversity. They also play a major role in storing flood water and can reduce flooding in built-up areas, vital given the changing weather patterns associated with global climate change.

Wetlands therefore provide tremendous economic benefits, for example: water supply (quantity and quality); fisheries (over two thirds of the world's fish harvest is linked to the health of coastal and inland wetland areas); agriculture, through the maintenance of water tables and nutrient retention in floodplains; timber and agricultural production; energy resources, such as peat and plant matter; wildlife resources; transport; and recreation and tourism opportunities.

- Wetlands improve water quality by removing and sequestering pollutants and sediments in the water.

- Wetlands store floodwaters, acting like natural sponges and slowing down the force of flood and storm waters as they travel downstream. Far from posing a flood threat, wetlands should be viewed as buffers, to protect areas where people live (Anonymous 2008d).

- Wetlands offer habitat for wildlife. Many migratory birds and other wildlife depend on the ecological setting of wetlands for their survival.

- Wetlands support biodiversity. The variety of living organisms found in wetlands contributes to the health of our planet and our own lives possible by ensuring our food supply, regulating the atmosphere and providing raw materials for industry and medicine.

- Wetlands provide valuable open space and create wonderful recreational opportunities. Hiking, fishing, boating and bird watching are just a few of the activities people can enjoy in wetland areas. The scenic vistas of wetlands make them an ideal area for nature photographers or painters.

- Wetlands are vital in preventing further climate change by acting as a store of carbon. Until recently this has not been fully appreciated, and in Ireland it has still not been adequately communicated to the general public. For example, peatlands are known to store 20-30% of the worlds soil carbon exceeding by three times the amounts stored in tropical rainforests (Bragg and Lindsay 2003).

In addition, wetlands have special attributes as part of the cultural heritage of humanity: they are related to religious and cosmological beliefs, constitute a source of aesthetic inspiration, provide wildlife sanctuaries, and form the basis of important local traditions.

These functions, values and attributes can only be maintained if the ecological processes of wetlands are allowed to continue functioning. Unfortunately, and in spite of important progress made in recent decades, wetlands continue to be among the world's most threatened ecosystems, owing mainly to ongoing drainage, conversion, pollution, and over-exploitation of their resources.

Putting an economic value on something as abstract as the ecological services of a wetland is a difficult idea for most people, but is becoming a more accepted economic tool. More commonly, the open market puts monetary values on society's goods and services. In the case of wetlands, there is no direct market for services such as clean water, maintenance of biodiversity, and flood control. There is, however, a growing recognition that such natural benefits do have real economic value and that these values need to be included in decision-making processes (see Table 4.1).

In a recent report by the Biodiversity Unit of the Department of the Environment, Heritage and Local Government (Anonymous 2008d) the biodiversity value of wetlands in Ireland was estimated to be worth €385 million per year to the Irish economy. In addition a further proportion of the €330 million assigned by this study to the economic value of the nature and eco-tourism value of all Irish habitats can be assigned to wetlands.

One other stark fact to emerge from this report is that "it is clear that the benefits of biodiversity far exceed the costs of the current levels of biodiversity protection" in Ireland, an indication that we still do not value the functions and services provided by wetlands to our well being as a society.

Numerous other reports exist in the literature that give clear examples of the economic value of wetlands. The UK Environment Agency has a wealth of literature showing the value of intact functioning wetlands in the control and alleviation of flooding episodes (Anonymous 2008d). In addition a number of reports exists which show that intact wetland systems provide excellent value for money in the provision of water services when compared to the costs that would accrue if these services had to be supplied by artificial systems. An illustration is the example from the USA where the State of New York purchased a watershed area at a cost of 1.5 billion dollars, rather than spend 3 to 8 billion dollars it estimated it would cost for artificial waste water treatment facilities to do the same job (Anonymous 2008d).

In many ways, the economic benefits received from wetlands are comparable to the benefits received from things such as public schooling, health care and municipal infrastructure.

Unfortunately, to date, society has generally only realized the benefit of wetland services after they have disappeared or been seriously degraded. Problems with flooding, lost recreational opportunities, reduced fish populations and more costly water treatment are examples of costs understood only after a wetland ecosystem has been degraded or destroyed.

The idea behind putting an economic value on some of these wetland benefits before ecosystem-altering decisions are made is to recognize these potential costs up front and thereby put wetland-related decisions on a more economically sound footing.

Table 4.1. Examples of the economic benefits that wetland provide

USE BENEFITS			**NON-USE BENEFITS**
Direct Use Benefits	**Indirect Use Benefits**	**Option Benefits**	**Existence Benefits**
recreation - boating - birding - wildlife viewing - walking - angling trapping-hunting commercial harvest - nuts - berries - grains - fisheries - peat - forestry	nutrient retention water filtration flood control shoreline protection groundwater recharge external ecosystem support micro-climate stabilization erosion control associated expenditures, e.g., travel, guides, gear, etc.	potential future uses (as per direct and indirect uses) future value of information, e.g., pharmaceuticals, education	biodiversity culture heritage archaeology non-use bequest value

(Modified from Barbier et al. 1997)

5 County Clare Wetlands

5.1 County Clare an introduction

County Clare, is situated on the West Coast of Ireland in the province of Munster covering an area of some 318,784 hectares. It is bounded by counties Galway to the north, Limerick and Kerry to the south and Tipperary to the East. Its natural boundaries comprise Galway Bay to the north, the River Shannon and Lough Derg to the east, the Shannon Estuary to the south and the Atlantic to the west.

The population of Clare based on the 2006 census is 110,950 (54,902 female & 56,048 male). The distribution of population is uneven with an increasing trend towards the south east of the county and in particular the urban area of Ennis. Notwithstanding this, Clare is a relatively rural county in population terms.

Clare has an extremely diverse economy. Agriculture and agriculture-related activities still form an important element of the county's economic base but industrial development is of great importance in the Ennis and Shannon Areas, with the Shannon Free Zone being one of the biggest Regional Industrial Centres in the country.

5.2 County Clare's natural wealth

The County is recognised as having some of the most exceptional natural environments in the country, notably the Burren, the coastline and Lough Derg. Clare has a coastline of 360 km in length. This consists of 192 km of Atlantic seaboard and an estuarial freshwater coastline of approximately 168 km. Although County Clare is internationally renowned for the karst landscape of the Burren, which is underlain by karstified limestone, which is highly water permeable, the county displays an abundance and rich diversity of wetlands types.

The County can be divided into 3 main regions as follows (see Figure 5.1):

Uplands (A): The upland areas of Slieve Aughty and Slieve Bernagh occur in the eastern part of the County and are associated with older Silurian and Devonian rock.

Intermediate Region (B): This region includes much of the western side of the County including the Burren. The topography is gently sloping and includes peaks at Slieve Elva (343 m) in the northwest and Slievecallan (391 m) in the west.

Lowlands (C): The areas immediately north, south and east of Ennis are low-lying. Similarly, the Kilkee to Kilrush area, stretching south-westerly to Loop Head, is a lowland region.

The main river in the county is the River Fergus, which follows a course southward across the lowland of the county through a series of lakes until it becomes tidal below the town of Ennis. The Fergus drains the centre of County Clare and is 1,043 km^2 in area; springs associated with the river constitute important water supplies for the town. The largest lake on the Shannon, Lough Derg, forms the eastern boundary of the county. While in the west a number of smaller rivers drain from the uplands, the short distance westwards, into the Atlantic or to the south into the Shannon Estuary.

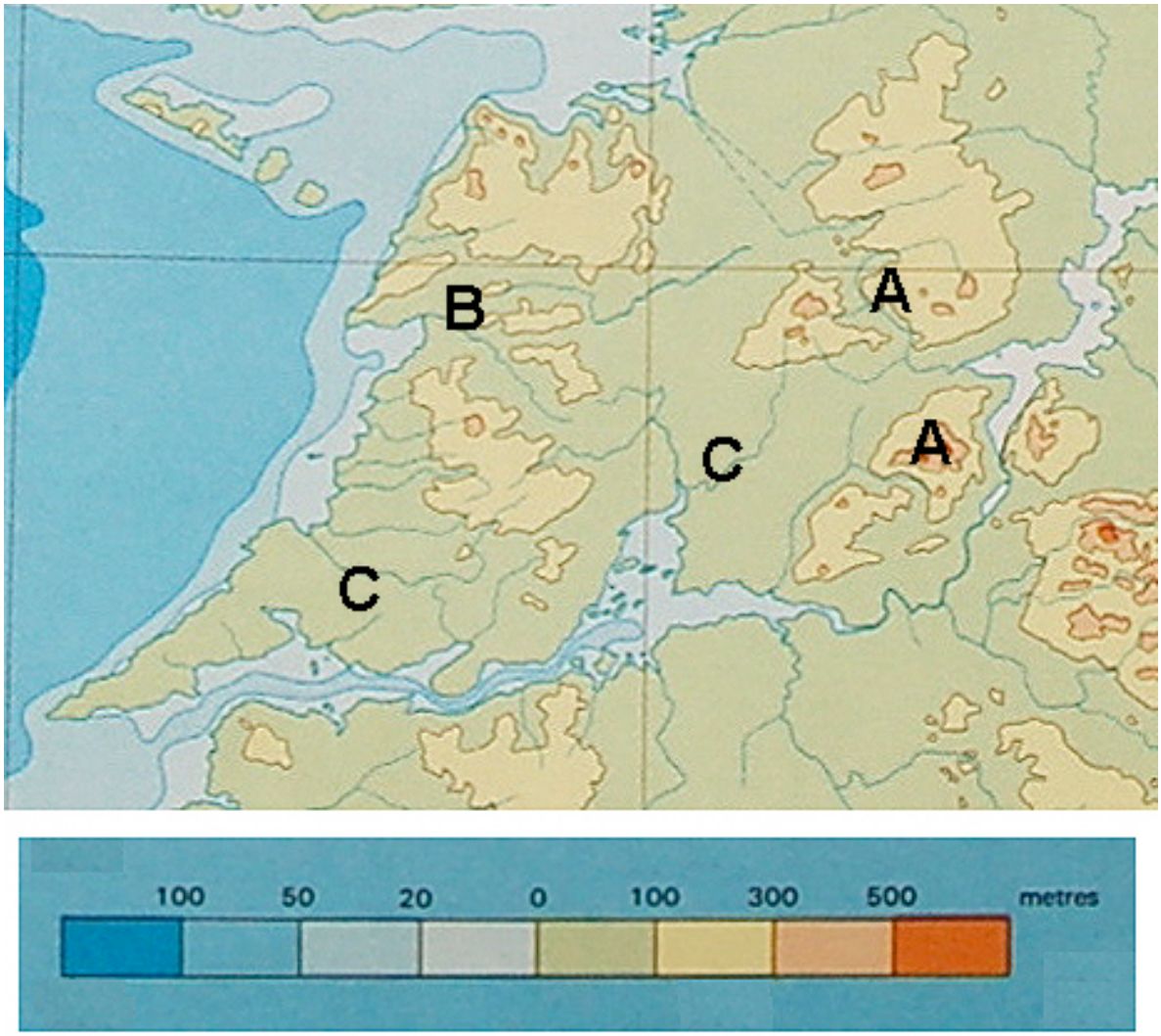

Figure 5.1. Relief and drainage map of County Clare showing uplands (A); intermediate regions (B) and lowlands (C).
Adapted from the Royal Irish Academy – Atlas of Ireland, Anonymous 1979. *(Copyright RIA)*

5.2.1 Geology

The county is based on only three major rock types (see Figure 5.2), each occurring over large areas, namely Early Carboniferous limestone (in the Burren and centre of the county referred to as Courceyan limestone in Figure 5.2), Late Carboniferous sandstone and shales (extending from Ennis west and south westwards to Loop head referred to as Namurian sandstones and shales in Figure 5.2) and Caledonian sedimentary and metamorphic rocks (in the eastern half of the county and extending towards Lough Derg referred to as Upper Devonian – Lower Carboniferous old red sandstone and Silurian sandstones in Figure 5.2) (Anonymous 1979). Consequently the basic geology is relatively uniform with a few exceptions and the geological interest is derived from the structural forces that have acted on the carboniferous limestones and grits, including glaciation, solution and marine erosive action.

The basic alkaline nature of the limestone that occurs near the surface throughout much of Clare means that the ground-water is enriched with Calcium leading to the development of a rich diverse flora present in the ground-water fed wetlands in the county such as fens, turloughs and marshes. This is in total contrast to the bog ecosystems of the county dependant on acid (calcium poor) conditions provided by non-alkaline rock types and rainfall as their main water supply.

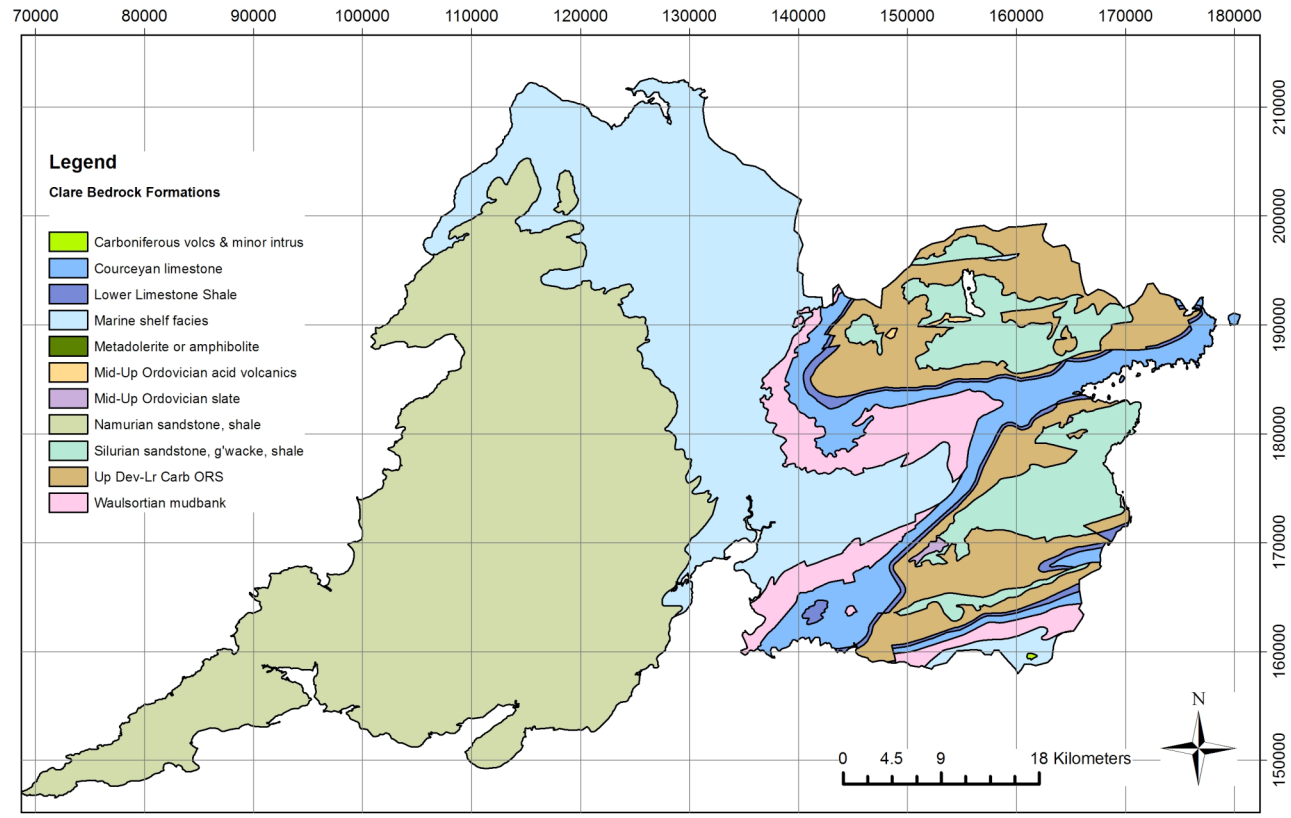

Figure 5.2. The solid geology of County Clare showing the main rock types occurring in the county. Source: Geological Survey of Ireland 1:500000 bedrock map.

5.2.2 Soils

Over much of the county the parent material of the soils is glacial drift (see Figure 5.3), which was deposited during the last (Midlandian) glaciation, except for the area from Milltown Malbay to Loop head where glacial deposits, referred to as Till derived from Namurian Sandstones and shales (TNSSs) in Figure 5.3 were laid down during the earlier Munsterian glaciation (Anonymous 1979).

The soils derived from the Munsterian and Midlandian glacial deposits are generally wet, poorly draining gleys which occur west of Ennis and south westwards to Loop Head. The remainder of the county is defined by a mosaic of better drained podzolics and brown earths, with poorer draining soil types in the upland areas in the east of the county adjoining Lough Derg.

A notable exception to the soil map is found in the Burren, where glacial activity exposed a bare limestone rock landscape, referred to as Karstified Rock (KaRck) in Figure 5.3, with pockets of deposited till derived from limestone (TLs in Figure 5.3). This is one of the factors that has resulted in this area developing such a unique flora in this region in the north of the county.

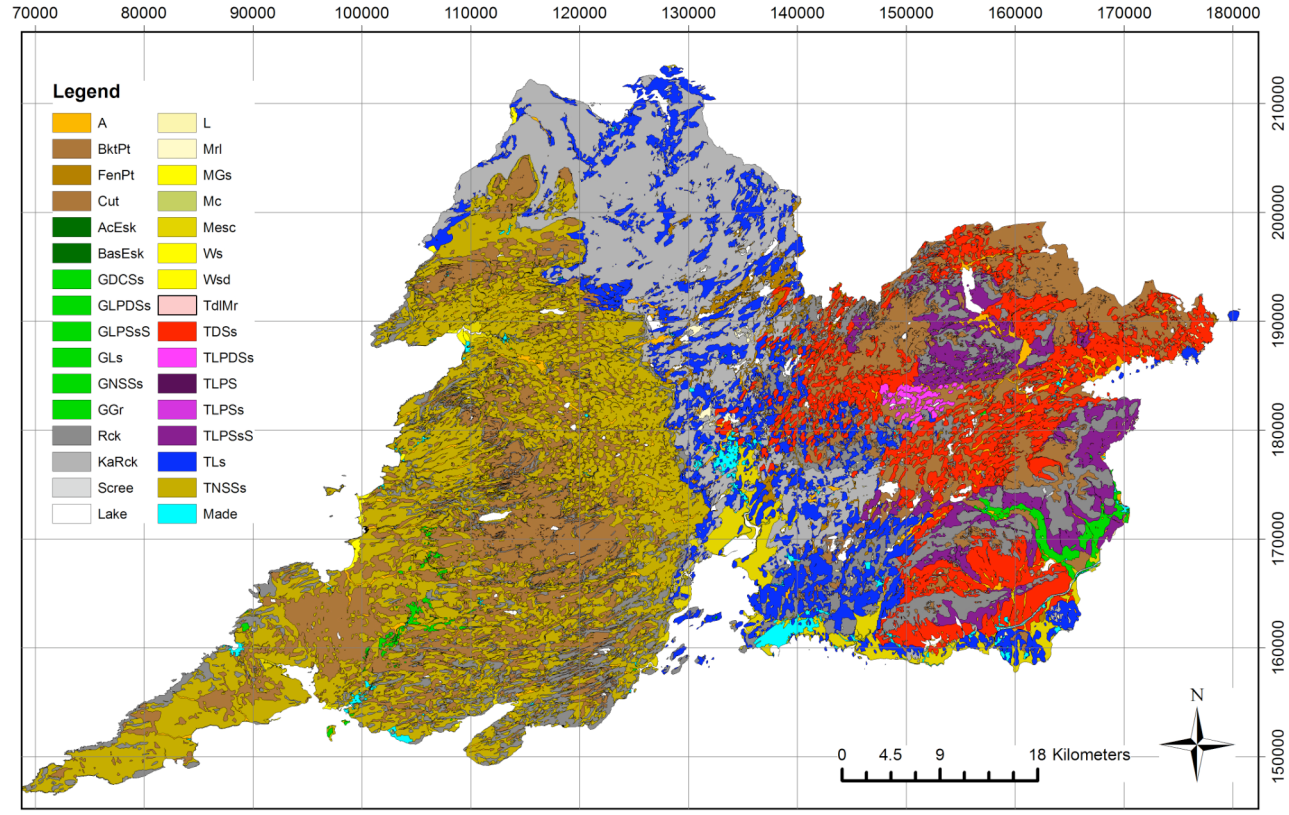

Figure 5.3. Sub-soil (parent material) map of County Clare.
Source: Teagasc subsoil map (Meehan 2004).

Abbreviations to major deposits in Figure 5.3: KaRck, Karst Rock; TLs, Limestone Till; BktPt, Blanket Peat; FenPt, Fen Peat; Cut, Cutover Bog; TNSSs, Till derived from Namurian Sandstones and shales; TDSs, Till derived from Devonian Sandstone; TLPSsS, Till derived from Lower Palaeozoic Sandstones and Shapes; TDSs, Till derived from Devonian Sandstones and Shales

5.2.3 Climate

In common with most areas along the western seaboard of Ireland, County Clare has a climate that can be described as wet and windy, with relatively cool summers and mild winters. It should be noted, however, that Clare receives less rainfall than many other areas along the western seaboard, probably due to the absence of significant mountainous areas on the coast. The mean annual rainfall varies from 1,000 mm to 1,400 mm (Anonymous 1979) with the higher amounts falling in the uplands around Slieve Elva and Slieve Callan (1,400 mm) with slightly less rain falling in the more inland Slieve Aughty Mountains and Slieve Bernagh upland range (1,200 mm). The lowland areas of the county and the peninsula extending towards Loop Head receive mean annual rainfall of approximately 1,000 mm.

Again the climatic variation of Clare and the microclimatic conditions present contributes to the presence of the unusual floral diversity of the Burren (Aalen et al. 1997). In addition, the abundance of rainfall contributes to high water-tables thus facilitating the development of wetlands. Furthermore, the year-round high rainfall of the upland areas has facilitated the development of blanket bogs.

5.2.4 Geographic Location

Situated at Latitude: 53° 8' 48 N, Longitude: 9° 4' 32 W, Clare is located at the western extremity of Ireland, which itself lies at the western extremity of Europe. Due to this situation many of the ecosystems with their range in North-western Europe, take on a slightly different form in this part of Ireland, than elsewhere within their range. This puzzled many of the early botanists who first came to the Burren and found species growing together that in their view and experience should never occur in such an association. Another example, is the clear geographic gradient in bog vegetation that been shown to occur between the west and east of Ireland (Schouten 1984), a gradient that has been shown to continue across Europe. Some of the factors responsible for this include the proximity of the expansive Atlantic Ocean and the maritime influences present being unique to this part of the World.

5.2.5 Habitat Diversity and Wetlands

The varying geological, climatic and soil conditions referred to above have all contributed to a rich and diverse landscape within the county. The variety of wetland habitats found within Clare is explored in more detail in section 5.3.

The most well-known and studied part of County Clare is without a doubt the Burren, renowned for its unique flora (and fauna). Plants occur here in abundance that are almost or totally unknown in the rest of Ireland. Alpine species are mixed with arctic-alpines and purely arctic types, and amidst these groups, Mediterranean species also find a suitable climate. The invertebrate fauna has also been examined, and the same trends have been discerned in it. It includes several species unknown in Great Britain. It is the mixture of geographical types that makes the Burren unique in Europe and of the greatest biological interest.

The Clare coastline is also punctuated by areas of natural and scientific interest. These include the shore south of Spanish Point for its marine biology. The Cliffs of Moher and to a lesser extent of Loop Head support large nesting populations of seabirds, while on the south coast several estuaries, most notably the Fergus, are visited by huge numbers of wildfowl and wading birds. Inland there are also wildfowl resorts, Loughs Atedaun and Cleggan are good examples.

Many of the limestone lakes of Clare contain and are surrounded by an interesting flora. Two of these are in the south, Ballycar Lough and Dromoland Lough, and as one goes north, elements of the Burren flora appear in the community. This is best developed at Lough Bunny.

To the east, the old red sandstone stretches over to Lough Derg and above the drift is much covered by blanket bog, except where natural woodland has persisted. Lough Derg itself has an interesting flora, well shown at the mouth of the Scarriff River and including some juniper scrub (Goodwillie 1972).

5.3 Wetland Habitats in County Clare – a brief description

Clare contains a wide range of wetlands of high international and national importance. Due to the varying topography, hydrology, climate, coastline and soils present it has wetland habitats ranging from raised bogs, blanket bogs, fens, marshes, coastal lagoons, large riverine systems, variety of lakes, springs, wet woodlands and many more. Clare is likely to contain some of the finest examples of calcareous fens, springs and turloughs that occur in Ireland and Northwest Europe.

In the section which follows, a brief description and illustration of each of the main wetland habitat types occurring in Clare, and being mapped as part of the County Clare Wetland Survey (CWS), are presented.

In addition to the general habitat descriptions this summary introduction to habitats includes some additional information on the wildlife value of these habitats. An indication is also provided of the main threats faced nationally by the more 'natural' of these habitats deemed to be of high conservation importance, which is based on the NPWS report entitled 'The Status of EU Protected Habitats and Species in Ireland' (Anonymous 2008d).

For a more detailed description of the wetland habitat types, the main floral species that occur in them, and detailed relationship of the Heritage Council classification system for habitats to the habitat classification system used in the EU Habitats Directive the reader is referred to **Appendix 6a** and **6b** at the end of this report. The detailed habitat accounts in this Appendix are based on the Heritage Council Guide to Habitats in Ireland (Fossitt 2000).

For further information on best practice management guidelines for many of the wetland habitats listed, the reader is referred to "The Living Farmland – A Guide to Farming for Nature in Clare" (Anonymous 2008c) which provides practical advice on habitat maintenance and improvement for landowners and farmers. In addition the NPWS website (www.npws.ie) provides a range of guidelines to help with the protection, management and wise use of conservation worthy habitats and protected species including information on the Rural Environment Protection Scheme (REPS), Farm Plan Schemes, Notifiable actions *inter alia*. Furthermore the Irish Peatland Conservation Council have published a Management Handbook for Peatland which provides practical advice on habitat restoration (see www.ipcc.ie).

Dystrophic lakes

Natural dystrophic lakes are an Annex 1 habitat under the EU Habitats Directive.

Natural lakes and ponds that are highly acidic (pH range 3.5-5.5), base-poor and low in nutrients, and where the water is brown in colour owing to inputs of humic and other acids from peat.

They are usually associated with blanket bogs, mainly the lowland type, raised bogs, cutover bogs and wet heathland areas and are characterised by peaty rather than rocky margins and substrata. The transition from bog to open water is often abrupt. These lakes are important habitats for insect life.

The principal threats to natural dystrophic lakes and ponds are peat cutting, overgrazing and afforestation of peatland habitats.

Relatively common in upland blanket bog areas throughout the county such as within the Lough Atorick Bogs NHA.

Acid oligotrophic lakes

Annex 1 habitat under the EU Habitats Directive.

Lakes and ponds that are low in nutrients, base-poor and acidic. Most acid oligotrophic lakes are associated with areas of acidic bedrock and many have rocky margins. The substrate in shallow water is either rock, organic lake sediment, or coarse mineral material (sand and gravel). Water is often brownish in colour as a result of inputs from peaty soils or bogs in the catchments. These lakes support communities of submerged and floating aquatic plants.

These lakes are important habitats for insect life.

The principal threats to acid oligotrophic lakes include nutrient enrichment arising from agricultural practices such as overgrazing and excessive fertilisation, as well as afforestation, and waste water from housing developments in rural areas. Lakes may also be negatively affected by the introduction of invasive alien species, and their utilization for an increasing number of sport and leisure activities.

This habitat type is relatively common in areas with a non-calcareous bedrock. An example is Doo Lough in West Clare.

Limestone and marl lakes

Hard water lakes and ponds of limestone areas that are base-rich and poor to moderately rich in nutrients (oligotrophic to mesotrophic).

The water is typically clear and the lake sediment usually has a high proportion of marl, a white clay precipitate of calcium carbonate. Marl-forming Stoneworts (*Chara* spp.) are often abundant and may form dense carpets in unpolluted waters. Various-leaved Pondweed (*Potamogeton gramineus*) is also characteristic. These lakes are frequently fringed by rich fen and flush vegetation. These lakes are important habitats for insect and birds.

Hard water lakes are often shallow and have a natural high capacity to buffer the effects of enrichment from phosphorus. However, build up of phosphorus in the sediment of these lakes can lead to rapid shifts in ecosystem quality. There is a continued threat from nutrient enrichment in these lowland lakes arising from intensification of agriculture and urban developments.

A good example of this habitat type is Lough Bunny located in the Burren region.

Mesotrophic lakes

Lakes and ponds that are moderately rich in nutrients, and where the water is sometimes discoloured by algae. Characteristic aquatic plants include White Water-lily (*Nymphaea alba*), Yellow Water-lily (*Nuphar lutea*), and a large number of Pondweeds, Stoneworts (*Chara* spp.) may also be present. The fringing and aquatic plant communities are typically more lush than those associated with oligotrophic lakes.

These lakes are important habitats for insect and birds.

The principal threats to mesotrophic lakes include nutrient enrichment arising from agricultural practices such as overgrazing and excessive fertilisation, as well as afforestation, and waste water from housing developments in rural areas. Lakes may also be negatively affected by the introduction of invasive alien species, and their utilization for an increasing number of sport and leisure activities.

Many of the lakes surrounding Ennis such as Ballyallia Lake fit into this category as reported by Tubridy (2006).

Eutrophic lakes

Natural Eutrophic lakes are an Annex 1 habitat under the EU Habitats Directive.

Eutrophic lakes and ponds that are high in nutrients and base-rich and the water is usually discoloured or turbid, often grey to green in colour, from the abundant algae and suspended matter present.

Some water bodies are naturally eutrophic but most Irish lakes are eutrophic as a result of enrichment and high levels of nutrients entering the water.

Characteristic aquatic plants of eutrophic lakes and ponds include Duckweeds (*Lemna* spp.), Pondweeds (*Potamogeton* spp.) and Spiked Water-milfoil (*Myriophyllum spicatum*). Submerged aquatics are usually rare or are restricted to shallow waters owing to poor light penetration. Reed beds on sheltered shores and dense stands of fringing vegetation are characteristic of eutrophic lakes and ponds.

The main threat to this lake type is further nutrient enrichment caused by human activities.

Some small field ponds in the area surrounding Ennis were categorised as Eutrophic by Tubridy (2006). No natural eutrophic lakes have been recorded from County Clare.

Turloughs

Priority habitat under the EU Habitats Directive.

Turloughs are seasonal lakes that occupy basins or depressions in limestone areas, and where water levels fluctuate markedly during the year. They are virtually unique to Ireland and their greatest concentration is in counties Clare, Galway and Roscommon.

The general pattern is to flood in winter and dry out in summer, but there may be other sporadic rises in response to periods with high rainfall levels. Turloughs normally fill through underground passages and sinkholes in the limestone, but some also have inflowing rivers or streams. Some turlough basins retain standing water in channels, pools or small lakes when flooding subsides. All areas within the normal limit of flooding are considered as part of the turlough habitat. The presence of the distinctive dark moss, *Cinclidotus fontinaloides*, on stone walls or rocks can help to establish the flooding level within a turlough.

Soils of turlough basins can include marls, peat, clays or loams. Large boulders or exposures of bedrock may also be present.

Nutrient enrichment and inappropriate grazing regimes are the main threats to turlough habitats in Ireland.

A well known example of this habitat type is Carran Turlough located in the Burren.

Reservoirs

Open water bodies that are used for the storage and supply of water. It includes natural lakes where water levels fluctuate significantly and unnaturally as a result of water abstraction, in addition to modified lakes with dams or retaining walls or banks or entirely artificial water bodies, some lined with concrete and that are used as reservoirs.

Redshank (*Polygonum persicaria*) is often common along the draw-down zone of reservoirs in lowland areas.

An example of this habitat occurs at Ballymacaula, East of Kilmaley Village, County Clare.

Other artificial lakes and ponds

Includes farm ponds, artificial or ornamental bodies of standing water that may be found in parks, demesnes, gardens or golf courses as well as flooded quarries, tailings ponds and water treatment plants (with open water). The nutrient status of these artificial water bodies is variable and may be high as in the case of hypertrophic lakes in urban parks.

These water bodies are often important habitats for invertebrates and amphibians as they represent a more 'natural' habitat within otherwise highly managed environments. They may also have a high educational value in urban areas as a first contact point for people with a wetland habitat and its wildlife.

The main threats faced by such habitats include water pollution, habitat destruction caused by changes in farming practice or abandonment and infill by encroaching vegetation.

An example of this habitat can be seen at Kilbrecken Silver Mines.

Eroding/upland rivers

Annex 1 habitat under the EU Habitats Directive.

Natural watercourses, or sections of these, that are actively eroding, unstable and where there is little or no deposition of fine sediment. Eroding conditions are typically associated with the upland parts of river systems where gradients are often steep, and water flow is fast and turbulent. For some rivers on the seaward side of coastal mountains, particularly in the west of Ireland, eroding conditions persist to sea level because of comparatively steep gradients over short distances, and high rainfall. Small sections of other lowland rivers may also be eroding where there are waterfalls, rapids or weirs. The beds of eroding/upland rivers are characterised by exposed bedrock and loose rock. Pebbles, gravel and coarse sand may accumulate in places, but finer sediments are rarely deposited. These rivers vary in size but are usually smaller and shallower than depositing/lowland rivers.

The unstable rocky channels of eroding/upland rivers usually support little vegetation cover. Submerged rocks and boulders may be colonised by aquatic mosses. Exposed rocks and wet shaded banks may also support extensive cover of lichens and liverworts. Higher plants are generally rare or absent except in places where fine sediments are trapped.

Pressures from eutrophication, overgrazing, excessive fertilisation, afforestation and the introduction of invasive alien species are the main threat to this habitat. Almost two thirds of the rivers assessed by the Environmental Protection Agency (EPA) are at risk of failing to meet their environmental objectives.

Many of the streams and rivers of County Clare fit this category. One such example is the upper reaches of Annageeragh River in West Clare.

Depositing/lowland rivers

Annex 1 habitat under the EU Habitats Directive.

Watercourses, or sections of these, where fine sediments are deposited on the river bed. Depositing conditions are typical of lowland areas where gradients are low and water flow is slow and sluggish. These rivers vary in size but are usually larger and deeper than those above. In a natural state these rivers erode their banks and meander across floodplains.

Plant and animal communities are influenced by numerous factors including substratum type, water force, nutrient status, water quality, channel size, water depth, human impact, disturbance and shade. Within a river channel there may be deep pools, backwaters, banks or mid-channel bars of gravel, sand or mud, in addition to vegetated islands and fringing reed beds. The substratum of depositing/lowland rivers comprises mainly fine alluvial or peaty sediments. Vegetation may include floating and submerged aquatics, with fringing emergents in shallow water or overgrowing the banks.

Due to their location in lowland areas, where agricultural activities are prevalent and with increased population pressures, most of these rivers have been modified to some extent to control water flow, facilitate navigation or prevent flooding and erosion. Canalised or walled sections of rivers, dredged or deepened sections, and artificial earth banks may occur. These activities all alter the natural river bank and adjacent vegetation occurring along such rivers.

The principal threats to these rivers include nutrient enrichment arising from agricultural practices, human developments along river banks and the introduction of invasive alien species, and utilization for sport and leisure activities.

There are some examples of this habitat occurring in County Clare such as the Lower River Shannon and Lower River Fergus.

Canals

Canals are artificial linear bodies of water that were originally constructed for the purpose of navigation. They typically lack strong currents and any significant channel or bank erosion. This means that canals tend to have closer affinities with ponds than rivers. They are readily colonised by aquatic plants and frequently support floating, submerged or emergent vegetation.

Locks that are used to control water levels are considered as part of the canal habitat.

Canals are important habitats for fish, insect and bird life.

All canals require management and maintenance to keep them open and operational. Where canals are abandoned they rapidly become choked with aquatic vegetation.

Headrace Canal which runs from O'Briensbridge to Ardnacrusha is an example of this habitat type.

Drainage ditches

These are linear water bodies or wet channels that are entirely artificial in origin, and some sections of natural watercourses that have been excavated or modified to enhance drainage and control the flow of water. Drainage ditches may be intimately associated with a range of other wetland types, including wet grassland, and modified marsh, bog and fen habitats.

Drainage ditches are generally not used for navigation and are typically narrower than canals. Drainage ditches either contain water (flowing or stagnant) or are wet enough to support wetland vegetation. Water levels are also likely to undergo seasonal fluctuations.

Drainage ditches must be maintained and cleared in order to keep them open. Those that are overgrown with vegetation are likely to be cleared intermittently.

Common habitat type throughout County Clare, examples of the habitat can be seen at most wetland sites such as Tullagher Lough Bog.

Calcareous springs

Priority habitat under the EU Habitats Directive.

Calcareous spring fens develop around permanent freshwater springs or areas of water seepage that are especially rich in calcium. The upwelling of water is often associated with an interface between permeable and impermeable rock or soil layers.

The water supply may be from upwelling groundwater sources, or from seepage sources or sometimes from geo-thermal sources. Petrifying springs may be closely associated with Alkaline fens but with less fluctuations in water. A key requirement is a steady flow of water, though this may dry up for short periods.

Springs are often very small features covering no more than some tens of metres. Petrifying springs occur on shallow peaty or skeletal mineral soils.

On contact with the atmosphere at the spring head, carbon dioxide is lost from the water or is depleted by photosynthetic activities of plants growing in the spring, which results in the precipitation of a calcium bicarbonate marl or tufa crust. The vegetation in such areas, and especially mosses may be coated in a thick crust of lime. Larger petrifying springs may form tufa cones that constitute a singular habitat.

Springs occur in lowland and upland areas, are often very limited in extent and may be associated with a variety of different habitats such as alkaline fen, woodland, heathland, grassland, limestone rich boulder clay or gravel deposits or on exposed rock.

Spring vegetation is characterized by an abundant or dominant moss cover and may or may not be peat-forming.

Calcareous spring fens are rare in Ireland.

As calcareous spring sites are often small in extent they are threatened by a range of land reclamation, turf cutting, and drainage activities, which can rapidly degrade their structure and function. Damage to this habitat type is likely to have increased in severity since the 1990’s due to these activities, which adversely impact on these small scale habitats.

Examples of this habitat can be seen throughout much of the karst landscape of the Burren, often in association with fens or turloughs. An example is Fahee Spring found at Carran (Fahee) Turlough.

Non-Calcareous springs

Non-calcareous springs that are irrigated and kept permanently moist by acidic to neutral water that is base-poor and typically oligotrophic. They may be associated with skeletal mineral or peaty soils. Vegetation is typically dominated by mosses and a few higher plant species.

Non-Calcareous Springs occur in lowland and upland areas, are often very limited in extent and may be associated with a variety of different habitats such as woodland, heathland, grassland, bogs, wet clay banks or gravel deposits or on exposed bare rock.

As these spring sites are often small in extent they are threatened by a range of land reclamation, turf cutting, afforestation and drainage activities, which can rapidly degrade their structure and function. Damage to this habitat type is likely to have increased in severity since the 1990's.

To date this habitat type has not been reported from County Clare although it is likely to occur in the non-limestone region of the county.

Reed and large sedge swamps

Swamps are commonly found around lakes, on slow flowing river banks and estuaries.

They are usually species-poor stands of vegetation that are dominated by Reeds and other large grasses or large, tussock-forming Sedges. Most reed and large sedge swamps are overwhelmingly dominated by one or a small number of species, as in the case of reed beds. Stands of vegetation can range from very dense to open.

Unlike tall-herb swamps below, in reed and large sedge swamp the broad-leaved herb component is a minor element in the vegetation.

Swamps support a number of EU protected species including Otter, Sedge Warbler, Water Rail, Moorhen and other water fowl.

The principal threats to this habitat include nutrient enrichment and damage arising from agricultural practices (overgrazing, mowing and drainage), human developments around lakes and utilization of lakes for increased sport and leisure activities.

Examples of this habitat are evident throughout Clare, an example of the habitat can be seen within Oysterman's Marsh NHA.

Tall herb swamps

Annex 1 habitat under the EU Habitats Directive.

Tall-herb swamps are comparatively species-rich stands of vegetation dominated by herbs that occur in wet areas where the water table is above the ground surface for most of the year, or where water levels fluctuate regularly as in the case of tidal sections of rivers. Tall herb swamps are not dominated by reeds.

Swamps support a number of EU protected species including Otter, Reed Warbler, Water Rail, Moorhen and other water fowl.

The principal threats to this habitat include nutrient enrichment and damage arising from agricultural practices (overgrazing, mowing and drainage), human developments around lakes and utilization of lakes for increased sport and leisure activities.

Reported from area adjacent to Clonlea Lough, County Clare by Tubridy (2006).

Wet grassland

Annex 1 habitat under the EU Habitats Directive.

Rushy fields or wet grassland can be found on flat or sloping ground in upland and lowland areas. It occurs on wet or waterlogged mineral or organic soils that are poorly-drained or, in some cases, subjected to seasonal or periodic flooding. On sloping ground, wet grassland is mainly confined to clay-rich gleys and loams, or peaty soils that are wet but not waterlogged. Wet grassland occurs on areas of poorly-drained farmland that have not recently been improved, seasonally flooded alluvial grasslands such as the River Shannon callows, and wet grasslands of turlough basins.

Agricultural intensification over the past century, drainage, increased fertilisation and more recently, abandonment of pastoral systems, which contributes to rank vegetation and scrub encroachment, all lead to the loss of some typical flora and to a reduction in the area of the habitat nationally.

Common throughout Clare, can be seen throughout the lowlands of the county.

Marsh

Annex 1 habitat under the EU Habitats Directive.

Marsh is found on level ground near slow-flowing river banks, lake shores, and in other places where mineral or shallow peaty soils are waterlogged, and where the water table is close to ground level for most of the year.

Unlike swamps, standing water is not a characteristic feature except, perhaps, during very wet periods or in winter months. Marshes tend to be comparatively species-rich especially with herbs. It can be an ideal breeding ground for waders such as Snipe.

The main threats to this habitat include the spread of invasive species, arterial drainage and agricultural improvement at the edge of rivers and lakes.

Marsh has been reported widely from County Clare. The habitat has been reported from Ballycar Lake by Conaghan and Fuller (2004).

Wet Heath

Annex 1 habitat under the EU Habitats Directive.

Wet heaths include vegetation with at least 25% cover of dwarf shrubs such as Ling Heather, on peaty soils and shallow wet peats that typically have an average depth of 15-50 cm (where deeper peat deposits occur the habitat is usually classified as bog).

Wet heath can occur in upland and lowland areas and is widespread on the lower slopes of hills and mountains that are either too dry or too steep for deep peat accumulation. Wet heath can grade into, or form intimate mosaics with upland blanket bog, or lowland blanket bog with minor changes in slope and topography.

Wet heath is typically dominated by Ling Heather (*Calluna vulgaris*) and Cross-leaved Heath (*Erica tetralix*), or by Purple Moor-grass (*Molinia caerulea*) and/or Sedges. Moss and Lichen cover may be high in areas of undamaged wet heath. Wet heaths and adjacent blanket bog areas support a number of EU protected species including Red Grouse, Curlew, Golden Plover and Hen Harrier.

Reclamation, afforestation and burning have resulted in extensive loss of wet heath. Overstocking of land with sheep has also degraded large areas of the habitat, especially in western regions, through overgrazing and trampling. This has depleted heather and other plant cover and allowed invasion by non-heath species, or exposure of peat to severe erosion. Although various schemes to initiate recovery of damaged habitat through more sustainable stocking rates have been in operation for a number of years, recovery has been slow.

Examples of this habitat are often in mosaic with Blanket Bog in the uplands of the county such as at Woodcock Hill NHA.

Raised bogs

Priority habitat under the EU Habitats Directive.

Raised bogs are accumulations of deep acid peat (3-12 m) that originated in shallow lake basins or topographic depressions at the end of the last glaciation 10,000 years ago. The name is derived from the elevated surface, or dome, that develops as raised bogs grow upwards from the surface accumulating organic material; the domed effect is often exaggerated when the margins of a bog are damaged by turf cutting or drainage, and are drying out.

The surface of a relatively intact raised bog is typically wet, acid and deficient in plant nutrients (as bogs receive most of nutrients through rainfall), and supports specialised plant communities that are low in overall diversity. The vegetation is open and colourful *Sphagnum* mosses dominate the ground layer. Raised bogs are most abundant in the lowlands of central and mid-west Ireland.

Intact actively growing raised bog is extremely rare, having decreased in area by over 35% in the last 10 years. Ongoing deterioration of the hydrological conditions of raised bogs at current rates caused by peat cutting, drainage, forestry and burning severely threatens the viability of the habitat at most locations in Ireland.

Examples of this habitat type include Tullagher Lough and Bog SAC and Red Bog - O'Briensbridge cNHA.

Upland blanket bog

Priority habitat under the EU Habitats Directive, provided that active peat accumulation is occurring within a site.

Upland blanket bog occurs on flat or gently sloping ground above 150 m and is widespread on hills and mountains throughout Ireland. The 150 m limit serves to distinguish upland from lowland blanket bog but is loosely applied. Peat depths vary and normally fall in the range of 1-2 m, but can be much deeper in pockets. Upland blanket bog can be extremely wet where it occurs on level terrain and may have surface drainage features that are typical of lowland blanket bog.

Blanket bog areas support a number of EU species including Irish Hare, Red Grouse, Curlew, Golden Plover and Hen Harrier.

Current pressures and threats include overstocking by grazing animals (especially sheep), peat erosion, drainage, burning and infrastructural developments (i.e. windfarms).

Good examples of this habitat occur within the Lough Atorick Bogs NHA in the eastern part of the County.

Lowland blanket bog

Priority habitat under the EU Habitats Directive, provided that active peat accumulation is occurring within a site. Depressions on peat substrates (found within blanket bog areas) are an Annex 1 habitat under the EU Habitats Directive.

Lowland blanket bog, also known as Atlantic or oceanic blanket bog, is more restricted in its distribution than the upland type and is largely confined to wetter regions along the western seaboard where the annual rainfall exceeds 1250 mm. Blanket formation started 4,000 years ago as the climate became wetter. Described as a climatic peat type, it occurs on flat or gently sloping ground below 150 m. Peat depths vary considerably (1.5-7 m) depending on the underlying topography, and are usually intermediate between those of raised bog and upland blanket bog. The vegetation of lowland blanket bog is typically 'grassy' in appearance. This habitat includes important breeding grounds for a number of EU Bird Directive species including Merlin, Golden Plover, Hen Harrier and Red Grouse.

Blanket bogs depend to a large degree on maintenance of surface water flow patterns at a landscape scale and hence are dependent on sensitive land management practices. Extensive areas have been destroyed or highly modified (chiefly through reclamation, peat extraction, conifer afforestation but also via erosion and even landslides triggered by human activity). Current pressures include overstocking with grazing animals, peat extraction, drainage, burning and infrastructural developments, and in the past unsuitable afforestation projects.

An example of this habitat occurs within Oysterman's Marsh NHA.

Cutover bog

Depressions on peat substrates (found within cutover bog areas) are an Annex 1 habitat under the EU Habitats Directive.

Cutover bog is a variable habitat, or complex of habitats, that can include mosaics of bare peat and re-vegetated areas with woodland, scrub, heath, fen and flush or grassland communities. It occurs where part or all of the original peat has been removed through turf cutting, by the traditional hand method or mechanically, for either domestic or commercial purposes.

The nature of the recolonising vegetation depends on numerous factors including the frequency and extent of disturbance, hydrology, the depth of peat remaining, and the nature and soil chemistry of the peat and the underlying rock or soil. Standing water is usually present in drains, pools or excavated hollows. Some large areas of cutover bog have been reclaimed as farmland or planted with trees, particularly conifers.

The full extent of the cutover may be difficult to establish as it frequently grades into other marginal habitats or farmland.

Common throughout the peatland areas of Clare such as Monmore Bog in the western part of the county.

Eroding blanket bog

This habitat occurs on blanket bogs (upland and lowland) where part of the original peat mass has been lost through erosion, and where sizeable areas of bare peat are exposed. Eroding blanket bog is most commonly associated with upland areas, and mountain peaks and ridges in particular. The causes of erosion are numerous; some erosion may have occurred as a natural process but, over the last two decades, overgrazing by livestock (particularly sheep) has been a major contributory factor.

Eroding blanket bog is often characterised by networks of channels and gullies that have cut down through the protective layer of vegetation to expose the underlying peat. As erosion continues, these channels widen, deepen and coalesce until eventually the rocky substratum is reached. Some small blocks of the original bog, known as peat haggs, may remain.

To be categorised as eroding blanket bog, a substantial proportion of the original bog surface should be missing and peat should have eroded below the rooting zone of the surface vegetation. In such situations, the process is likely to be irreversible, or recovery very slow, even if damaging activities cease. Eroding blanket bog also occurs on peatlands damaged by bog bursts when sizeable areas of bare peat are exposed.

In Clare this habitat is recorded from Maghera Mountain Bogs NHA.

Rich fen and flush

Alkaline (rich) fen is an Annex 1 habitat under the EU Habitats Directive. Saw sedge (*Cladium mariscus*) fen, a particular type of rich fen, is a **priority habitat** under the EU Habitats Directive.

Rich fen and flush are peat forming wetlands that receive mineral nutrients from sources other than rainfall, usually groundwater or flowing surface waters that are at least mildly base-rich or calcareous, and are usually found over areas of limestone bedrock. The substratum is waterlogged peat and this usually has a high mineral content.

Fens differ from bogs because they are less acidic and have relatively higher mineral levels. They are therefore able to support a much more diverse plant and animal community.

They occur in a variety of situations including valleys or depressions, valley head fens, within transition mire and tall reed beds, on the landward side of hard-water oligotrophic lakeshore communities, calcium-rich flush areas in blanket bogs, dune slack areas, fens adjacent to raised and blanket bogs, in turlough sites, depressions in limestone pavement and wet hollows in machair, and spring fed habitats including cliffs, and even saltmarsh.

Alkaline fen may also occur as a secondary regenerating habitat on mined out bog sites which have been excavated to the fen peat layer.

Vegetation is typically dominated by Black Bog-rush (*Schoenus nigricans*) and/or small to medium Sedges (grass like plants). Rich fen and flush can be important for orchids. A well-developed layer of brown moss is also characteristic.

Rich fen are also important habitats insects and for a number of rare snail species.

Like most peatland types in Ireland, fens have declined in extent mostly as a result of activities such as peat mining, agricultural drainage, infilling, and fertiliser pollution and eutrophication. Only limited measures have been introduced to address these damaging activities, which are likely to have increased in severity since the 1990's.

The habitat is relatively widespread throughout the limestone region of the Burren. An example of the habitat has been reported from Ballycullinan Lake SAC.

Poor fen and flush

Poor fen and flushes include peat-forming communities that are fed by groundwater or flowing surface waters that are acid. In most cases the substratum is acid peat which has a higher nutrient status than that of surrounding acid bogs. The vegetation of poor fens and flushes is typically dominated by sedges and extensive carpets of mosses, in particular, *Sphagnum* moss.

Poor fens occur in a variety of situations including areas flushed by moving water in upland and lowland blanket bogs, flushed depressions in grassland areas, cutover bogs and wet heath areas.

Like most peatland types in Ireland, poor fens have declined in extent mostly as a result of activities such as peat cutting and mining, afforestation, agricultural drainage, infilling, and fertiliser pollution and eutrophication.

Present throughout many of the upland bog sites within the county such as Lough Acrow Bogs NHA.

Transition mire and quaking bog

Annex 1 habitat under the EU Habitats Directive.

Transition mires and quaking bogs are peat-forming communities developed at the surface of waters with little or moderate amounts of nutrients, with characteristics intermediate between rich (alkaline) and poor (acidic) fen types. For this reason, they are considered as a separate habitat but they may occur within, or on the fringes of other peat-forming systems.

They present a large and diverse range of plant communities. In large peaty systems, the most prominent communities are swaying swards, floating carpets or quaking mires formed by medium-sized or small Sedges, associated with *Sphagnum* or brown mosses.

Transition mires and quaking bogs are usually associated with the wettest parts of a bog or fen and can be found in wet hollows, infilling depressions, or at the transition to areas of open water.

The vegetation frequently forms a floating mat or surface scraw over saturated, spongy or quaking peat. Standing water may occur in pools or along seepage zones. The vegetation typically comprises species that are characteristic of bog, fen and open water habitats.

In some cases the mire occupies a physically transitional location between bog and fen vegetation, for example on the margin of a raised bog, or may be associated with certain valley and basin mires.

Like most peatland types in Ireland, transition mire have declined in extent mostly as a result of activities such as peat cutting and mining, afforestation, agricultural drainage and reclamation, infilling, and fertiliser pollution from adjacent farmland.

Extensive patches of this habitat were recorded from the area around Oystermans Marsh NHA.

Wet pedunculate oak-ash woodland

Priority habitat under the EU Habitats Directive.

This type of woodland is associated with areas that are flooded or waterlogged in winter but which dry out in summer. It occurs on periodically-flooded alluvial sites that are well above the limits of regular inundation, and on drumlins and other sites with heavy, poorly-drained clay soils that are subject to waterlogging.

The woodland is dominated by Pedunculate Oak (*Quercus robur*) and/or Ash (*Fraxinus excelsior*), with other common components including Alder (*Alnus glutinosa*), Willows (*Salix* spp.) can be locally abundant.

They occur widely throughout the country usually as small and isolated stands with the most extensive areas in the south-west. When flooding subsides in alluvial sites, exposed channels and depressions may remain wet or waterlogged.

The area of alluvial forests has declined in Ireland and this, taken together with their fragmented nature, abundance of alien invasive species and sub-optimal grazing regimes and drainage continues to threaten the habitat.

Rare habitat type in Clare, has been reported from Lough O'Grady cNHA.

Riparian woodland

Riparian woodlands are wet woodland habitats of river margins (gallery woodland) and low islands that are subject to frequent flooding, or where water levels fluctuate as a result of tidal movement (in the lower reaches of rivers).

Riparian woodland is dominated by stands of Willows that may include native and non-native species. Alder (*Alnus glutinosa*) is occasional. Stands of Reed Canary-grass (*Phalaris arundinacea*) are common. Indian Balsam (*Impatiens glandulifera*), an introduced species, is locally abundant. These woodlands often reveal an accumulation of river borne debris, including dead vegetation and plastic, when water levels are low. A fine coating of grey mud on vegetation and tree bases that are regularly submerged and emersed is also characteristic.

Their fragmented nature, abundance of alien invasive species and sub-optimal grazing regimes and drainage continues to threaten the habitat.

Habitat is known to occur within the Lower River Shannon SAC.

Wet willow-alder-ash woodland

Includes woodlands of permanently waterlogged sites that are dominated by willows (*Salix* spp.), Alder (*Alnus glutinosa*) or Ash (*Fraxinus excelsior*), or by various combinations of some or all of these trees.

It includes woodlands of lake shores, stagnant waters and fens, known as carr, in addition to woodlands of spring-fed or flushed sites. Carr occurs on organic soils and fen peats that are subject to seasonal flooding but remain waterlogged even when flood waters recede.

As the area of fen has declined so has the area of wet woodland, mostly as a result of activities such as peat cutting and mining, conifer afforestation, agricultural drainage and reclamation, infilling, and fertiliser pollution from adjacent farmland. Although drainage of fens may in some cases have led to a local short term increase in the cover of wet woodland in some areas.

Likely to be the most common wet woodland type in County Clare, examples of the habitat can be seen within Dromore Woods and Loughs SAC.

Bog woodland

Priority habitat under the EU Habitats Directive.

Woodlands found on intact ombrotrophic bogs (raised or blanket), bog margins and cutover bog. Bog woodland typically occurs on deep acid peat that is relatively well-drained in the upper layers and is commonly associated with former turf cutting activity or drainage or where internal raised bog drainage patterns allow the development of woodland stands (i.e. soak systems on bogs). It may also occur in areas of cutover bog where most of the peat has been removed. Downy Birch (*Betula pubescens*) is the usual dominant and may form pure stands. Willows (*Salix* spp.) may also occur.

A characteristic feature is the ground cover of *Sphagnum* moss species which often form deep carpets, usually with *Polytrichum* mosses and occasional Lichens.

Woodland of waterlogged acid peats in hollows or depressions in areas of upland woodland on siliceous rocks may also be included in this habitat category.

Bog woodlands are closely associated with raised bogs, occurring either on intact bogs, on cutaway or on transition mires (transition between fen and bog). They are found mostly in the central and north midlands. Their total area is uncertain.

They are threatened by drainage, peat cutting, burning and development; although in the long term it is believed that they will expand as cutaway re-floods.

A relatively rare habitat in Clare, an example has been reported from Loughanilloon Bog Bog NHA.

Scrub

Annex 1 habitat under the EU Habitats Directive.

Found on a variety of habitat types, scrub includes areas that are dominated by at least 50% cover of shrubs (e.g. Gorse), stunted trees or brambles. The canopy height is generally less than 5 m, or 4 m in the case of wetland areas.

Scrub frequently develops as a precursor to woodland and is often found in inaccessible locations, or on abandoned or marginal farmland. In the absence of grazing and mowing, scrub can expand to replace grassland or heath vegetation. Trees are included as components of scrub if their growth is stunted as a result of exposure, poor soils or waterlogging. If tall trees are present, these should have a scattered distribution and should not form a distinct canopy.

Examples of this habitat can be seen within Cloonloum More Bog NHA.

Lagoons and saline lakes

Priority habitat under the EU Habitats Directive.

Coastal lagoons are enclosed bodies of standing brackish water that are wholly or partially separated from the sea by banks of sand, shingle or rock, or by land barriers of rock or peat. Tidal influence is much reduced by these physical barriers or is totally absent.

Salinity (the salt content of the water) is highly variable both within and between different lagoonal systems. It fluctuates on a daily and seasonal basis, depending on tides and inputs of freshwater or salt water following storms and, in some situations, may exhibit the full range from sea water to freshwater conditions. Water levels in lagoons generally undergo seasonal fluctuations (high in winter and low in summer) unless strictly controlled by pumping. Strong water currents are absent and this is a key feature which distinguishes lagoons from other marine water bodies.

In addition to typical sedimentary lagoons, this habitat may also occur where brackish waters has become impounded behind artificial barriers (usually as a result of construction), coastal lakes with natural outlets to the sea that experience some tidal exchange at high tide or during storm conditions, and other lakes that are isolated from the sea but which are slightly saline as a result of percolation of sea water or inputs from salt spray and storm waves or surges.

There is no evidence of any significant loss of coastal lagoon habitat range in the last 100 years. The most damaging activity has been the deliberate drainage of the largest lagoon (Tacumshin Lake, Co. Wexford) for agricultural reasons and a smaller lagoon (Shannon airport, Co. Clare) for safety reasons. Further loss of habitat has occurred as a result of natural silting-up. The quality of the habitat has been impacted by water pollution in the form of excessive nutrient enrichment mostly from agricultural sources, but also due to domestic effluents due to an increase in urbanization, commercial and industrial activities adjacent to lagoons.

An example of this habitat includes Farrihy Lough situated on the western coast of County Clare.

Dune slacks

Annex 1 habitat under the EU Habitats Directive.

Dune slacks are nutrient-enriched wet areas that occur in hollows or depressions either behind or between dune ridges, or in blow-outs in sand dunes. The water table is either at, or close to the surface for much of the year and dune slacks may or may not dry out in summer.

Vegetation typically comprises Creeping Willow (*Salix repens*), Common Reed (*Phragmites australis*), Sedges, Rushes and broadleaved wetland herbs. A range of orchids are common found. Dune slacks that remain permanently wet are characterised by Mare's-tail (*Hippuris vulgaris*) and Water Horsetail (*Equisetum fluviatile*).

This habitat is under serious threat from a range of impacts including overgrazing, undergrazing, over-stabilisation of dunes, water abstraction and drainage, golf course developments, forestry and coastal protection works.

Few examples occur in Clare, they have been reported from Carrowmore Dunes SAC.

5.4 Protection of Clare Wetlands

Due to their recognised ecological importance, many wetland sites in Clare are offered legislative protection under various site conservation designations. The main nature conservation designations that afford protection to wetland sites are summarised below.

NP – National Park
National parks are defined as areas where one or several ecosystems are not materially altered by human exploitation and occupation; where plant and animal species, geomorphological sites and habitats are of special scientific, educational and recreational interest or which contain a natural landscape of great beauty (www.NPWS.ie). The Burren National Park is the only such site in County Clare and contains a small proportion of wetland habitats.

NNR - National Nature Reserve
National Nature Reserve are areas set aside for their conservation value by the Minister for the Department of Environment, Heritage and Local Government. These sites are usually State owned, in cases where these areas are privately owned, land-owners enter into a management agreement with the National Parks and Wildlife Service. There are three designated National Nature Reserves located in County Clare (Dromore Woods and Loughs; Ballyteige (Clare); and Slieve Aughty Mountains) that contain wetland habitats recorded in the CWS site database.

SAC – Special Area of Conservation
Special Areas of Conservation have been selected from the prime examples of wildlife conservation areas in Ireland. The legal basis from which selection is derived from the EU Habitats Directive (92/43/EEC of the 21st May 1992) (CEC 1979). SACs that are undergoing the formal designation process but have not finally been submitted to Europe are called cSACs which stands for "candidate Special Areas of Conservation".

Actions that may affect the ecological integrity of sites are not to be permitted except in circumstances of overriding public interest or safety. Land-owners require permission from the Minister of the Environment to carry out certain 'notifiable actions' such as drainage or fertiliser application, depending on the habitats in question.

To date a total of 99 sites and sub-site SACs in County Clare containing wetland habitats (as classified by the Clare Wetland Survey) are recorded in the CWS site database (see Table 7.4 in results section 7.5 below and Appendix 8).

SPA - Special Protection Area
Special Protection Areas for Birds are areas which have been designated to ensure the conservation of certain categories of birds. Ireland is required to conserve the habitats of two categories of wild birds under the European Birds Directive (Council Directive 79/409/EEC of the 2nd April 1979) (CEC 1979).

The NPWS is responsible for ensuring that such areas are protected from significant damage.

In County Clare a total of 23 sites and sub-site SPAs containing wetland habitats (as classified by the Clare Wetland Survey) are recorded in the CWS site database (see Table 7.4 in results section 7.5 below and Appendix 8).

NHA – Natural Heritage Area
The basic designation for wildlife conservation is the Natural Heritage Area (NHA). This is an area considered important in a national context for the habitats present or which holds species of plants and animals whose habitat needs protection. Some of these sites are small, such as roosting areas for rare bats; others can be large such as a blanket bog or a sand dune system.

To date in Ireland, 75 raised bogs have been given legal protection, covering some 23,000 ha. A further 73 blanket bogs, covering 37,000 ha are also designated as NHAs throughout the country (www.NPWS.ie). Under the Wildlife Amendment Act (2000), NHAs are legally protected from damage from the date they are formally **proposed** for designation. The protection afforded to Natural Heritage Areas is similar to that afforded to Special Areas of Conservation as described above.

To date in County Clare a total of 15 sites and sub-site NHAs containing wetland habitats (as classified by the Clare Wetland Survey) are recorded in the CWS site database (see Table 7.4 in results section 7.5 below and Appendix 8).

pNHA - proposed Natural Heritage Areas
Proposed Natural Heritage Areas were published on a **non-statutory** basis in 1995, but have not since been statutorily proposed or designated. These sites are of significance for wildlife and habitats. Some of the pNHAs are tiny, such as a roosting place for rare bats. Others are large - a woodland or a lake, for example.

Nationally pNHAs cover approximately 65,000 ha and NPWS has indicated that designation will proceed on a phased basis over the coming years (www.NPWS.ie). Prior to statutory designation, pNHAs are subject to limited protection being considered in afforestation grants, REPS and recognition by planning authorities.

Within County Clare a total of 39 pNHAs sites containing wetland habitats (as classified by the Clare Wetland Survey) are recorded in the CWS site database (see Table 7.4 in results section 7.5 below and Appendix 8).

cNHA – candidate Natural Heritage Area
Candidate Natural Heritage Area is the name given to wildlife sites that are proposed to NPWS by third parties for consideration as NHAs. Prior to designation these sites require survey and evaluation for their conservation value. If they are considered of national conservation value they may then enter the formal NHA designation process. These sites have no legal protection until they are taken up into the formal NHA designation process.

A total of 88 site and sub-site cNHAs containing wetland habitats are recorded in County Clare in the CWS site database.

5.5 CWS Wetland types

The County Clare Wetland Survey (CWS) set out to map the distribution and extent of all freshwater wetland habitat types as defined by the Fossitt habitat classification system of the Heritage Council Guide to Habitats (Fossitt 2000).

The Heritage Council Guide to Habitats in Ireland sets out a standard hierarchical scheme for the identification of habitats in Ireland. The guide is a practical tool to allow identification and recording of habitat types.

The guide lists the main terrestrial wetland and wetland related habitats in Ireland under the main level 1 categories of freshwater, grassland and marsh, heath and dense bracken, peatlands, woodland and scrub and coastland. Table 5.1 adapted from Fossitt (2000) lists the main wetland habitat types being recorded and mapped as part of the CWS.

The level 1 wetland habitat categories are further divided to level 2 and subsequently level 3 as shown in Table 5.1. These levels provide progressively more detail of the specific wetland habitat(s) recognised.

It was the aim of the CWS to categorise as many of the wetland sites identified in County Clare as possible in terms of the occurrence of the 34 level 3 wetland habitat types. Identification to this level was of course only possible where specific habitat information on sites was available or where aerial photography allowed identification of a particular level 3 habitat type (see Materials and Methods, for a discussion of limiting factors in relation to habitat recognition and identification encountered during the CWS).

Where a site could not be identified to level 3, the Fossitt classification scheme has the advantage that it allowed identification of habitats on sites to level 1 or level 2 in most cases.

See Appendix 6a of this report for a more detailed description of the individual level 3 habitats, and the relationship of the Fossitt habitat types to those listed on Annex 1 of the EU Habitats Directive. Detailed descriptions of each wetland habitats is presented in Appendix 6b. These descriptions are taken from Fossitt (2000) with some minor modifications to the text.

Table 5.1. The 34 level three Fossitt (2000) wetland habitat types being recorded as part of the County Clare Wetlands Survey 2008. Level 3 Fossitt habitats with an equivalent habitat under Annex 1 of the EU Habitats Directive are marked with an *, while priority habitats under the EU Habitats Directive are marked with **.

Fossitt Level 1 Habitat Code and Name	Fossitt Level 2 Habitat Code and Name	Fossitt Level 3 Habitat Code and Name
F Freshwater	FL Lakes and Ponds	FL1 Dystrophic lakes *
		FL2 Acid oligotrophic lakes *
		FL3 Limestone/marl lakes
		FL4 Mesotrophic lakes
		FL5 Eutrophic lakes *
		FL6 Turloughs **
		FL7 Reservoirs
		FL8 Other artificial lakes and ponds
	FW Watercourses	FW1 Eroding/upland rivers *
		FW2 Depositing/lowland rivers *
		FW3 Canals
		FW4 Drainage ditches
	FP Springs	FP1 Calcareous springs **
		FP2 Non-Calcareous springs
	FS Swamps	FS1 Reed and large sedge swamps
		FS2 Tall herb swamps *
G Grassland and Marsh	GS Semi-natural grassland	GS4 Wet grassland *
	GM Freshwater marsh	GM1 Marsh *
H Heath & dense bracken	HH Heath	HH3 Wet heath *
P Peatlands	PB Bogs	PB1 Raised bogs **
		PB2 Upland blanket bog **
		PB3 Lowland blanket bog **
		PB4 Cutover bog *
		PB5 Eroding blanket bog
	PF Fens and Flushes	PF1 Rich fen and flush **
		PF2 Poor fen and flush
		PF3 Transition mire and quaking bog *
W Woodland and scrub	WN Semi-natural woodland	WN4 Wet pedunculate oak-ash woodland **
		WN5 Riparian woodland
		WN6 Wet willow-alder-ash woodland
		WN7 Bog woodland **
	WS Scrub/transitional woodland	WS1 Scrub *
C Coastland	CW Brackish waters	CW1 Lagoons and saline lakes **
	CD Sand dune systems	CD5 Dune slacks *
CWS Unknown wetland type	na	na

6 Compilation of the County Clare Wetland Survey GIS and Database of Sites

6.1 Background and Project set-up

This County Clare Wetlands Survey was undertaken over a 3 month period from the end of July 2008. The study was primarily a desk study not involving any field survey of sites or ground truthing of habitat information.

Information on known and potential wetlands in County Clare; as well as key areas where wetlands might be likely to occur was abstracted from a variety of existing third party GIS datasets, previous surveys of particular wetland types, published and other research information sources, personal communication with ecological practitioners and staff in Clare County Council and from a desk-based survey of colour aerial photographs of the entire county.

The project depended on the co-operation and assistance of the many groups and individuals who provided data to the project (see Appendix 2 for a list of all groups and individuals who were consulted).

The main challenge of this project was to abstract a list of sites containing one of the 34 wetland types being recorded (see above) and obtain area information for the different wetland types present on the sites recognised in County Clare.

As part of the CWS mapping project two main databases were created to hold site information.

The first was a CWS GIS dataset (created using ArcView 9.2 GIS software package and subsequently converted for use with MapInfo) to hold site related information on each wetland site identified. The dataset is in the form of an ESRI shapefile (point dataset) with numerous attributes containing data on each site such as, area, designation (where relevant), habitats recorded etc.

The second was a CWS Site Database (Filemaker Pro 8.0 software database package supporting data export to Excel format spreadsheets) which held the same information as in the GIS database, plus some additional site specific data unsuitable for storing in GIS format. The site database allowed for easier sorting of site records, data input of site information and subsequent data analysis.

Data from both of these databases was readily exported into an Excel spreadsheet which allowed data exchange between the CWS GIS dataset and main CWS Site database, and accessibility to data for third parties without the appropriate GIS or database software.

6.2 Materials & Methods

The data collection period for information on sites held within the CWS GIS and associated site database was undertaken from the 27 July 2008 to 20 October 2008. See Appendix 1 for details of data sources used during the project period and Appendix 3 for the methodologies used in importing site data.

The methodology employed during the course of the study is illustrated in Figure 6.1. The main stages involved were: data acquisition; design and set-up of *CWS Site database* and *CWS GIS database*; site identification and background research; data entry (and mapping) and data transfer between databases; data analysis and result presentation.

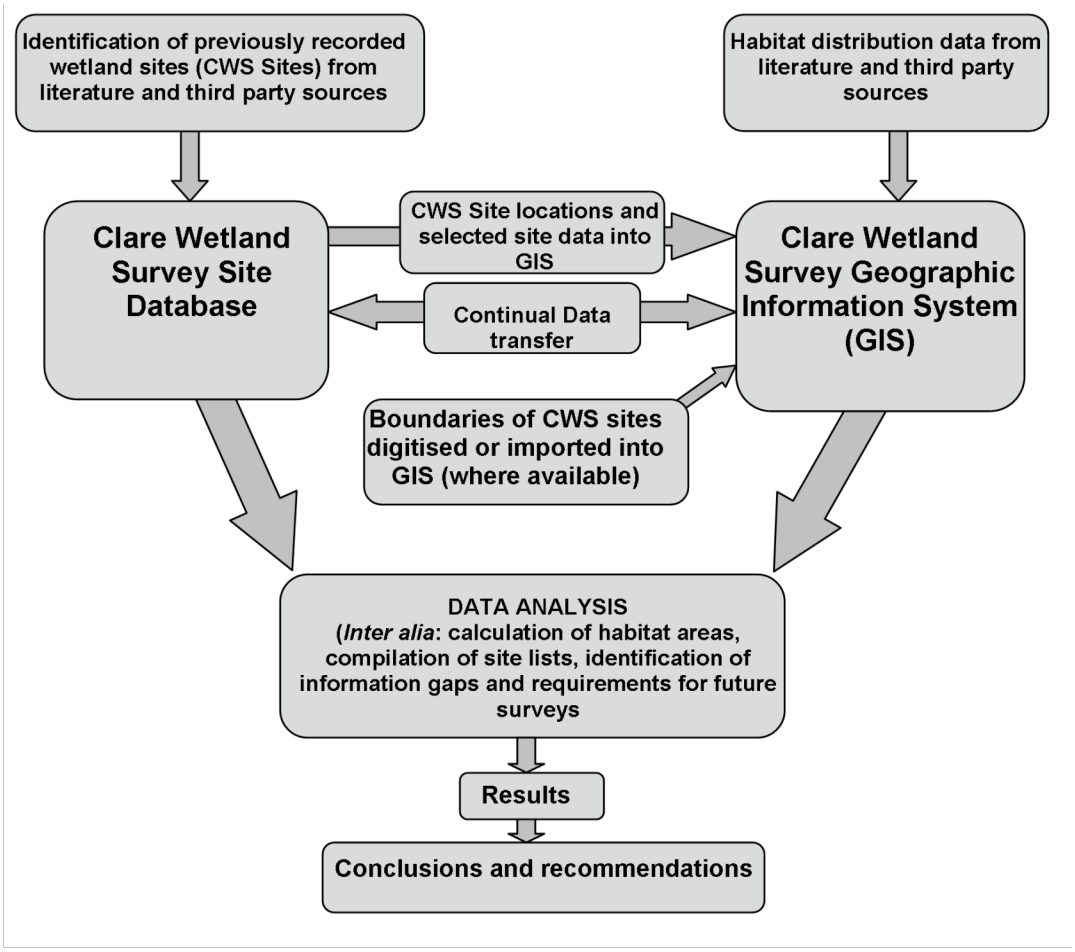

Figure 6.1. Flow chart illustrating the various steps undertaken during the course of the Clare Wetland Survey 2008.

6.2.1 Data acquisition

The first stage of the CWS involved identifying potential wetland site data sources which included published literature, unpublished reports, scientific publications, digital data-sets, and information held by State agencies, non-governmental organisations and ecological practitioners.

Data acquisition involved gathering published and unpublished literature and requesting data from as wide a range of relevant third parties as possible. The list of data sources consulted in the compilation of the county Clare wetland site list is provided in Appendix 1.

The requested information was held in a variety of formats including GIS data sets, habitat and site records in databases and speadsheets, and in published reports, surveys and scientific publications.

Within these sources wetlands have been identified and assigned to a particular wetland category using a variety of classification schemes, including the Annex 1 Habitats Directive system; Fossitt classification system; the CORINE wetland classification system; together with other classification systems used in relation to specific habitat studies (e.g. NHA survey, fens & flushes, fen classification system of Crushell 2000) and raised and blanket bog surveys.

A list of sites containing various "wetland" categories identified by these research groups, was produced from the data sources that existed, to compile a comprehensive list of all sites that contain at least one of the 34 wetland habitats being mapped as part of the CWS.

6.2.2 CWS Site identification and background research

On project commencement an extensive literature review was carried out on the amalgamated datasets with the aim of identifying previously reported wetland sites throughout County Clare. Following the literature review each site found to contain, or believed to contain one of the 34 wetland types being recorded in this study, was added to the CWS site database and an individual site record was created. Basic site data (county, grid reference etc.) and data in relation to the occurrence and extent of one or more of the wetland types was recorded in relation to each site record.

Where more than one individual site occurred within a larger NHA or SAC complex, a record was created for both the site complex and the individual sub-sites within the main site recognised by previous researchers (see Appendix 3 for further details).

Following completion of the data recording process, any of the sites included within the CWS database for which no wetland type had been recorded, were examined on aerial photographs. Where no wetland areas were recorded within the site boundary the site was marked as a non-wetland site, and transferred out of the CWS site database and stored in a non-wetland site database (a list of the non-wetland sites in County Clare is presented in an Excel file on the CD rom accompanying this report).

For an explanation of the specific data recorded on sites see Appendix 3. This information was stored in the CWS site database within a series of database fields thus enabling effortless searches, data-examination and creation of site lists during the data analysis stage of the study.

6.2.3 GIS Data compilation and GIS wetland identification

ArcView 9.2 GIS software package on a Windows Operating System was used throughout the CWS for all mapping purposes. During the same period as the site database was being developed, GIS data-sources were incorporated into the CWS Geographical Information System (GIS). Following the acquisition of the relevant base-maps and aerial photographs from Clare County Council other data-sets were entered as they became available (see Appendix 1 for list of all GIS datasets used during the CWS). See Appendix 3 for further details of methodology employed in compiling the GIS.

Soon after commencement of the survey it became apparent that the literature review would identify principally the sites that had been previously surveyed or reported in any detail. Therefore, GIS data compilation work was concentrated on identifying sites that may occur outside of the existing network of designated sites (which are a major proportion of previously reported sites). The county was systematically surveyed on a 10km x 10km basis using Colour Aerial Photographs (Ordnance Survey of Ireland, 2007 series) avoiding existing designated sites and known lakes and rivers (which were contained in data-sources obtained from the EPA). A minimum area of circa 1 hectare was set in the identification of new wetland sites by GIS. As new sites were identified they were noted and a polygon drawn encircling all identifiable contiguous wetland habitats.

Where possible, habitat types were recorded in the associated attribute table, although in many cases this was not possible due to difficulty in determining differences between such habitats as wet grassland, fen and marsh. In the cases where it was not possible to definitively determine the wetland type from aerial photographic examination, the site was entered into the 'CWS unknown wetland type' habitat category. In other cases a mosaic category was created to map habitat types that are impossible to differentiate due to their close spatial association (e.g. HH3_PB3 Wet heath - Blanket bog mosaic; HH1_HH3 - Dry - wet Heath mosaic *inter alia*).

It is important to note that aerial photographic surveying is a relatively crude exercise and should not be used for any more than identifying 'potential' wetland types. Habitats can only be assigned (especially to level 3 of Fossitt) by field survey and ground-truthing.

Data-sets added from third party sources were transformed where necessary (and possible) to comply with the Fossitt classification used during the CWS. Details on how these datasets were dealt with and incorporated into the GIS are presented in Appendix 3 and 4.

6.2.4 Data Transfer and Mapping of CWS Database sites

The sites identified from the literature review were exported from the site database and imported into the GIS as individual points by using the grid co-ordinates reported in the literature. Each of the sites was examined in the GIS and the exact location confirmed. This took considerable time as many of the reported grid references were inaccurate, therefore, other means such as townland searches had to be used to aid in the identification of site locations. Once sites were confirmed, corrected data was exported back into the CWS site database. Following this, boundaries of CWS sites were identified. In the case of designated sites, boundaries previously drawn by NPWS were used, however where sites occurred outside of designated sites, draft boundaries were drawn around the area that appeared to contain the wetland site in question (see Appendix 3 for further details).

Due to time constraints, it was not possible to systematically attempt to map the habitats of all of the CWS sites. From the existing information on these sites, their potential to hold wetland habitats is known and aerial survey would have been of very limited further value, as sites would need to be ground-truthed in any case to confirm habitat identification. Furthermore, much of the existing digital habitat data-sets that became available during the course of the CWS tended to be biased towards these sites.

The specific mapping considerations employed in the CWS are outlined in Table 6.1 below. This table gives an indication of the particular mapping rules applied in relation to each of the 34 wetland types being mapped in the CWS.

6.2.5 Data Analysis and presentation of results (GIS and CWS site database)

Following the compilation of the GIS, area calculations were carried out on each habitat type, including the category 'CWS unknown wetland type'. This allowed a minimum estimate of the extent of each habitat type within the county to be prepared. These calculations were also carried out at Level 1 and Level 2 of Fossitt, as some areas were only identified to these levels.

Maps were drawn showing the distribution of CWS wetland sites throughout the county. The GIS shapefiles emanating from the survey were transformed into MapInfo Format as required by Clare County Council (CCC). A legend was drawn to match the requirements of CCC, which was similar to that used in previous habitat maps produced in the county. Both ESRI shape-file and MapInfo Table formatted files are included on the CD accompanying this report.

Due to the scale of mapping used, it was not possible to display the entire habitat map of the county in printed format to be included in this final report. As an alternative two random 10km x 10km squares were selected to display the approximate coverage and appearance of the final habitat map. The complete CWS wetland GIS dataset is included on the report CD.

Various site lists and tables were drawn up using a combination of the CWS site database and the GIS database. This together with the area data allowed a provisional assessment to be made of the diversity and extent of different wetland habitats in Clare. Other details of sites were summarised using the CWS site database based on the fields such as damage, threats and conservation status thus allowing overall conclusions to be drawn concerning the status of the wetland resource in County Clare.

Table 6.1. Habitat Mapping considerations from the County Clare Wetlands Survey 2008.

Fossitt Level 3 Habitat Code and Name	Comments on Habitat Mapping
FL1 Dystrophic lakes	Systematic recording of all lakes undertaken. Assignment to this habitat type where data available.
FL2 Acid oligotrophic lakes	Systematic recording of all lakes undertaken. Assignment to this habitat type where data available.
FL3 Limestone/marl lakes	Systematic recording of all lakes undertaken. Assignment to this habitat type where data available.
FL4 Mesotrophic lakes	Systematic recording of all lakes undertaken. Assignment to this habitat type where data available.
FL5 Eutrophic lakes	Systematic recording of all lakes undertaken. Assignment to this habitat type where data available.
FL6 Turloughs	Systematic recording of all turloughs identified in third party GIS files and paper based maps undertaken.
FL7 Reservoirs	Not mapped unless identified in third party GIS data sets.
FL8 Other artificial lakes and ponds	Not mapped unless identified in third party GIS data sets.
FW1 Eroding/upland rivers	All rivers were identified in third party GIS data set but not possible to definitively determine Level 3.
FW2Depositing/lowland rivers	All rivers were identified in third party GIS data set but not possible to definitively determine Level 3.
FW3 Canals	Not mapped unless identified in third party GIS data sets.
FW4 Drainage ditches	Only mapped where third party GIS data sets include this habitat type.
FP1 Calcareous springs	Only mapped where third party GIS data sets include this habitat type.
FP2 Non-Calcareous springs	Only mapped where third party GIS data sets include this habitat type.
FS1 Reed and large sedge swamps	Not possible to determine from Aerial Photographs. Only mapped where third party GIS data sets include this habitat type.
FS2 Tall herb swamps	Not possible to determine from Aerial Photographs. Only mapped where third party GIS data sets include this habitat type.
GS4 Wet grassland	Not possible to determine from Aerial Photographs. Only mapped where third party GIS data sets include this habitat type.
GM1 Marsh	Not possible to determine from Aerial Photographs. Only mapped where third party GIS data sets include this habitat type.
HH3 Wet heath	Not possible to determine from Aerial Photographs. Only mapped where third party GIS data sets include this habitat type.
PB1 Raised bogs	Mapped to level 2 from Aerial Photographs. Also mapped where third party GIS data sets include this habitat type.
PB2 Upland blanket bog	Mapped to level 2 from Aerial Photographs. Also mapped where third party GIS data sets include this habitat type.
PB3 Lowland blanket bog	Mapped to level 2 from Aerial Photographs. Also mapped where third party GIS data sets include this habitat type.
PB4 Cutover bog	Mapped to level 2 from Aerial Photographs. Also mapped where third party GIS data sets include this habitat type.
PB5 Eroding blanket bog	Mapped to level 2 from Aerial Photographs. Also mapped where third party GIS data sets include this habitat type.
PF1 Rich fen and flush	Not possible to determine from Aerial Photographs. Only mapped where third party GIS data sets include this habitat type.
PF2 Poor fen and flush	Not possible to determine from Aerial Photographs. Only mapped where third party GIS data sets include this habitat type.
PF3 Transition mire and quaking bog	Not possible to determine from Aerial Photographs. Only mapped where third party GIS data sets include this habitat type.
WN4 Wet pedunculate oak-ash woodland	Not possible to determine from Aerial Photographs. Only mapped where third party GIS data sets include this habitat type.
WN5 Riparian woodland	Not possible to determine from Aerial Photographs. Only mapped where third party GIS data sets include this habitat type.
WN6 Wet willow-alder-ash woodland	Not possible to determine from Aerial Photographs. Only mapped where third party GIS data sets include this habitat type.
WN7 Bog woodland	Not possible to determine from Aerial Photographs. Only mapped where third party GIS data sets include this habitat type.
WS1 Scrub	Not possible to determine from Aerial Photographs. Only mapped where third party GIS data sets include this habitat type.
CW1 Lagoons and saline lakes	Not possible to determine from Aerial Photographs. Only mapped where third party GIS data sets include this habitat type.
CD5 Dune slacks	Not possible to determine from Aerial Photographs. Only mapped where third party GIS data sets include this habitat type.
CWS Unknown wetland type	Areas mapped under this category where habitat could not be assigned to one wetland habitat types above or where habitats occurred in a complex mosaic within a site.

6.2.6 CWS Site Database – structure and content

A specific CWS site database was created at the outset of this project to hold data on the wetland sites recorded during the course of this study. The database was created in Filemaker Pro Version 8.0v2 which runs on both PC and Mac platforms. Site information from this database is readily exported to Excel spreadsheets (see Appendix 8 and the associated total database export Excel spreadsheet included on the CD Rom containing this report).

In summary the main CWS database held information on CWS site name and code, site provenance, size (area in ha or length in km), third party site name and code codes, national grid reference, site conservation designations, habitat information on the specific wetland vegetation type(s) present and the area of each (or an estimate where no accurate data was available), information on rare species of note, and a summary of published reports holding information on the site and the nature of same.

A second database, holding a list of references relating to the GIS data sources, and scientific reports and publications referring to wetlands in County Clare, make up the complete CWS database. Each of these sources was given a unique code which was recorded with the CWS site database.

An overview of the data fields used to record information on sites, in the CWS GIS and site database are provided in Appendix 4. The main data entry layouts within the CWS site database are illustrated in Appendix 5.

7 Results

7.1 CWS Data Limitations

A number of difficulties and limitations with respect to the compilation of the CWS list of wetland sites were encountered, which the reader should be aware of, before interpretation of the data is undertaken and to provide an estimate of the level of confidence that can be applied to the data from the current study.

7.1.1 Wetland site identification

Although every effort was made to compile a complete map of all wetland sites in County Clare, from an examination of aerial photographs, and from data held by external sources, it is very probable that additional smaller wetland sites do occur which have not been mapped within the CWS GIS and database. Therefore the list of sites presented here should not be regarded as definitive.

Primarily this lack of site identification is due to: the small nature of some wetland types making mapping impractical (e.g. drains); it was not possible to include all areas of common habitat type such as wet grassland, which may occur in a mosaic within other habitats including improved grassland; the occurrence of wetland areas that cannot be identified from aerial photographs; and because detailed habitat maps do not exist for certain areas identified as being of conservation value.

7.1.2 Wetland habitat type classification

During the selection of wetland sites, it was not always possible to ascertain with complete certainty, which of the wetland types recognised by this survey, occurred on a given site.

In other cases, where more than one wetland type occurred within a site, in a complex mosaic of habitats, the habitat was recorded as 'CWS Unknown Wetland Type'. To ascertain the level 3 Fossitt category (or even level 1 in the case of wet grassland, reed-swamp, marsh or fen) present on these sites ground truthing via field surveys will be required.

The data-sets which contributed to the habitat map came from a variety of sources (as recorded within GIS). This has meant that it is of varying quality, much of it originates from detailed field surveys while other data may originate from Satellite Imagery (in the case of degraded raised bog from Corine dataset). Therefore, it must be emphasised that the habitat map should be treated with care and used only as an indicative map of habitat distribution.

7.1.3 Estimation of the extent of wetland habitats on sites identified

Where a detailed GIS habitat map existed, with wetland habitats mapped and characterised to Fossitt level 3, the information was incorporated into this study, and the area data was used in final estimation of level 3 Fossitt habitat extent within County Clare. The habitat extent data covers the entire county (with patchy distribution) and although somewhat biased towards previously recorded sites was not restricted to these areas.

In the case where wetland habitats could only be characterised to Fossitt level 1 or 2, the area data was used to this level only.

As a result of these limitations the area data results provided here should be regarded as provisional. Only with future surveys and ground truthing by experienced ecologists will level 3 habitat identification be possible. It is envisaged that the habitat map is a 'work in progress' and should improve as new data becomes available. The calculated habitat area data are a useful guide towards the relative abundance of different habitat types in the county and we believe provide a good indication of minimum area estimates for each habitat type.

7.1.4 Time constraints

In general all data provided to the CWS was incorporated in the GIS dataset prepared during the course of this study.

However, due to the time constraints some data provided by third party sources has not been incorporated into the GIS, nor has all relevant site data been transferred to the CWS site database. A list of potentially useful data sources that have not been consulted during the CWS due to unavailable data or late submission by third parties are presented at the end of Appendix 1. Due to time constraints, it was also not possible to systematically assess the threats and damage to all CWS wetland sites by aerial photograph analysis.

7.2 CWS Site Database

The CWS site database version 1.0 holds information on 300 wetland sites (sites and sub-sites) in county Clare. The report CD includes a copy of the original Filemaker Pro CWS site database. In addition to the wetland sites recorded in the CWS site database a further 63 site records which were found not to contain wetlands but do occur in County Clare is also provided in a separate non-wetland database on the report CD.

A list of the wetland sites recorded in the CWS database and the specific wetlands recorded on each is provided in Appendix 8 in this report (an Excel version of this spreadsheet is included on the report CD). The data on wetland habitats occurring on sites is summarised in Table 7.1 below.

The list of all information (with the exception of detailed site descriptions) held on the various site records in the CWS database is provided on the Excel spreadsheet file (CWS_total_dbase_site_data_export.xls) included on the report CD.

7.3 CWS GIS Database

In all, approximately 45 datasets were incorporated into the GIS (see Appendix 1 for full list of GIS sources). Data was extracted from many of these sources while others were used as base maps to indicate the likely occurrence or otherwise of wetland habitats.

In all 1932 habitat polygons (excluding sliver polygons) were imported from other datasets and a further 137 were created during the course of the CWS. The total area of wetland in county Clare within the CWS GIS dataset is 23,440 ha in a total of 2069 mapped wetland units.

The outputs from the CWS GIS includes six individual ESRI shape-files and equivalent MapInfo Tab files. These are summarised in Table 7.1 below and further details are presented in Appendix 3 and 4. Copies of these files can be found on the report CD.

Table 7.1. Final GIS output files from the CWS wetland survey. Further details of output files are presented in Appendix 4.

File Name	Brief Description
CWS Site Locations	Point file showing the location of each CWS site stored in the CWS site database. Contains much of the data contained in the CWS site database within the file attribute table.
CWS Site Boundaries	Polygon file showing the boundary of each CWS site stored in CWS site database. Standard attributes include area, site name, area, source, designation etc.
CWS Polygon Habitats	Polygon file showing the boundary of each CWS site stored in CWS site database. Standard attributes include area, Fossitt code and source.
CWS Spring Sites	Point file showing the location of spring sites identified during the course of the CWS. Standard attributes include Fossitt code, townland name, source and grid co-ordinates.
CWS Clare Rivers	Line file showing rivers throughout county Clare as identified from third party sources. Attributes include name, length, order, source, and unique segment code.
CWS Drainage Ditches	Line file showing drainage ditches throughout as identified from third party sources. Attributes include length, source and Fossitt code.

7.4 Distribution and extent of wetlands in County Clare

The County Clare Wetlands Survey has identified more than 2069 discrete wetland mapped areas within the county, with an area of 23,440 ha, which represents 7.4 % of the area within the entire county.

In terms of the main habitat types in County Clare the results suggest that on a county basis, the 23,440 ha of wetland recorded, cover the following percentage of the county: lakes 2.57% , bogs and wet heaths 2.52%, fens & flushes, marsh, reedbeds and wet grassland cover 1%, while the remaining 1% has been assigned to the CWS unknown wetland type.

The average area of each habitat unit was 11.3 hectares, which comprised the following size categories:

- 37% of all habitat units were less than 1 hectare
- 46% were between 1 and 10 hectares in extent
- 17% were between 10 and 60 hectares

Less than 0.1% were more than 60 hectares in extent

Therefore the vast majority (81%) of habitat units were less than 10 hectares in extent. While generally speaking the larger habitat areas would be of higher conservation value, a large number of smaller sites are especially important as they can offer connectivity at the landscape scale between the larger habitat patches. Furthermore, some important habitat types typically occur as small discrete sites such as poor fen, dune slack and spring habitats.

Detailed information is stored on 300 wetland sites in the CWS Site database. These wetland sites occur within and outside of recognised conservation worthy areas. Figure 7.1 below shows the location of CWS sites identified, represented as points, in County Clare. The boundaries (where they have been drawn, see Appendix 4) of these sites are included in Figure 7.2. Extensive data that has been extracted from existing data sources for each of these sites is stored in the CWS site database and the GIS database.

It is clear from Figure 7.2 that a considerable number of wetland sites have been surveyed in County Clare, although the distribution of sites tends to be biased towards the region of the Burren in the northern part of the county. In contrast there are areas of the county that appear to be poorly represented most notably the South western part of the county (area between Inagh, Cooraclare and Kilmurry) and the Eastern part of the county (area between Tulla, Broadford and Scarriff). It is possible that these areas contain less wetlands of conservation importance due to topographical and hydrological conditions.

However, from an analysis of the detailed habitat distribution map of the county (not shown), there appears to be an abundance of unsurveyed wetlands in these parts of the county. The true value of these areas for wetland biodiversity will remain unknown until systematic field surveys are carried out.

The County Clare Wetlands Survey has identified more than 2069 discrete wetland habitat areas (total extent 23,440 ha), mainly by collating existing mapped data but also through the identification of unknown wetland sites by aerial photograph analysis. Due to resolution difficulties created by the scale of the county no large scale complete high resolution wetland habitat map of the county is presented in this report, although an example of the final CWS GIS layout with the various CWS shape-files presented is shown in Figure 7.3. This map is only for illustration purposes therefore the habitat polygons are all indicated by the same colour (red).

Two 10km squares representing two different parts of the county (R17 and R58, see Figure 7.4 below for details of their location) were selected to illustrate the extent of the habitat mapping within the CWS GIS. Figure 7.5a shows the overall habitat distribution for the 10km square R17 and Figure 7.5b shows the south-eastern part of this square in greater detail. Similarly Figure 7.6a and 7.6b show the same habitat maps for the 10km square R58.

To obtain a complete overview of the wetland distribution in county Clare based on the results of this study, the reader is asked to consult the GIS map file contained on the CD accompanying this report. It is envisaged that the GIS will be primarily used as an exploratory and research tool in future biodiversity inventories of the county, as mentioned earlier this should only be used as a crude indicative habitat map.

By analysing the GIS, it is clear that most of the bog sites occur in the upland areas in the east and west of the county, with a significant number of raised bogs (at the south western extremity of their range) occurring in the low-lying areas of South Clare. Unsurprisingly bogs are largely absent from the limestone

area around the Burren. Lakes are distributed throughout the county, although again unsurprisingly are absent from the limestone regions, being largely replaced by ephemeral lakes or turloughs.

The lakes of County Clare are varied in character, depending on the hydrogeology of the area in question. Limestone / marl lakes are of high conservation importance and are well represented in Clare compared to the remainder of the country. However, from literature sources, it is clear that these lakes are becoming increasingly endangered due to nutrient enrichment. Other internationally important wetlands include dune slacks, lagoons and fens. Only two dune slacks were identified during CWS and considering the abundance of dune systems are likely to be under-represented in this survey. The Clare coastline is relatively well endowed with the uncommon lagoons or saline lake habitat which occurs mainly in the northern and southern parts of the coast.

In contrast to the bogs, fens were most widely reported from the limestone region; however the true distribution of this habitat remains largely unknown due to the absence of targeted survey work.

Table 7.2 and 7.3 summarises the extent of each wetland habitat type recorded during the course of the Clare Wetland Survey. Because there has been extensive digital mapping of lakes and rivers the total number of sites appearing in the CWS GIS database is likely to be very accurate. We can see from table 7.2 that of the 557 open water lakes in the county, the ecology of some 165 has been reported in the past (based on CWS site database review). The breakdown of the lakes into the trophic categories identified by Fossitt was based on desktop work by NPWS and is therefore only for indicative purposes. It is most likely that many of the oligotrophic lakes in the GIS would actually fall towards the mesotrophic category based on the results of Tubridy (2006) where most of the lakes they surveyed on the ground actually fitted into this category.

A national desk-based study aimed at collating all existing information on turloughs and identifying potential sites is currently being undertaken on behalf of NPWS (E. Mayes, *pers. comm*.). A draft subset of County Clare of this study was made available to the CWS. From this study and the CWS, it is clear that there are a large number of potential turlough sites in the county that need to be systematically surveyed as a priority. These habitats have been much impacted by land-use in the past and are most sensitive to nutrient enrichment.

Natural Watercourses
Natural watercourses are abundant throughout Clare, totalling over 5,700 km in length. It is of interest to note the absence of water courses in the Burren region, due to the Karst landscape, where the rivers tend to flow below the surface. It is most likely that the majority of the water courses identified would fit into the Upland Eroding river category due to the steep terrain and proximity of the sea. However, there are some major depositing rivers also in the county (River Fergus and River Shannon) which hold some of the richest ecological diversity and provide excellent habitat for flora and fauna.

Springs
It is most likely that springs are under represented in the current survey. Most of the sites originated from the Geological Survey of Ireland karst database. Calcareous Springs (*with Tufa formation) are of international ecological importance and from anecdotal evidence are most common throughout the limestone region in Clare. However, such features are often small and extremely local and to date have not been identified or surveyed in any systematic way.

Swamps
Swamps often occur around the margin of open water lakes. Again, it is likely that this habitat is underrepresented in the survey, especially the tall herb variant, which was only previously mapped at two sites. As can be seen from Table 7.2, swamps have been quite widely reported from known sites (115 sites recorded). It is not possible to identify this habitat from aerial photography therefore it is likely some of the 'CWS Unknown wetland category' may in fact hold this habitat type.

Wet Grassland
Wet grassland is one of the more common wetland types throughout Ireland. However, partly due to its widespread distribution, it has not been surveyed in detail. There are likely to be many species rich wet grasslands throughout Clare, considering the mainly basic nature of much of the soils and parent material. Again it is difficult to distinguish this habitat from marsh and other wetland habitats from aerial photography, but also because of its widespread and common occurrence it would prove difficult to map.

Bogs
Bogs are probably the most widely surveyed habitats in County Clare. They are also relatively easy to distinguish (to Fossitt level two) from aerial photography. Many of the bogs in County Clare have been heavily impacted by afforestation, drainage and peat cutting although there are a number of excellent

examples of Blanket Bog (although restricted in extent) identified in recent surveys (Derwin *et al.* 2004). Clare also holds some of the most south-western raised bogs in the country in the south-western part of the county. For this reason these raised bogs although heavily degraded are of considerable interest (Foss and O'Connell 1991).

Fens & Flushes
When it comes to Fens and Flushes Clare is certainly one of the richest counties in Ireland for these diverse wetland ecosystems. Although 483 ha of Fens and Flushes have been mapped in County Clare and 117 sites have been reported in the literature, it is very difficult to get an accurate estimate of the resource due to an absence of targeted survey work (Foss 2007). Recent surveys carried out in Monaghan have highlighted the rarity of this ecosystem and also highlighted the absence of reliable information on their distribution and extent (Foss and Crushell 2007 & 2008).

Wet Woodland
Wet woodlands were sparsely recorded during the mapping process with a total area of only 155 ha, the habitat is likely to be under-represented in the GIS. Unfortunately, the GIS data from the National Survey of Native Woodlands (NSNW) was not available on time to be incorporated into this study. However, some relevé data that was reviewed indicates that a significant number of wet woodland sites have been identified by the NSNW.

Coastal Wetlands
Coastal freshwater wetlands that occur in Clare include lagoons and dune slacks. As mentioned previously dune slacks are very rare in the county despite some spectacular dune systems being present. These dune slacks are of high ecological interest where they occur, however in Clare some have probably been degraded or destroyed in the past by recreational use, including for example golf course developments. Lagoons are rich habitats for birds and other fauna and have been reported from the northern and southern coastline of Clare. They have been surveyed in the past and the 19 sites reported in the CWS database is likely to be an accurate reflection of the occurrence of this habitat in the county.

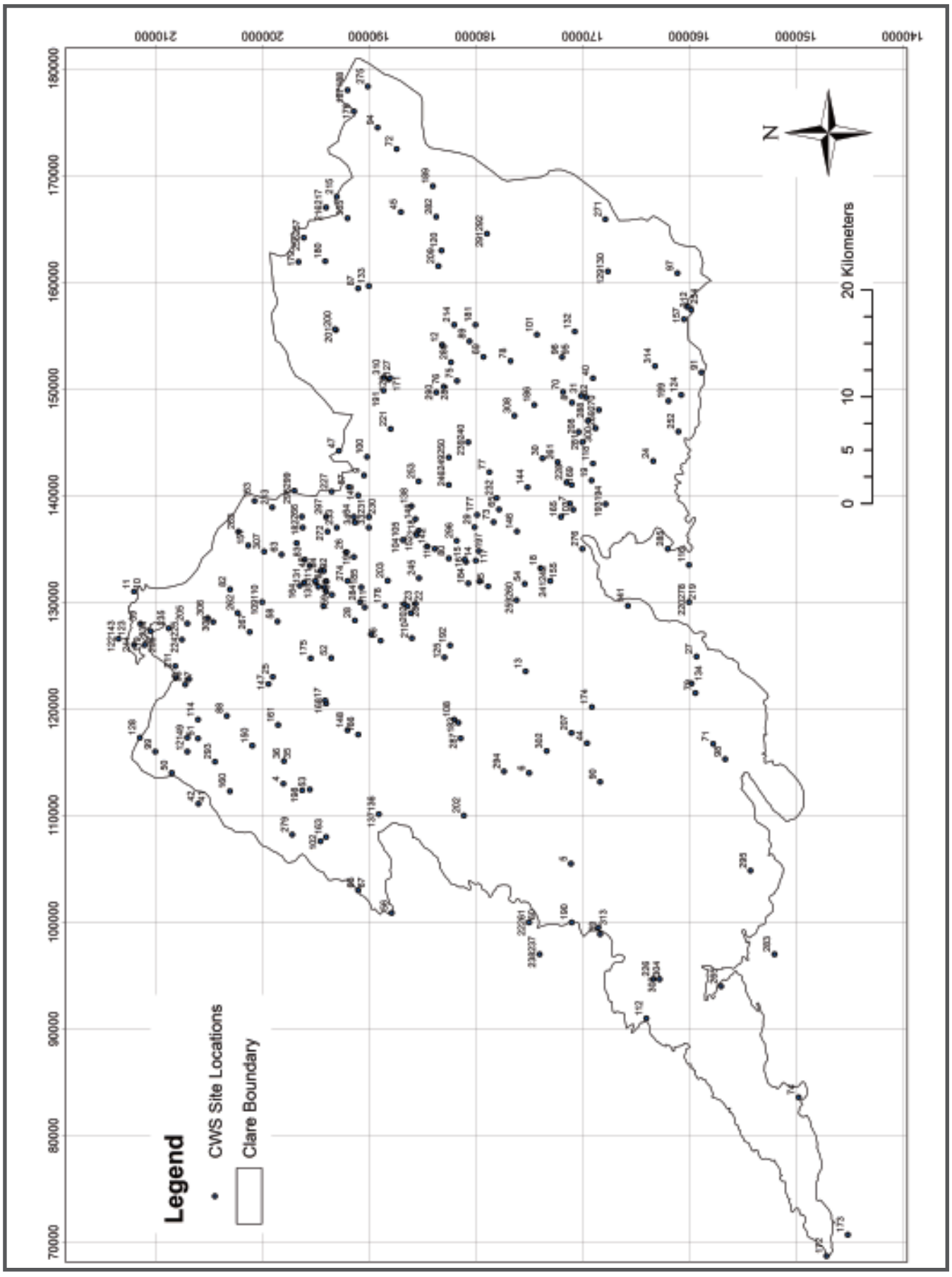

Figure 7.1: Location of wetland sites throughout Clare, represented as point sources, and labelled according to CWS site code recorded during the County Clare Wetlands Survey 2008.

Note: some site locations appear to have two site codes due to multiple designation and therefore duplication in the site database. Furthermore, some sites appear off-shore because the central grid reference of these estuarine, coastal and marine complexes is situated off-shore. For example, the Galway Bay Complex (CWS Site Code: 122) appears off the north coast of Clare although it contains lagoon habitat along the Clare coast.

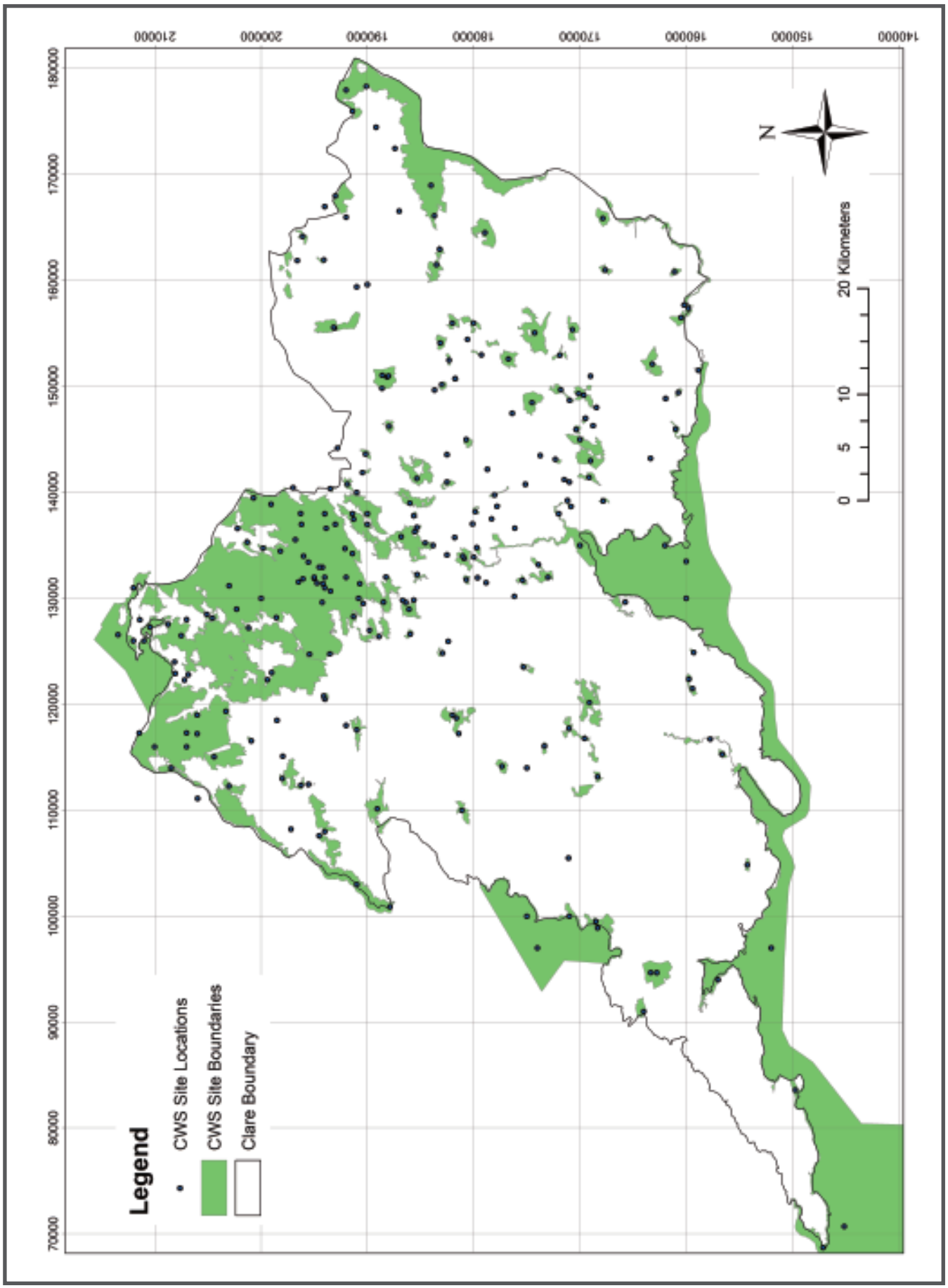

Figure 7.2. The location and extent of wetland boundary areas, and unmapped areas (without a boundary) represented as point sources, in County Clare based on the County Clare Wetlands Survey 2008.

Note: the boundary of one site, Slieve Aughty SPA has been excluded from the figure for illustration purposes.

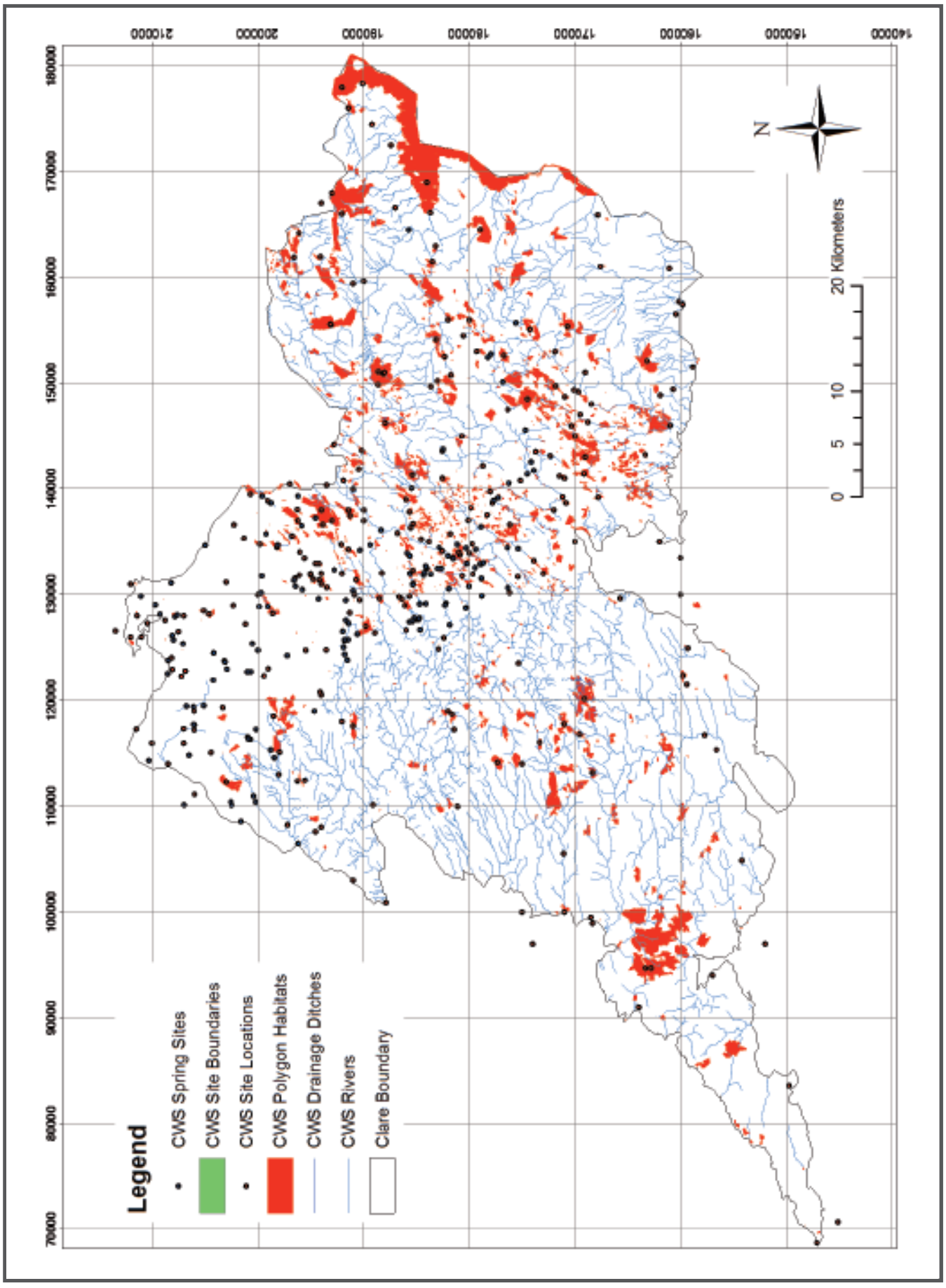

Figure 7.3. Example of final CWS GIS layout with the various CWS shape-files presented. This map is only for illustration purposes therefore the habitat polygons are all indicated by the same colour (red). For a detailed example of habitat maps see Figures 7.5 & 7.6 below.

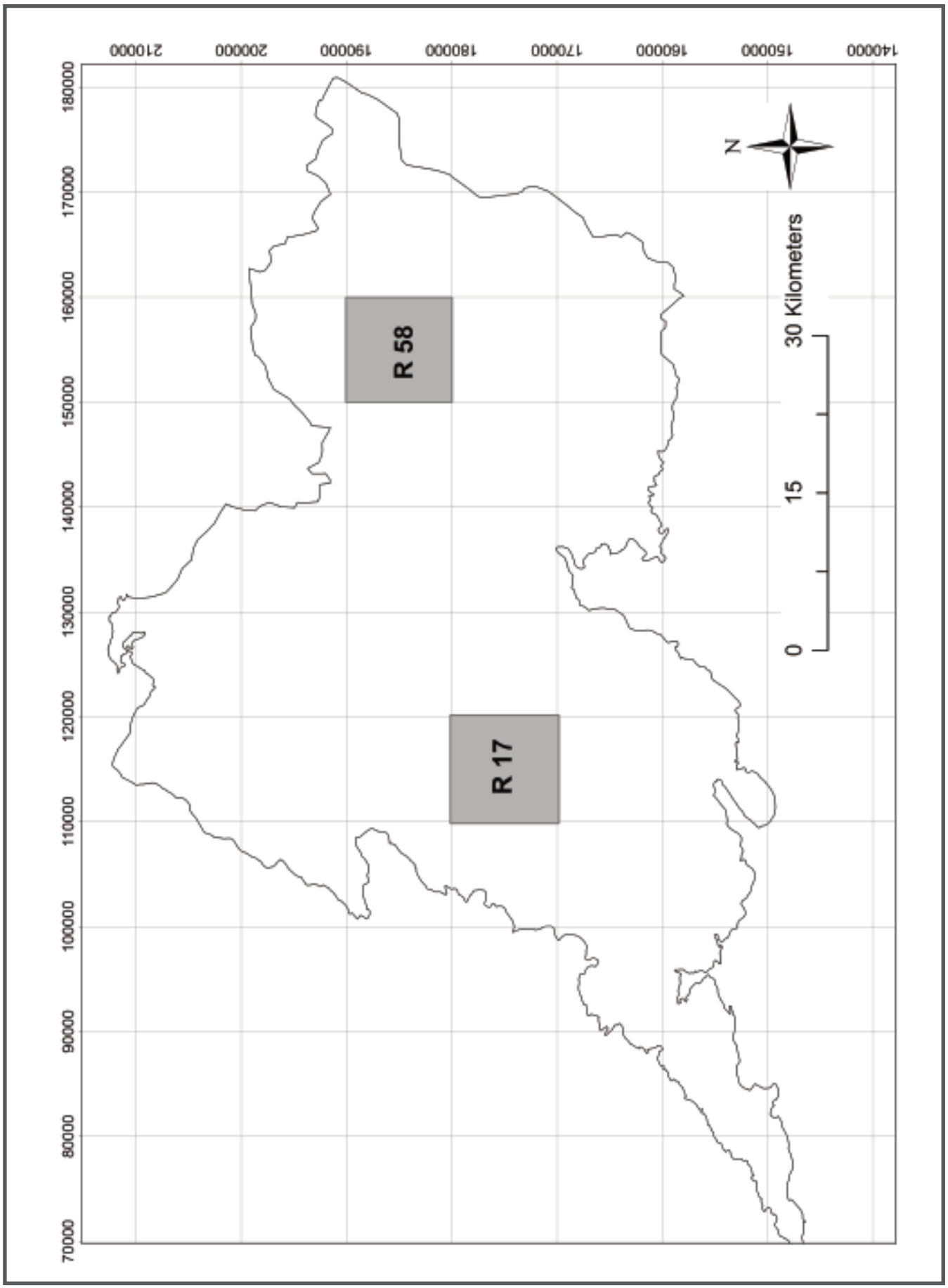

Figure 7.4. The location within County Clare of the two representative areas selected to illustrate habitat coverage within the CWS GIS (see Figures 7.5a;b & 7.6a;b below). R17 is in the western part of the county while R58 is in the eastern part of the county.

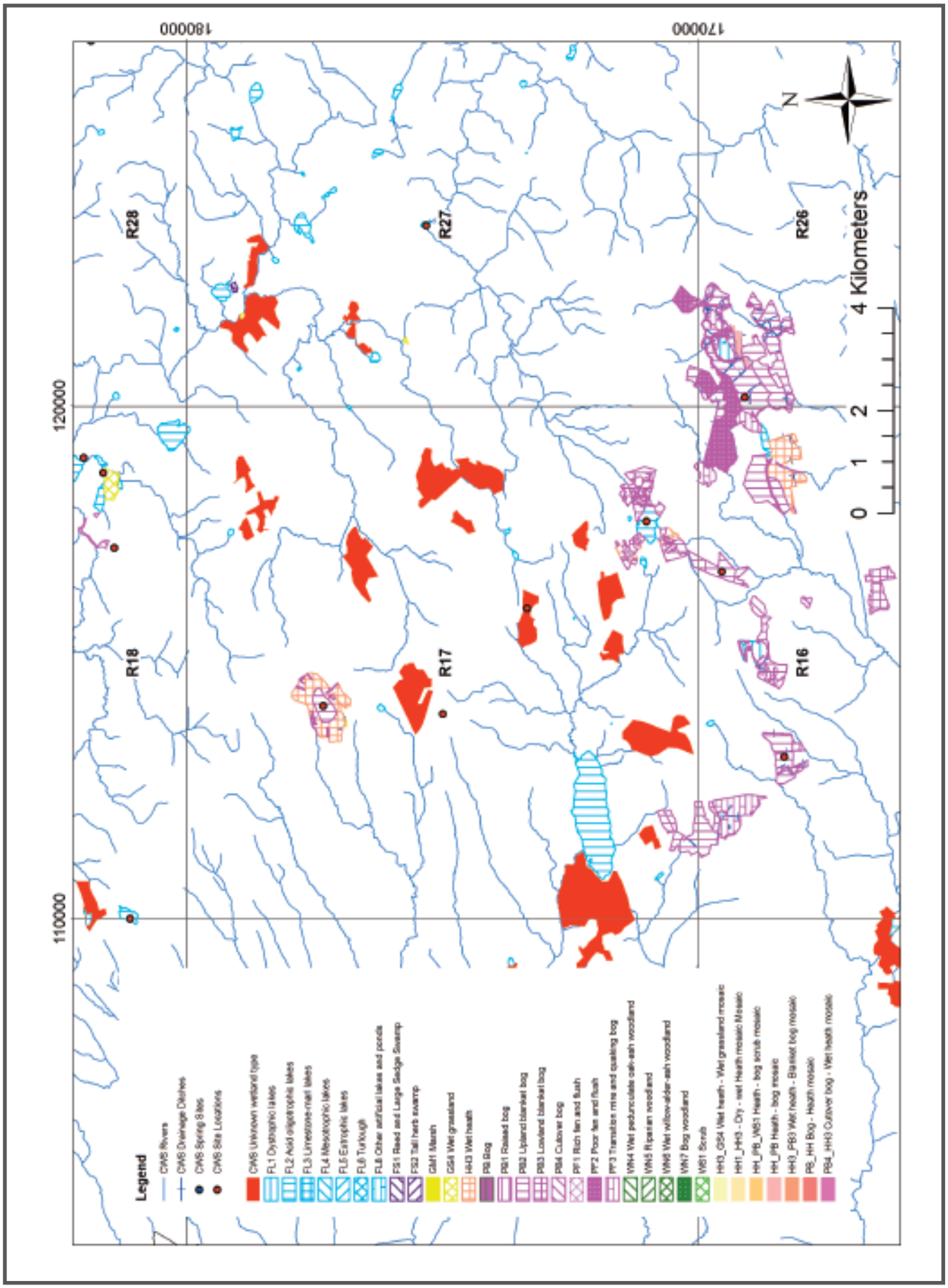

Figure 7.5a. Indicative wetland habitat distribution within 10km R17 in western Clare compiled as part of the Clare Wetland Survey 2008.

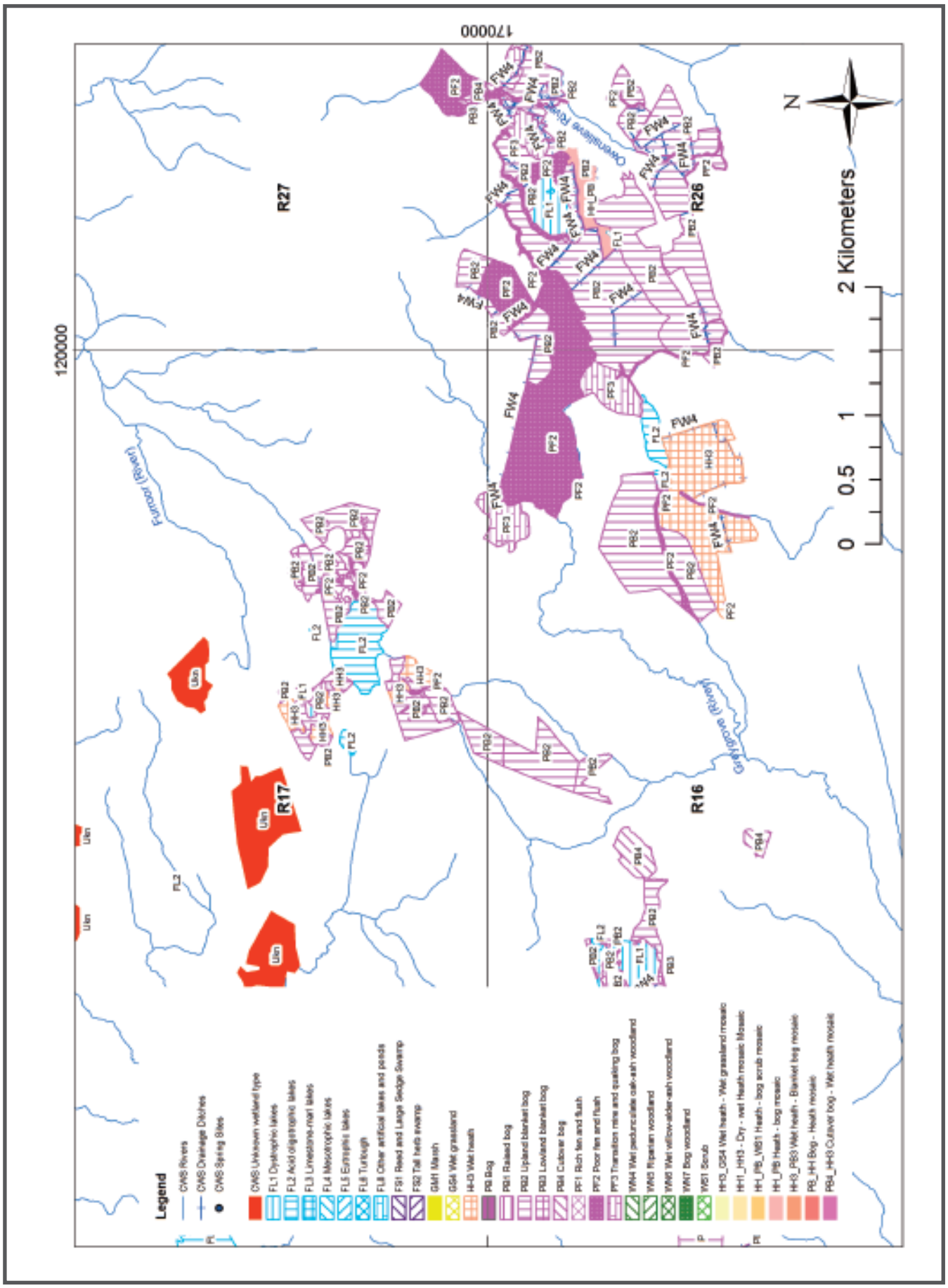

Figure 7.5b. A subset of Figure 7.5a above showing the detail of habitats in the south-eastern part of Square R17. Habitats are labelled according to Fossitt code. For legend see Figure 7.5a. Compiled as part of the Clare Wetland Survey 2008.

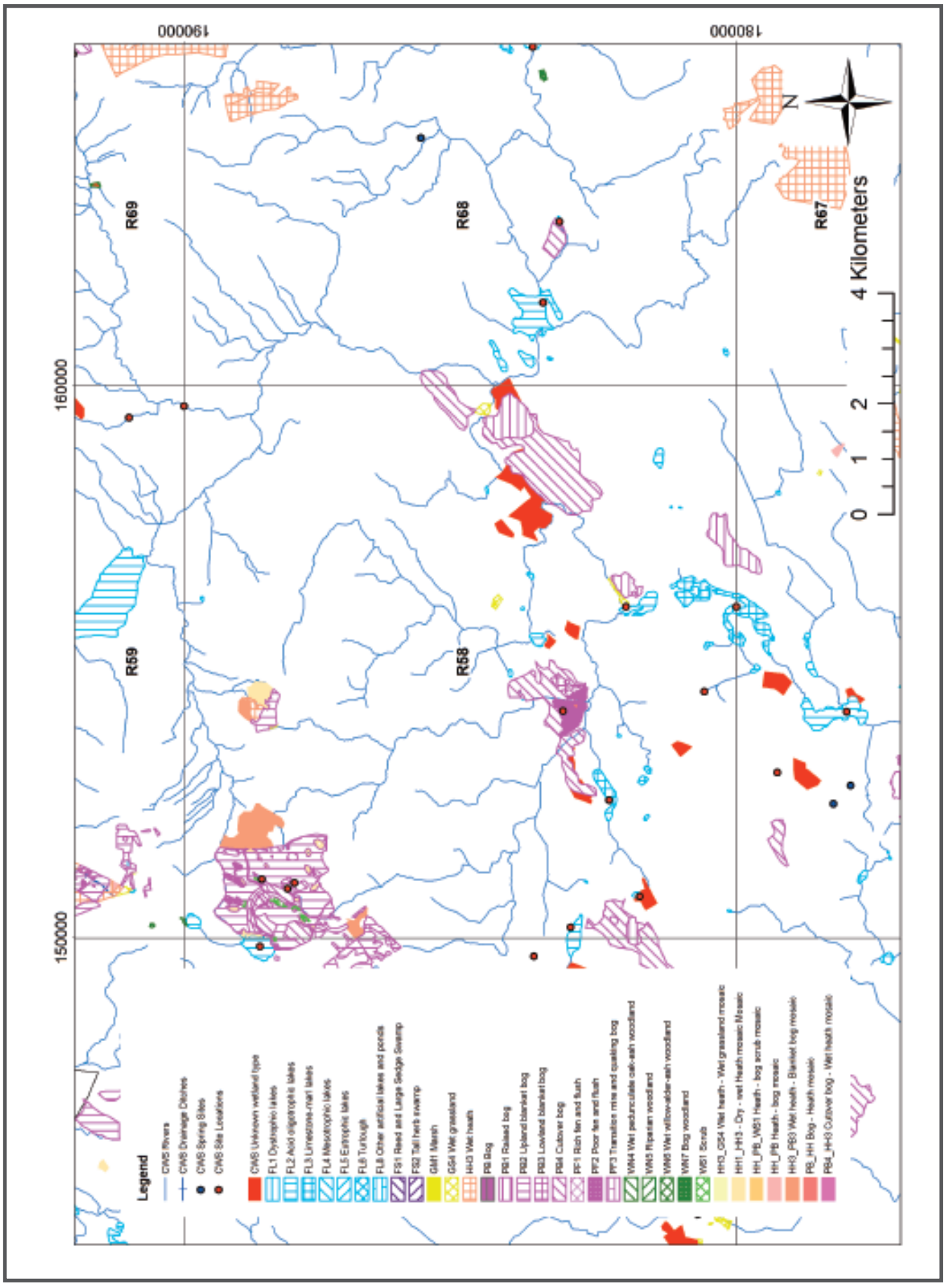

Figure 7.6a. Indicative wetland habitat distribution within 10km R58 in western Clare compiled as part of the Clare Wetland Survey 2008.

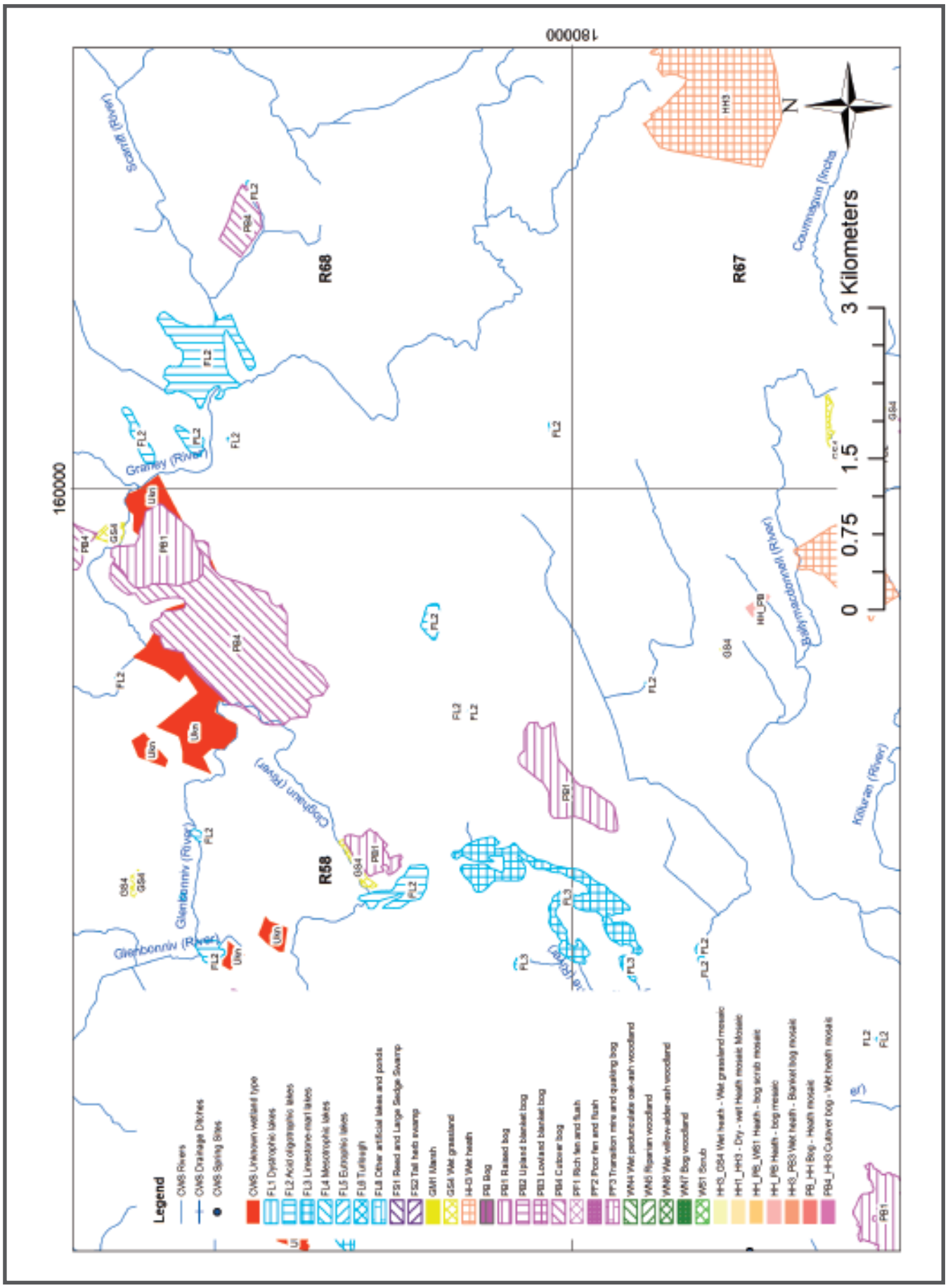

Figure 7.6b. A subset of Figure 7.6a above showing the detail of habitats in the south-eastern part of Square R58. Habitats are labelled according to Fossitt code. For legend see Figure 7.6a. Compiled as part of the Clare Wetland Survey 2008.

Table 7.2. The number of discrete sites of each Fossitt wetland level recorded in County Clare as part of the County Clare Wetlands Survey 2008.

Individual sites under 0.025 ha in extent were omitted as their occurrence is usually due to GIS mapping irregularities (i.e. inclusion of slivers). Fossitt habitat levels shown: Level 1 - bold italics; Level 2 - bold and Level 3 – plain text.

Habitat Code and Name	Number of Sites Recorded in CWS Site Database	Number of discrete habitat areas mapped in CWS GIS dataset
FL Lakes & Ponds	**165**	**557**
FL1 Dystrophic lakes	13	15
FL2 Acid oligotrophic lakes	16	216
FL3 Limestone/marl lakes	23	211
FL4 Mesotrophic lakes	15	73
FL5 Eutrophic lakes	8	18
FL6 Turloughs	50	19
FL7 Reservoirs	3	0
FL8 Other artificial lakes and ponds	3	4
FW Watercourses	**119**	**2834**
FW1 Eroding/upland rivers	28	
FW2 Depositing/lowland rivers	40	
FW3 Canals	3	
FW4 Drainage ditches	79	76
FP Springs	**23**	**137**
FP1 Calcareous springs	20	58
FP2 Non-Calcareous springs	0	
FS Swamps	**115**	**110**
FS1 Reed and large sedge swamps	99	108
FS2 Tall herb swamps	28	2
G Grassland & Marsh	**150**	**627**
GS4 Wet grassland	103	596
GM1 Marsh	62	31
HH3 Wet heath	26	42
PB Bogs	**96**	**364**
PB1 Raised bogs	21	28
PB2 Upland blanket bog	19	198
PB3 Lowland blanket bog	11	28
PB4 Cutover bog	60	104
PB5 Eroding blanket bog	1	0
PF Fens & Flushes	**117**	**115**
PF1 Rich fen and flush	81	51
PF2 Poor fen and flush	19	40
PF3 Transition mire and quaking bog	26	24
WN Semi-natural woodland	**88**	**45**
WN4 Wet pedunculate oak-ash woodland	1	1
WN5 Riparian woodland	4	9
WN6 Wet willow-alder-ash woodland	32	21
WN7 Bog woodland	19	14
WS1 Scrub	91	13
CW1 Lagoons and saline lakes	19	4
CD5 Dune slacks	4	2
Non-Fossitt Mosaic Habitat Types		**98**
HH_PB Heath - bog mosaic	NA	10
PB4_HH3 Cutover bog - Wet heath mosaic	NA	1
PB_HH Bog - Heath mosaic	NA	3
HH3_PB3 Wet heath - Blanket bog mosaic	NA	14
HH3_GS4 Wet heath - Wet grassland mosaic	NA	2
HH1_HH3 - Dry - wet Heath mosaic	NA	30
CWS Unknown wetland type	**NA**	**131**

Table 7.3. The total area (ha) or length (km, for linear features) of the different wetland types recorded in County Clare as part of the County Clare Wetlands Survey 2008.

Fossitt habitat levels shown: Level 1 - bold italics; Level 2 - bold and Level 3 – plain text.

Habitat Code and Name	Total area (ha) or Length (km) of habitat types recorded in County Clare during the CWS	Percentage of County Clare covered by CWS habitat
FL Lakes & Ponds	**8204**	**2.57**
FL1 Dystrophic lakes	45.4	**0.01**
FL2 Acid oligotrophic lakes	1650.2	**0.51**
FL3 Limestone/marl lakes	6032	**1.89**
FL4 Mesotrophic lakes	204.2	**0.06**
FL5 Eutrophic lakes	2.2	**-**
FL6 Turloughs	267.7	**0.08**
FL7 Reservoirs	0	-
FL8 Other artificial lakes and ponds	3.4	-
FW Watercourses	**5740.5 km**	
FW1 Eroding/upland rivers		
FW2 Depositing/lowland rivers		
FW3 Canals		
FW4 Drainage ditches	2.5 km	
FP Springs		
FP1 Calcareous springs	NA	
FP2 Non-Calcareous springs	NA	
FS Swamps		
FS1 Reed and large sedge swamps	309	**0.10**
FS2 Tall herb swamps	3.7	-
G Grassland & Marsh	**2658**	**0.83**
GS4 Wet grassland	2586	**0.81**
GM1 Marsh	70.7	**0.02**
HH3 Wet heath	1935	**0.61**
PB Bogs	6097	**1.91**
PB1 Raised bogs	551.4	**0.17**
PB2 Upland blanket bog	1555	**0.49**
PB3 Lowland blanket bog	167.8	**0.05**
PB4 Cutover bog	3796	**1.19**
PB5 Eroding blanket bog	0	-
PF Fens & Flushes	**483**	**0.15**
PF1 Rich fen and flush	182	**0.06**
PF2 Poor fen and flush	142.5	**0.05**
PF3 Transition mire and quaking bog	158.4	**0.05**
WN Semi-natural woodland	**155**	**0.05**
WN4 Wet pedunculate oak-ash	2.9	-
WN5 Riparian woodland	4.1	**-**
WN6 Wet willow-alder-ash woodland	105.7	**0.03**
WN7 Bog woodland	42.2	**0.01**
WS1 Scrub	7.2	**-**
CW1 Lagoons and saline lakes	32.1	**0.01**
CD5 Dune slacks	0.2	**-**
Non-Fossitt Mosaic Habitat		
HH_PB Heath - bog mosaic	143.1	**0.05**
PB4_HH3 Cutover bog - Wet heath	1.2	**-**
PB_HH Bog - Heath mosaic	0.8	**-**
HH3_PB3 Wet heath - Blanket bog	72.2	**0.02**
HH3_GS4 Wet heath - Wet grassland	0.2	**-**
HH1_HH3 - Dry - wet Heath mosaic	211	**0.07**
CWS Unknown wetland type	**3127**	**0.98**

7.5 Wetland site conservation evaluation

As discussed in section 5.4 above, many wetland sites in Clare are offered some degree of legislative protection under a variety of national and international site conservation designation schemes.

Within the CWS site database information on conservation designations or status of sites was recorded in relation to the following conservation categories:

NHA - Natural Heritage Area – provides legal protection
cNHA - candidate Natural Heritage Area - no legal protection
pNHA - proposed Natural Heritage Area as advertised in 1995 - some legal protection
SAC - Special Area of Conservation – provides legal protection
cSAC - candidate Special Area of Conservation open to appeal/ transmitted to EU
SPA - Special Protection Area – provides legal protection
cSPA - candidate Special Protection Area
NP - National Park – provides legal protection
WHS - World Heritage Site
NNR - National Nature Reserve – provides legal protection
BIO - Unesco Biosphere Reserve
RAM - Ramsar Site
EDS - Eurodiploma Site
ASI - Area of Scientific Interest - no legal protection
BGR - Berne Convention Biogenetic Reserve
COR - Corine site
WS - Wildfowl Sanctuary
RFF - Refuge for Flora or Fauna
CBA - Coillte Biodiversity Area
Undesignated site - no known designation - no legal protection

The number of sites listed in the CWS database with a nature conservation designation and the degree of protection offered are summarised in Table 7.4 below. A list of the 300 wetland sites recorded in the CWS database and the specific conservation designations on each site is provided in Appendix 8 in this report (the Excel version of this spreadsheet is included on the report CD).

In the case of known wetland sites in County Clare, many fall within a designated site (SAC, NHA or SPA), which should in the long term provide a degree of protection for these sites. This optimism must, however, be tempered by the fact that habitat loss in terms of extent and quality of habitats is still occurring within candidate SACs and NHAs due to human interference (see section 7.8 below).

The NPWS is planning to produce Conservation Management Plans for each SAC, SPA and NHA in Ireland. Each plan will list the wildlife resources of the area, the current human uses, any conflicts between the two, and strategies for retaining the conservation value of sites. The draft plans will be given to a liaison committee and other interested parties for discussion and consultation. The NPWS will then prepare a final version of the conservation plan. Consultation on draft consultation plans has begun. Conservation Plans, once complete, will be reviewed on a 5 year cycle.

Data provided by the Management Planning Services Unit (MPSU) section in NPWS (dated 21 February 2007) indicates that 382 conservation plans are presently planned for wildlife sites in Ireland. In total 274 plans are in preparation, 64 plans are completed and ready to go to consultation, while 44 are in consultation or have gone through this process.

Within the NPWS Fen Study database (Foss 2007) of the 808 fen sites listed a total of 219 sites have management plans in preparation, 38 plans are completed and ready to go to consultation, while 40 are in consultation or have gone through this process. Implementation of the recommendations in these plans will provide additional conservation protection to fens within the listed sites.

To provide increased conservation protection under the Habitats Directive to SACs from damaging activities, a series of Notifiable Actions have been drawn up by the Department of the Environment on these areas (see www.npws.ie). A landowner must obtain a written consent before performing any such operations on, or affecting the land or waters within an SAC or fully designated NHA.

Table 7.4: The number of discrete wetland sites (and sites and sub-sites) recorded in the CWS Site database with their conservation designation and protection.

Conservation Designation	Protected Status	Number of discrete sites in the CWS database with this conservation designation	Number of sites and sub-sites in CWS database with this conservation designation	Total area of designated sites (ha) (inclusive of non-wetland habitats) from CWS GIS
NP - National Park	Protected	1	8	1,380
NHA - Natural Heritage Area	Protected	13 *	15	3,046
pNHA - proposed Natural Heritage Area	Partially Protected	39	na	46,500
cNHA – candidate Natural Heritage Area	Not Protected	88	na	Unknown
SAC - Special Area of Conservation	Protected	30 *	99	85,300
cSAC - candidate Special Area of Conservation	Protected	0	na	0
SPA - Special Protection Area	Protected	8 *	23	54,300
NNR - National Nature Reserve	Protected	3	6	536
ASI - Area of Scientific Interest	Not protected	41	na	Unknown
Other (e.g. Wildfowl Sanctuary; Refuge for Flora and Fauna; Wildfowl Sanctuary)	Limited Protected	5	na	Unknown
Undesignated sites	Not protected	85	na	3,765**

** Data on the current number of sites designated as NHA, SAC and SPA is confirmed by information on the NPWS website dated 30 October 2008.*

*** Based mainly on provisional site boundaries drawn during CWS 2008.*

Although these data indicate a positive outlook for the protection of wetlands within conserved areas in the county, one of the key findings to emerge from the conservation evaluation in the CWS site database is that 152 site records (of the 300 sites recorded or 50% of sites) have no protection although their conservation value has been recognised and proposed by third parties who provided data to the current project.

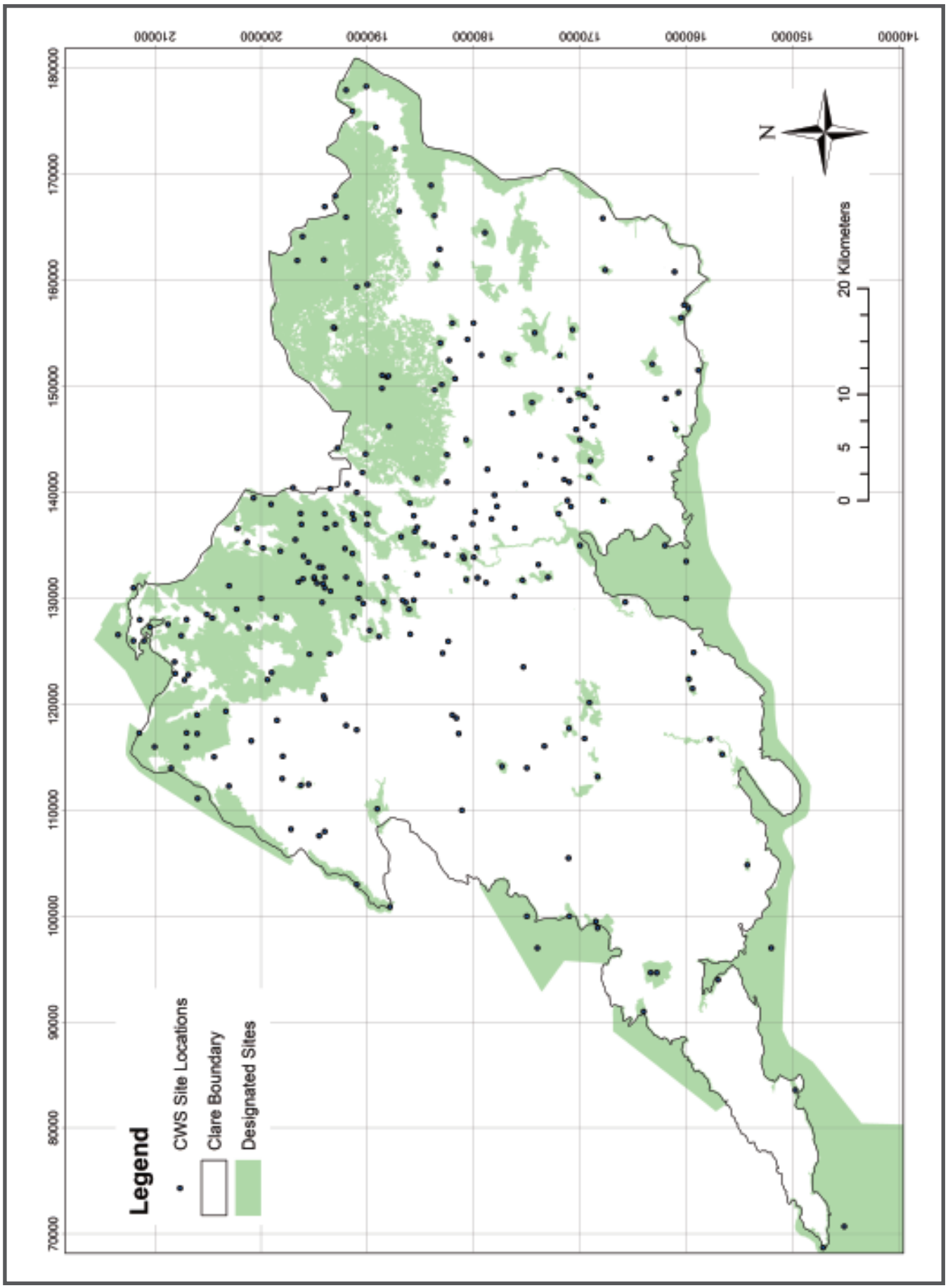

Figure 7.7. The location of CWS sites in relation to designated sites (NHAs; pNHAs; SAC and SPAs) throughout County Clare recorded during the County Clare Wetlands Survey 2008.

Source of designated site boundaries: NPWS, June 2008.

7.6 Damage to County Clare wetlands

The majority of, if not all, Irish wetland sites have been subject to some degree of human damage or modification from their natural state in the past, and continue to be threatened by such activities.

Wetlands, and bog, fen and marsh areas in particular have historically been regarded as less productive than adjacent agricultural land and measures have been taken to 'improve' their quality for agriculture. The principal method of land improvement has usually involved some form of drainage, burning clearance or addition of nutrients so as to facilitate the removal of peat, the planting of trees, or the creation of new grazing areas, pasture or farmland.

In addition, a more recent trend has been the use of wetlands as areas to illegally dispose of rubbish and landfill materials.

Reclamation and drainage works are an ongoing agricultural management tool which affect the hydrological condition of wetland habitats.

During the course of the CWS, past and existing damage to wetlands were noted when these were reported in third party reports, surveys and data sources, and an overall assessment of the severity was undertaken where data was provided. The scale for the severity of damage used was: Not serious; Serious; Very Serious and Unknown.

The damaging operation (based on the list of damaging operations recorded as part of the NHA surveys by NPWS (Lockhart *et al.* 1993), and the main habitats likely to be affected are detailed in Table 7.5 below. This list of damaging operations on wetlands is by no means exhaustive (i.e. wind farm developments and their impact on upland bog and wet heath areas are not included) and might be expanded in the future should a detailed survey of damage to wetland sites be undertaken or based on the results of field surveys.

Although insufficient time was available to undertake any detailed aerial photographic survey to record damage on sites recorded in the CWS, published reports indicate that 28 of the sites recorded in the CWS site database (see CWS Site Database on the report CD) were being damaged. It was clear from the GIS survey that extensive damage has been caused to the Clare wetland resource by past planting of conifers in upland bog areas, peat cutting throughout the bog areas and drainage activities across most wetland types.

It is likely that the final number of sites being negatively affected by damaging activities will be much higher, as the 2008 NPWS report on the conservation status of EU Habitat Directive sites in Ireland (NPWS 2008), many of which are wetlands, found that the conservation status of these habitats is far from satisfactory. In fact the overall assessment for wetland habitat types listed under the EU Habitats Directive (see Appendix 6a) found that only 4 habitats were in favourable conservation status, while 7 were poor and 16 habitat types were deemed to have a bad conservation status overall.

Included in the latter bad conservation status category were priority habitats such as Lagoons, Calcareous springs, Raised bogs, Blanket bogs, Rich fens and Wet woodland; while habitats defined as poorly conserved included Dune slacks, Turloughs, Tall herb swamps, Marsh, Bog woodland and Scrub. These habitats account for a significant part of the wetland habitat resource in County Clare.

Table 7.5: Damaging operations recorded on sites as part of the CWS. The damaging operations marked with an * are especially associated and likely to impact negatively on wetland sites.

Damaging Operation Code	Damaging Operation	Broad Wetland habitats most at threat from damaging operation
001	Coastal Infilling or Reclamation *	Lagoons, Dune slacks
002	Wetland Infilling *	Fens, Marsh, Bog, Reed Swamp
003	Agricultural Improvement *	Fen, Marsh, Wet Grassland
004	Clearance of scrub *	Wet woodland, Bog Woodland
005	Hedgerow removal	
006	Felling of native or mixed woodland	
007	Drainage *	Bogs, Fens, Marsh, Reedbed, Lakes, Wet Grassland
008	Modifications to Watercourses *	Rivers, Drainage channels
009	Grazing *	Bogs, Lake margins, Fen, Marsh, Reedbed, Turloughs
010	Mowing / Cutting	
011	Burning *	Wet heath, Bogs
012	Application of Fertilizers *	Lakes, Rivers, Turloughs
013	Application of Pesticides	
014	Bait Digging	
015	Hunting and Fishing *	Lakes, Rivers
016	Golfing	
017	Camping / Caravaning	Lagoons, Dune Slacks
018	Other Recreational	
019	Littering	
020	Dumping *	Bog, Fen, Marsh
021	Building / Civil Engineering	
022	Water Polluting Operations *	Lakes, Rivers
023	Aquaculture	
024	Peat Cutting / Hand *	Bogs, Dystrophic lakes
025	Peat Cutting / Mechanical *	Bogs, Dystrophic lakes
026	Inland Mineral Extraction	
027	Removal of Beach Material *	Lagoons, Dune slacks
028	Collection of Biological Material	
029	Collection of Geological Material	
030	Introduction of Exotic Species	
031	Natural Spread of Unwanted Species	
032	Afforestation *	Bogs, Wet Heaths, Wet Grassland

8 Conclusions & Recommendations

8.1 Distribution and extent of the Clare wetland resource

The aim of the County Clare Wetlands Survey (CWS) was to prepare a CWS GIS dataset and maps with an associated CWS site database of all the freshwater wetland sites in County Clare. Through the inclusion of data on sites and their habitats, provided by other groups, it has been possible to create a provisional summary wetland habitat map for the county, incorporating a large number of disparate data sets.

In total some **2069 mapped wetland habitat units with a total wetland area of 23,440 ha** has been identified in the County Clare wetland GIS, representing **7.4 % of the area within the county**. In addition the CWS site database contains additional site information on 300 discrete wetland sites that have been previously reported in the literature. All of the 34 wetland habitat categories were recorded during the course of the survey illustrating the diversity of the wetland resource within County Clare.

The wetland sites identified were characterised and mapped as far as possible in terms of the wetland habitat(s) present (using Fossitt 2000) and the extent of each habitat type(s) within the county was estimated. The accuracy of this data and the detail of information on sites was very much dependent on the level of detail recorded by previous surveys and reports.

A significant number (131 sites) of previously unrecorded wetland totaling over 3,000 ha were identified through a survey of aerial photographs. In some instances habitats on these sites were identified to level 2 of the Fossitt classification although in most cases the sites could only be positively identified as belonging to the 'CWS unknown wetland types' category.

Additional wetland sites are sure to exist within the county that have not been incorporated into the CWS dataset due to time constraints, ongoing surveys in the county which have yet to be completed, some additional reference data sets that were not made available during the survey (see Appendix 1) or due to a lack of mapped habitat data particularly within recognised conservation areas (i.e. NHAs, SACs and SPAs).

Figure 7.1 shows the location of the various discrete wetland sites identified, represented as point sources, in County Clare mapped from the CWS GIS.

The most valuable outcomes of the CWS are the two databases that have been developed during the course of the survey. These contain a vast array of information on the extent, distribution, previous studies carried out and characteristics of the entire wetland resource in the county. They should prove most useful as information sources for any future investigations into the biodiversity contribution of Clare wetlands.

8.2 Knowledge of the Clare wetland resource

From the results of the present County Clare Wetlands Study it has been possible to assemble a list of sites, which in all probability contain wetland habitats.

It is likely that other sites with wetland habitats do exist in County Clare outside of these sites which await discovery following a systematic wetland survey of the county and following inclusion of additional data sources which could not be incorporated into the CWS GIS at this time, due to time constraints, ongoing surveys or because data in digital format was not forthcoming.

In relation to the sites which have been identified to date, significant gaps exist in relation to our knowledge of this wetland resource. Specifically, the following information deficits have been identified:

- Confusion over the wetland type that exists on many of the CWS sites. This confusion arises principally due to the fact that wetlands often occur as a mosaic of different types within a single site and no detailed habitat maps exist that make area estimation on such sites possible. In addition due to the limitations associated with habitat identification from aerial photography it was not possible to identify the exact habitat type present within many sites. Therefore these areas were mapped in a 'CWS Unknown wetland type' in this project.

- There is a significant lack of information on the true extent of wetland habitat types occurring on many sites, making it difficult to assign more than estimated area data to many sites, and limiting our knowledge of the exact extent of the complete wetland resource in County Clare.

- Improvements in our knowledge of the wetland resource in County Clare, will only be achieved when a systematic wetland survey of the county, where classification of wetland type follows strict criteria, where extent of wetland type(s) is accurately mapped, and where previously unsurveyed areas identified as being potentially important for wetlands are surveyed. Any future wetland surveys of the county should prioritise key habitats that are deemed most threatened and for which information is lacking.

To this end, **Table 8.1** is an overall appraisal of the necessity to carry out further research or surveys on the various wetland habitats in Clare based on the results of this survey and with reference to previous experience of wetland habitat conservation. Habitats are scored according to their requirement for future survey.

The scoring system applied is based on a priority scale: low priority (1) – medium priority (2) – high priority (3). Scores are applied to three different criteria including conservation importance of the habitat, the occurrence of an information deficit and perceived threat and sensitivity of the habitat (see caption of Table 8.1). These scores are then summed for each habitat type and ranked from highest to lowest.

Those habitats with a higher score are deemed to be of the highest priority for future research or investigation using a 'traffic light' system. Red being high priority (score 11-15), orange being medium (score 6-10) and green being of low priority (score 1-5). This ranking system has been developed for use in the CWS and should be considered provisional. We believe however, that it is a relatively robust objective means of determining survey priorities.

Those habitats that came out with the highest priority **include fens, turloughs, lakes** and **springs**. In the case of **raised bogs** they came out high due to their high conservation importance and threatened status. However since surveys have been carried out on these habitat type before it scored low for information gaps. We believe in this case the high ranking indicates that restoration or management measures should be applied to safeguard the habitat from future loss.

Table 8.1: Assessment of survey priority for County Clare wetland habitats recorded during the County Clare Wetlands Survey 2008.

Conservation interest is based on the following scale: Very High (5) = habitat listed as priority on EU Habitats Directive; High (4) = habitat listed on EU Habitats Directive; Medium (3) = Semi-natural habitats; Low (1) = Artificial or heavily modified habitats.
Information Deficit is based on the following scale: High (5) = Major information gaps, no previous systematic survey carried out; Medium(3) = Habitats well reported but no systematic survey carried out; Low (1) = Habitats Surveyed systematically throughout county.
Perceived Threat (sensitivity) is based on the following scale. High (5) = Habitat currently threatened and highly sensitive; Medium (3) = Habitat under threat but not overly sensitive; Low (1) = Habitats not threatened and resilient.

Fossitt Level 3	Conservation interest	Information deficit	Perceived threat	Overall Priority for survey and assessment
CWS Unknown wetland type	Unknown	5	Unknown	High
FP1 Calcareous springs	5	5	5	15
PF1 Rich fen and flush	5	5	5	15
FL3 Limestone/marl lakes	5	5	5	15
FL6 Turloughs	5	5	5	15
PF3 Transition mire and quaking bog	4	5	5	14
FL2 Acid oligotrophic lakes	4	5	5	14
FP2 Non-Calcareous springs	3	5	5	13
PF2 Poor fen and flush*	5	5	3	13
FS2 Tall herb swamps	4	5	3	12
GS4 Wet grassland	3	5	3	11
PB1 Raised bogs	5	1	5	11
WN5 Riparian woodland	5	1	5	11
CD5 Dune slacks	5	1	5	11
FL4 Mesotrophic lakes	3	5	3	11
HH3 Wet heath	4	3	3	10
GM1 Marsh	4	3	3	10
FW1 Eroding/upland rivers	4	3	3	10
FW2 Depositing/lowland rivers	4	3	3	10
FS1 Reed and large sedge swamps	3	3	3	9
PB2 Upland blanket bog	5	1	3	9
WN6 Wet willow-alder-ash woodland	3	1	5	9
PB3 Lowland blanket bog	5	1	3	9
WN7 Bog woodland	5	1	3	9
PB5 Eroding blanket bog	4	1	3	8
FL1 Dystrophic lakes	4	1	3	8
FW4 Drainage ditches	1	5	1	7
WN4 Wet pedunculate oak-ash woodland	5	1	Unknown	6
CW1 Lagoons and saline lakes	5	1	Unknown	6
PB4 Cutover bog	3	1	1	5
WS1 Scrub	1	1	3	5
FL5 Eutrophic lakes	1	1	1	3
FL8 Other artificial lakes and ponds	1	1	1	3
FW3 Canals	1	1	1	3
FL7 Reservoirs	1	1	1	3

**Poor fen, although not listed as being on the Habitats Directive is an almost unique to Ireland and is recognised as being of high conservation importance.*

8.3 Clare Wetland Survey Recommendations

From the results of the County Clare Wetlands Study the following recommendations in relation to future surveys, additional data acquisition and project development are suggested:

1. Both datasets should be maintained and updated regularly. Additional sources of information on wetlands in County Clare should be incorporated into them as these become available. Appendix 1 details reports which may contain additional wetland information which were not examined as part of this project. In addition NPWS are likely to produce additional detailed habitat maps of sites (i.e. NHAs, SACs and SPAs) which should be incorporated into the CWS dataset.

2. The CWS GIS and site database provides a useful reference source on the identification of sites for future wetland survey in County Clare and should be developed further. **A significant number of sites have been identified for which site boundaries, and detailed survey information and associated habitat maps is lacking.** These sites should be examined as part of any future County Clare wetland field survey. Clusters of these sites occur especially in the south western part of the county, (between Inagh, Cooraclare and Kilmurry) and the eastern part of the county (between Tulla, Broadford and Scarriff).

3. A number of wetland habitat types have been identified in County Clare, for which habitat data, information on habitat extent, site boundaries and conservation status is lacking in many cases. These should be a priority for surveyed as part of the ongoing development of a wetland inventory for the county. These habitats include: **turloughs, rich fen and flush, tall herb swamp, spring sites** and **wet grassland** (see **Table 8.1**).

4. Within the CWS GIS a number of wetland sites have been newly identified for which habitat data is currently rather rudimentary. These should be surveyed to improve our knowledge of this resource, in terms of the habitat types and extent present and assess their potential as conservation worthy areas.

5. Future phases of the CWS should aim to provide the following information on the wetland sites being surveyed:

- A detailed site description highlighting the wetland habitat types (classified according to Fossitt) present on each site;
- Detailed mapping of the extent of each of the wetland type(s) within each site;
- Mapping of general site boundaries of the overall site to ensure conservation of a hydrologically intact unit;
- Recording of threats to the conservation and future protection of the site; to include restoration suggestions and management priorities and needs;
- Evaluation of each site on a national scale and ranking of each site in terms of its suitability and priority for designation within the NHA and/or SAC process.

6. The following habitats should be targeted and prioritised in any future surveys: **fens, turloughs, lakes** and **springs**. In addition, previously unsurveyed sites recorded during the course of the CWS should be prioritised for survey (see Table 8.1).

7. The protection of Clare's diverse wetland resource depends on strict enforcement of national conservation legislation by the NPWS, and planning laws to ensure unauthorised damaging activities (such as those identified during the CWS) are prevented.

8. Restoration of threatened and degraded wetland habitats should be encouraged such as the heavily degraded and unique raised bogs of south Clare, and the highly modified blanket bogs of the upland areas where forestry has caused significant losses. Funding opportunities for such initiatives should be investigated and pursued.

9. **A public awareness campaign** should be undertaken to inform the people of Clare of the value of the county's wetland resource and the ecosystem services they provide.

10. A standard methodology / approach should be developed by the Heritage Council for Phase I desk based wetland surveys that may be undertaken in the future throughout Ireland. The methodology used during the CWS could be refined further and improved upon to provide a useful template.

9 CWS Bibliography & Data Sources

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10 Appendices

In the report appendices which follow, the PDF layouts (produced from Excel or Word files) have been formatted and reduced to allow printing of tables at A4 page size. The original Excel spreadsheets from which some of these PDF's were produced are included on the CD rom included with this report.

List of Appendices

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Appendix 1: Reports & information sources consulted during the compilation of the CWS GIS & Site Database

Sorted by information source code. A full citation to the data sources used can be found in the CWS Report Bibliography.

Source title and author	Information Source Code	Information type	Data Content Comments
IPCC Irish Fen Inventory (Crushell)	01	Published report	Used to abstract information on sites
Irish Peatland Conservation Council Action Plan (Foss et al.)	03	Published report	Used to abstract information on 34 sites
Fergus Catchment Report (Curtis et al.)	06	Published report	Used to abstract information on the wetland habitats on 29 sites; 9 new sites added to CWS database
AFF Areas of Scientific Interest (An Foras Forbartha)	12	Published report	Used to abstract information on the wetland habitats etc. on 65 sites recognised in Clare by AFF
Raised Bog Report (Douglas et al.)	42	Published report	Used to abstract information on 3 sites
NPWS Blanket bog Evaluation report (Derwin et al.)	89	Published report	Used to abstract information on the wetland habitats and rare species; 1 new sites added to database. Report also contains specific areas of blanket bog on sites (not abstracted)
Vegetation of Irish Lakes (Heuff)	101	Published report	Used to abstract information on 7 sites
Shadow SAC Project (Crushell)	106	Published report	Data import of wetland sites proposed by NGOs outside of NHA/SAC network; 1 new site added to CWS database
NPWS Blanket bog report (Conaghan)	108	Published report	Used to abstract information on 1 site
NPWS Fen Study Database (Foss)	155	Database and Excel Spreadsheet	Used to abstract information on the fen habitats etc. present on 48 sites recognised in Clare
GSI National Bedrock Map of Ireland 1:500,000 Scale (GSI)	246	GIS Dataset	Used to determine the underlying solid geology of sites.
SRBD (2008) Lake segments. EPA, Wexford (EPA)	247	GIS Dataset	Used in Identifying lakes and water-bodies.
OSI (2008) Seasonal Lakes on 1830s Six Inch map series (OSI)	248	GIS Dataset	Shapefile extracted from OSI 6 Inch series of maps. Of limited use during CWS due to incomplete data.
OSI (2008) Marshes on 1830s Six Inch map series (OSI)	249	GIS Dataset	Shapefile extracted from OSI 6 Inch series of maps. Of limited use during CWS due to incomplete data.
OSI (2008) Historic floodplains: areas liable to flood on 1830s Six Inch map series (OSI)	250	GIS Dataset	Shapefile extracted from OSI 6 Inch series of maps. Used during the current study to identify historic floodplains.
EPA (2006) Lakes Water Quality. EPA, Wexford (EPA)	253	GIS Dataset	Selection of 23 lakes for which trophic status has been monitored. Used to establish level three of Fossitt for those lakes that have been monitored.
EPA (1997) Catchments All Island. EPA, Wexford (EPA)	255	GIS Dataset	Used as base-map in site and habitat mapping and wetland site identification.

Source title and author	Information Source Code	Information type	Data Content Comments
Geological Survey of Ireland (1998) Karst features dataset (GSI)	256	GIS Dataset	Used to locate known turlough and spring sites.
OSI (2008) Springs on 6 Inch series (OSI)	257	GIS Dataset	Shapefile extracted from OSI 6 Inch series of maps. Of limited use during CWS due to incomplete data.
OSI Color orthophotos (OSI)	258	GIS Dataset	Used as base-map in site and habitat mapping and wetland site identification.
EPA Corine Land-cover in Ireland (CLC2000) (OSI)	259	GIS Dataset	Used in the production of habitat and site maps.
OSI 1:5000 OS vector maps (OSI)	261	GIS Dataset	Used as base-map in site and habitat mapping and wetland site identification.
OSI 6 Inch Map series (OSI)	262	GIS Dataset	Used as base-map in site and habitat mapping and wetland site identification.
NPWS (2008) NHA Boundaries (NPWS)	263	GIS Dataset	Used in site and habitat mapping and wetland site identification.
NPWS (2008) SAC Boundaries (NPWS)	264	GIS Dataset	Used in site and habitat mapping and wetland site identification.
Turloughs over 10 ha (Goodwillie)	276	Published report & Habitat Maps	Used to abstract information on the wetland habitats on 7 sites
Heritage surveys of vulnerable landscape 2006 habitat map (Tubridy et al.)	277	Published report & GIS Dataset	Used to abstract information on 18 sites; Habitats mapped within the Ennis environs in GIS.
An ecological survey of habitat cover in the Shannon/ Newmarket-on-Fergus Region of south Co. Clare **(Conaghan et al.)**	283	Published report & GIS Dataset	Used to abstract information on 4 sites; 1 new site added to CWS database. Habitats mapped within the Ennis environs in GIS.
Habitat mapping, evaluation of semi-natural grassland and marsh and conservation recommendations: Ennis, Co Clare **(Hurley)**	285	GIS Dataset	Habitats mapped within the Ennis environs.
Habitat mapping, evaluation of semi-natural woodland and proposal of conservation strategies: Ennis, Co Clare **(Keegan)**	286	GIS Dataset	Habitats mapped within the Ennis environs.
Mullach Mor Habitat Map 1981 (Moles et al.)	288	Habitat Map	Used to abstract wetland habitat information
OSI 1:50000 Discovery series (OSI)	331	GIS Dataset	Used as base-map in site and habitat mapping and wetland site identification.
OSI Townlands (OSI)	332	GIS Dataset	Used as base-map to identify townlands.
Teagasc (2006) National Subsoils Data (EPA)	333	GIS Dataset	Identification of subsoil types

Source title and author	Information Source Code	Information type	Data Content Comments
NPWS (2008) pNHA Boundaries (NPWS)	334	GIS Dataset	Used in site and habitat mapping and wetland site identification.
NPWS (2008) Various Digital habitat maps originating from regional and national ecological surveys carried out by NPWS, Dublin submitted to CWS **See additional information below**	335	GIS Datasets	Used in the production of habitat and site maps.
Irish Char Conservation Group (Igoe)	340	Site list	Used to abstract information on 5 sites; 2 new sites added to CWS database
WRBD (2008) River segments (EPA)	341	GIS Dataset	Used in Identifying lakes and water-bodies.
SRBD (2008) River segments (EPA)	342	GIS Dataset	Used in Identifying rivers.
WRBD (2008) Lake segments (EPA)	343	GIS Dataset	Used in Identifying lakes and water-bodies.
NPWS (2008) SPA Boundaries (NPWS)	344	GIS Dataset	Used in site and habitat mapping and wetland site identification.
Teagasc (2006) National Soils Data (EPA)	345	GIS Dataset	Identification of soil types
Turlough Report (Sheehy Skeffington et al.)	349	Published report	Used to abstract information on 27sites; 18 new sites added to CWS database
Turlough Report (Regan et al.)	350	Published report	Used to abstract information on 7 sites
AFF Preliminary Areas of Scientific Interest in County Clare (Goodwillie)	353	Published report	Used to abstract information on the wetland habitats etc. on 53 sites recognised in Clare by AFF
Coastal Lagoon Survey 1996-1998 (Healy)	355	Published report	Used to abstract information on 6 sites; 4 new site added to CWS database
Report Wetlands of International and National Importance (Anonymous)	356	Published report	Used to abstract information on 2 sites
Vegetation of Irish Rivers (Heuff)	357	Published report	Used to abstract information on 3 sites; 2 new sites added to CWS database
Irish Peatland Conservation Council 2008 (Malone)	358	Wetland Site submission	Used to abstract information on 42 sites
Biochange WP 1.1 2008 (Gittings)	359	Wetland Site submission	Used to abstract information on 41 sites; 34 new sites added to CWS database
NPWS Fossitt Habitat Assignment on Conservation Areas (Lockhart)	360	Excel Spreadsheet	Used to abstract information on the wetland habitats present on 225 conservation worthy sites recognised in Clare by NPWS and added to CWS database; 58 non-wetland sites finally discarded
BSBI draft Plant Distribution Data for County Clare 2008 (Ward et al.)	395	Draft Dataset	Used to abstract habitat information on 60 wetland sites; Information on 67 new sites added to CWS database
Coillte Biodiversity Areas in Clare – Digital Habitat Map 2008 (Coillte)	396	Data table and GIS Dataset	Wetland habitat occurrence Coillte biodiversity areas in Clare.

Source title and author	Information Source Code	Information type	Data Content Comments
Environment Agency UK (Anonymous)	399	Published Report	Wetland and flood control information case studies
N18 Gort to Crusheen Road Scheme: Environmental Impact Statement; Route Selection Report; Constraints Study (Anonymous)	402 403 404	Published Report	Used to abstract information on wetland habitat occurrence in vicinity of proposed routes.
A national survey of potential turlough sites. Draft report prepared for NPWS 2008 (Mayes)	405	Draft GIS dataset	Used to identify potential turlough sites in county Clare and to cross-reference known Turlough sites.

NPWS Individual Data Sets Received in 2008 and included under data source code 335 above. Source code is referenced in the source attribute field of the polygon habitat shapefile in the CWS GIS.

NPWS Survey / Habitat Type	GIS Source Code	Shape-file Name
Shoreline Habitats (driftlines and stony banks)	335a	1210_1220_Moore&Wilson1999_Bleasdale _etal_1996_Clare
Lakes	335b	3110_3130_lwseg_0207_CLARE 3140_lwseg_0207_CLARE 3160_lwseg_0207_CLARE
Turloughs	335c	CA_3180_records_2007_Clare
Calaminarian Grasslands	335d	CA_6130_records_2007_Clare
Dunes from Coastal Monitoring Project (Ryle et al 2007)	335e	CA_dunes_CMP_Tim_Ryle_Clare
Upland habitats from Commonage Framework Plans and Red Grouse Habitat Survey (2008)	335f	Commonage_Clare RGHS_habitats_Ce
Fens (Foss 2007)	335g	FEN_COMP_Clare
Calcareous Grasslands from Grassland Monitoring Project	335h	Gmp2006_6210_CLARE
Raised Bogs	335i	Intactrb_surv_indesign_othersurv_CLARE 2dary_degraded_unsurv_othersources_CLARE rb_unsurv_indesign_othersources_CLARE rb_unsurv_outdesign_othersources_CLARE
Limestone Pavement	335j	Limestone_Pavement_Occurence_CLARE
Management Planning and Support Unit Mapping	335k	MPSU_all_habitats_Clare (draft data)
National Survey of Native Woodlands	335l	non-fips_osow_Clare NSNW_native_woodland_CLARE NSNW_Woodland_releves_Clare
Saltmarshes	335m	potential_national_saltmarsh_2007_Clare
Designated Site Inspection reporting	335n	SIRdata_Clare
Survey of potential Blanket bog NHA's (Derwin et al. 2004)	335p	Habitat shapefiles for all new Blanket bog NHAs identified in Clare.

Data sources on wetland habitats in county Clare that were not consulted in the CWS

Title	Data Type	Comments
Ennis by-pass EIA, Clare County Council	Reports and Figures	Not made available to CWS
Mapping the Broad Habitats of the Burren using Satellite Imagery (Parr et al.)	Published report & GIS Data	Not made available to CWS; Reference Bibliography 291
RPS Group (2008) South Clare Habitat Map (Anonymous)	Report & GIS data set	Survey not yet completed; Reference Bibliography 348
SAC boundary appeal files	Report data	Not made available to CWS. No easily accessible format;
Gort Lowlands Flood Report. Southern Water Global 1998 (Goodwillie et al.)	Report	Not made available to CWS; Reference Bibliography 226
NPWS National Survey of Native Woodland in Ireland (Perrin et al.; Higgins et al.)	Report & GIS data set	Report not yet completed; partly made available to CWS; Reference Bibliography 222; 220

Appendix 2: Groups and individuals contacted in the compilation of data for the CWS

** Sorted by organisation*

Individual	Organisation	Date Contacted
Tom Gittings	Biochange Project, University College Cork	September 2008
Brigid Barry	Biodiversity Officer, Clare County Council	July 2008
John Murphy	BirdWatch Ireland	September 2008
Stephen Ward, Sharon Parr	Botanical Society of Britain and Ireland (BSBI)	September 2008
Micheline Sheehy Skeffington	Botany Department, NUI Galway	August 2008
Sharon Parr	Burren Life	September 2008
Congella McGuire	Clare County Council	September 2008
Padraig McManus	Clare County Council	August 2008
Stephen Ward	Clare Heritage Forum	September 2008
Daniel O'Brien, Pat Neville & Myles McDonagh	Coillte Teoranta	September 2008
Frank Barrett	Department of Agriculture (Forest Service)	September 2008
Rory Callan, John Evans, John Pygott	Environment Agency, UK	September 2008
Eleanor Mayes	Environmental Consultant	August 2008
Geoff Oliver	Environmental Consultant	September 2008
Fiona O'Rourke	Environmental Protection Agency	August 2008
John Conaghan	Enviroscope Environmental Consultants	August 2008
Brid Higgins	Galway county Council	August 2008
Marie Mannion	Galway County Council	July 2008
Jerry Dunne	Galway County Council	October 2008
Michael Sheehy	Geological Survey of Ireland	August 2008
Congella McGuire	Heritage Officer, Clare County Council	July 2008
Fran Igoe	Irish Char Conservation Group & Shannon Regional Fisheries Board	September 2008
Sarah Malone	Irish Peatland Conservation Council	September 2008
Gemma Weir	MPSU, National Parks and Wildlife Service	August 2008
Liam Lysaght	National Biodiversity Data Centre	September 2008
Andy Bleasdale	National Parks and Wildlife Service	August 2008
John Cross	National Parks and Wildlife Service	July 2008
Caitríona Douglas	National Parks and Wildlife Service	July 2008
Julie Fossitt	National Parks and Wildlife Service	August 2008
Naomi Kingston	National Parks and Wildlife Service	August 2008
Neil Lockhart	National Parks and Wildlife Service	July 2008
Jim Ryan	National Parks and Wildlife Service	July 2008
John Wilson	National Parks and Wildlife Service	August 2008
Rachel Lowe	National Roads Design Office, Galway county Council	October 2008
Nathy Gilligan & Michael Collins	Office of Public Works	September 2008
Stephen Curran	Ordnance Survey of Ireland	September 2008
Paula Kearney	RPS Group	August & October 2008
Ken Bond	University College Cork	September 2008
Richard Moles	University of Limerick	September 2008
Paddy Kavanagh	Western River Basin District	August 2008

Appendix 3: Data import methodology for the CWS GIS & Site Database

A variety of data sources were used in the compilation of the list of sites included within the County Clare Wetlands Survey site database. The sources that were used are listed in Appendix 1.

In the case of one off sites provided by individuals or groups, data was entered directly from the information provided to the CWS database.

The following import methodologies were applied to the import of site information from more extensive electronic data set sources.

1 CWS Site Database

1.1 Natural Heritage Area & Special Area of Conservation NPWS Site Data and Fossitt habitat types

An electronic list of the sites provided by NPWS containing all recognised NHA, cNHA, SAC, cSAC and SPA sites was supplied by Dr. Neil Lockhart of NPWS in July 2008. The site list included the Fossitt habitat types present on the majority of the sites, together with site designation information.

Allowing for sites with multiple records (i.e. one site with two different designations is recorded twice) created by the NHA and/or SAC designation process a total of **225 unique site records** were created from this data set and information on these sites was imported.

The data for the sites provided was imported from a series of Excel spreadsheets.

Imported data included: Site code number; Site name; Site designation; Fossitt habitats present on sites; National Grid reference E & N.

1.2 NPWS Fen Study Database

An electronic list of the sites listed by NPWS with fen habitat types recorded was approved for use on the CWS project by Dr. Neil Lockhart of NPWS in July 2008.

Allowing for sites with multiple records created by the occurrence of sub sites within larger conservation worthy sites a total of **48 unique site records** were located in Co. Clare. Data on these sites was imported into the existing site records held within the CWS database.

The data for the sites provided was imported from a series of Excel spreadsheets created from within the NPWS National Fen Survey Database.

Imported data included: Fen types present on sites; Scientific interest on sites (Botanical; Zoological etc.); Previous reports and survey holding site information; Additional Site designation; Grid reference data where this data was missing on sites; Fossitt habitats present on sites.

1.3 Foras Forbartha ASI Site Lists for County Clare

Site data from both the AFF Preliminary ASI County Report (1972) and the final report on Areas of Scientific Interest in Ireland (1981) were abstracted for sites listed within the CWS database.

The data for these sites was imported manually from the published reports. Two additional site records were added to the CWS database from these reports.

Imported data included: Scientific interest on sites (Botanical; Zoological etc.); Previous reports and survey holding site information; Grid reference data where this data was missing on sites; a provisional list of Fossitt habitats present on sites were added to database on any sites lacking Fossitt data.

1.4 Other reports holding wetland information on Clare

A series of other reports holding information on a limited number of wetland sites in County Clare were consulted. A full list of these reports, studies and surveys can be seen in CWS Appendix 1.

In the case of each report the sites listed in County Clare were screened against the existing sites in the CWS database. If a site was not located within the CWS database, a new database site record was created.

In the case of both new and existing site records, data on the scientific interest present on the site, previous research source, habitats present, and basic site information was recorded within the CWS database.

The data for these sites was imported manually from the various published reports.

2 CWS GIS Database

2.1 Sites from CWS site database

A shapefile was created from an Microsoft Excel spreadsheet exported from the CWS site database. This dataset contained point information showing the location of each CWS site recorded from the extensive literature search and input from third parties.

Each point denoting a site had basic site information (originating from CWS site database) associated with recorded in various attribute fields including CWS site name, CWS site code, designation etc. The location of each point was subsequently checked using GIS to ensure that grid references were correct.

2.2 Designated sites – NHA/SAC/SPA

Site boundary files for all existing NHA, SAC and SPA site in County Clare were obtained from NPWS and directly imported into the CWS GIS. These boundary files were subsequently used to denote the boundaries of many CWS sites (those lying within designated sites). Where a CWS site was found to lie within a designated site, the boundary of the appropriate designated site was exported into a CWS site boundary shape-file. This shapefiles has a number of attributes including; source of the boundary, CWS site Code(s), calculated area, X_coord (easting), Y_coord (northing) of the polygon centroid.

In many cases, CWS sites had no existing boundaries associated with them especially in the cases where: they lay within a large designated site complex; or sites that had never been previously mapped (including many cNHA's). In the case where sites were contained within much larger designated sites, individual boundaries were not drawn, but the subsites were recorded in the attributes of the larger boundary. In the case where sites were outside of existing boundaries, a boundary was generated where on inspection the site was clearly visible on the aerial photograph and other base-maps.

Unfortunately, in some cases, CWS sites do not have boundaries associated with them as it was not possible to confirm the wetland area by referring to the relevant base-maps and background site data available.

2.3 Habitat type datasets

Many existing datasets (as listed in Appendix 1) were imported directly into the CWS GIS. Each habitat unit was then exported from its source into a CWS habitat (polygon) shapefile. This shapefile had a number of attribute fields associated with it including source, area and habitat type recorded as the alpha numeric code assigned by Fossitt (2000). Due to the different sources of the data it was often necessary to transform the habitat data into an appropriate Fossitt category. Where it was not possible to attain level 1 in Fossitt, then the habitat was assigned into a category 'CWS unknown wetland type'.

In the case of rivers, data was extracted from one primary source and imported into a separate CWS (linear) shapefile. Similarly with springs, the data was displayed in a separate (point) shapefile. The same attributes were assigned to these shapefiles as the polygon one above.

2.4 Paper based mapped sites

Due to time constraints a limited number of habitat maps available on paper were incorporated into the CWS GIS as part of this study. The appropriate wetland habitat types were identified on these sites, assigned to the relevant Fossitt wetland habitat and new wetland habitat polygons were drawn within the CWS habitat shapefile.

Specifically, this exercise was undertaken in relation to a habitat map of the Burren National Park in the Mullaghmore area (Moles and Travers 1981), maps of Turloughs produced by Goodwillie (1992) and an EIS habitat map for the Gort by-pass (Galway County Council 2006).

Appendix 4: Key to data fields in the CWS GIS and Site Database

As part of the CWS mapping project two main databases were created to hold site information.

The first was the *CWS GIS Database* (ArcView 9.2 GIS software package) to hold site related information on each polygon, point or linear feature mapped. Data held in this database was transformed into MapInfo format at the end of the project period for use by Clare County Council.

The second was the *CWS Site Database* (Filemaker Pro 8.0 software package) which held some of the information in the GIS database, but allowed for easier sorting of site records, additional data input on sites and data analysis of records.

This main CWS site database was supported by a second smaller Bibliography database which held information on reports, survey and GIS data sets which were consulted during the project. This database was used to create the report bibliography.

Data from both the GIS and Site database is readily exported into an Excel spreadsheet which allowed data exchange between the CWS GIS database and main CWS site database.

A series of database layouts, containing related site data, form the main structure and content of the CWS site database. These layouts were used when adding site related data to the database. These layouts (indicated by green buttons along the top of the CWS database window) and the site information they hold are:

Title layout: Opening title page layout of database displayed when FileMaker Pro application is launched, with title copyright statement and enter button.

Main Data Entry Layout: Layout containing basic site details including site names and codes (i.e. CWS name and code; other names and codes used by third party groups for site), total site area, location data and information on site designations.

Habitat, Species & Threats Layout: Layout containing site details on the wetland habitat type(s) present; Biological interest and rare species data on sites and where this information has been published.

This layout additionally recorded information on site damaging operations recorded with an overall severity scale.

Habitat Area Layout: Layout containing site details on the extent of the different wetland habitat type(s) present on the site (recorded in ha or length (km) for linear features).

Site Description Layout: Layout containing site descriptions obtained from various third party sources (e.g. NPWS, IPCC etc.).

An explanation of the data fields used in both the GIS database and CWS site database are provided below. Name in bold is the name applied to database field and seen when accessing the database in browse mode, the underlined name is the actual field name within database (used when exporting data). The appearance of the CWS GIS, site and bibliography databases is presented in Appendix 5.

4.1 Data fields in the CWS Site database

Main Data Entry Layout

CWS Site Code (CWS Site Code)
A unique site code created for the site as part of the CWS project.

CWS Site Name (CWS Site Name)
The name of the wetland site, based on specific name for site proposed by third party sources.

Total Site Area (ha) from Literature (Total Site Area (ha) from Literature)
The total site area in hectares as reported in Literature source.

Total Site Extent (ha) from GIS (Total Site Extent (ha) from GIS)
The total site area in hectares as calculated from the GIS.

Total Site Length (km) from GIS (Total Site Length (km) from GIS)
The total site length in km as calculated by the GIS for linear features such as rivers; ditches etc.

Easting Centre (Easting Centre)
The grid reference of the E co-ordinate of the site is recorded, where this is given in the new format of a 6 digit number.

Northing Centre (Northing Centre)
The grid reference of the N co-ordinate of the site is recorded, where this is given in the new format of a 6 digit number.

Grid Reference (Grid ref old)
The grid reference of the site is recorded, where this is given in the old format of a letter followed by 4 or 6 digit number.

Ortho photo number (ortho photo number)
Aerial photograph number of OSI ortho photo.

Six Inch map number (six inch map number)
The number(s) of the Ordnance Survey six inch to one mile scale map(s) in which the site is located.

1:5000 map number (one to 5000 map number)
The number(s) of the Ordnance Survey one to 5000 scale map(s) in which the site is located.

Discovery map number (discovery map number)
The number(s) of the Ordnance survey 1:50,000 map(s) in which the site is located.

Site Source (site source)
Details of who proposed the site as a site containing wetland types being recorded in CWS and where appropriate a reference to the study or report where the site was recorded.

Other Groups Site Code (Other Group Site Code)
The code number for the site used by third party groups (e.g. NPWS *inter alia*).

Other Groups Site Name (Other Group Site Name)
The name of the site used by third party groups in other studies or surveys.

Site Designations (site designations)
If the site has or was designated under one of the various conservation initiatives the appropriate designation is recorded, together with explanatory key.

Options: **NHA** - Natural Heritage Area with legal protection
cNHA - candidate Natural Heritage Area no legal protection
pNHA - proposed Natural Heritage Area as advertised in 1995 no legal protection
SAC - Special Area for Conservation with legal protection
cSAC - candidate Special Area for Conservation open to appeal/ transmitted to EU
pcSAC - proposed candidate Special Area for Conservation open to appeal/ not yet transmitted to EU
SPA - Special Protection Area
cSPA - candidate Special Protection Area
NP - National Park with legal protection
WHS - World Heritage Site
NNR - National Nature Reserve with legal protection
BIO - Unesco Biosphere Reserve
RAM - Ramsar Site
ESA - Environmentally Sensitive Area
EDS - Eurodiploma Site
ASI - Area of Scientific Interest
BGR - Berne Convention Biogenetic Reserve
COR - Corine site
WS - Wildfowl Sanctuary
RFF - Refuge for Flora or Fauna
CBA - Coillte Biodiversity Area
Undesignated site - no known designation

Townland Name(s) (Townland)
The name of the townlands in which the GIS or site occurs. Obtained from the GIS.

Solid Geology (Solid Geology)
The solid geology underlying the site. Obtained from the GIS.

Subsoil Type (Subsoil Type)
Subsoil (quaternary deposit) underlying the site. Obtained from the GIS.

River Catchment (River catchment Name)
River catchment in which the site occurs. Obtained from the GIS.

Corine Landuse (Corine Landuse)
Corine habitat type within site based on Corine GIS classification.

Liable to Flood (Liable to Flood)
Whether the site occurred within a Liable to Flood area as mapped on the OS six inch map. Yes/no option. Obtained from the GIS.

Site background/research/previous survey data (Site Background data)
List of publications and reports holding habitat information on the site. Code used to identify report in related CWS Bibliography database.

Type of Information held on site in literature (Type of Information Source available on site)
A list of information categories under which data has been recorded on the site, including:

Vegetation Type Data (relevé data); Species Data (both general and on rare species); Habitat Data (Fossitt format); Habitat Map available; Hydrochemical Data; Site Size (from published sources); Ownership Data; Detailed Site Description; Site Management; Conservation Designation.

Wetland Area on Site (Wetland Areas on site)
Check box system to record whether a CWS wetland type occurred on site, was likely to occur or was absent.

Polygon Source Comment (Polygon Source Comment)
Source of the GIS polygon used to describe the site. Options: NPWS Existing - shape file obtained from NPWS source; CWS new - polygon created as part of the current project; Other – shape file obtained from other third party study.

GIS Shapefile Source (GIS shapefile data reference)
Code number relating to the report or data source, as per Appendix 1, which contained the GIS shapefile for the site in question.

Comment Box (Comment box) (not exported to GIS site database)
Text field to hold temporary comments on site, queries on site etc. Used during data compilation phase.

Temporary flag record (Temporary flag record) (not exported to GIS site database)
Check box allowing the temporary flagging of selected site records.

Habitat, Species & Threats Layout

Main Fossitt Habitat Present (Main Fossitt habitat present)
A list of all Fossitt habitat types present within the site, based on the classification system of Fossitt was recorded (excluded Marine habitat types).

Rare/Noteworthy Species data source (Species data source)
List of publications and reports holding species information on rare and threatened species on the site. Code used to identify report in related CWS Bibliography database.

Rare/Noteworthy Species interest present on site (Site rare species present)
A list of species categories (for both flora and fauna)of interest which occur on the site; including:

Botanical	**Zoological Invertebrates**	**Zoological Vertebrates**
Higher Plant **Fern** **Bryological** **Lichen** **Algae**	**Invertebrates Mollusc** **Invertebrates Insect** **Invertebrates Arachnid**	**Birds** **Mammals** **Bats** **Amphibian** **Fish**

Site damaging operations (Site damaging operations)
List of site codes for damaging operations recognised by NPWS with explanatory key.

Overall severity of site damage (Severity of damage)
Four point damage severity scale. Based on NPWS scale.

Habitat Area Layout

Habitat Area in ha fields (Fossitt code plus the word Area e.g. PF1 Area)
A list of the extent of the Fossitt wetland habitat types occurring within the site, was recorded. Areas were calculated from the GIS and were entered against the appropriate habitat type.

Length present in km fields (Fossitt code plus the word Length e.g. FW2 Length)
A list of the length of the linear wetland habitat types occurring within the site, was recorded. Lengths were calculated from the GIS and were entered against the appropriate habitat type.

Site Description Layout

Site Description (Site description) (not exported to GIS site database)
Text field to hold third party site descriptions for site record.

Site Description Source (Site description source) (not exported to GIS site database)
Text field to hold name of the third party source who provided site description e.g. NPWS, IPCC etc.

4.2 Data fields in the CWS Bibliography database

Bibliog Number: Unique number created by Filemaker Pro application when new publication record is added to database. This is subsequently used in the main NPWS Fen Study database to relate back to reference in the Bibliography database.

Authors: Author(s) of report, surname and initial format.

Year: Year in which report/publication was published.

Title: Title of report/publication and where relevant title of book this appeared in.

Journal, Publisher, Location, No. Pages: further details of publication.

A series of check boxes indicating whether this reference was cited in the final fen study report; provided information to the study database and or was a NPWS blanket bog or raised bog survey report. These check boxes were subsequently used to generate lists of publication.

4.2 Data fields in the CWS GIS database

Six different GIS shapefiles (MapInfo Tab files) were created during the course of the CWS each containing a number of different attribute fields as described below.

4.2.1 CWS Site Locations

This file was created from an exported Excel document from the main CWS site database (section 4.1 above). All of the CWS sites and much of the information relating to each site are included within this file. The information relating to the sites are stored in columns of an Excel spreadsheet known as attribute fields. The title of the various attribute fields (columns) differ somewhat from the corresponding titles used in the CWS site database as detailed in Table 4.1 below. Due to time constraints, data was not entered into a number of fields.

Table 4.1. Data field labels from the CWS site database and corresponding labels from the CWS GIS site locations database.

CWS Site Database Label (see details in section 4.1 above)	CWS GIS Database Label
CWS Site Code	CWS_CODE
CWS Site Name	CWS_NAME
Wetland Areas on Site	WETLAND
Total Site Extent ha from GIS	AREA_GIS
Total Site Length km from GIS	LENGTH_GIS
Northing Centre	Y_COORD
Easting Centre	X_COORD
Grid Ref Old	PREV_G_REF
Site Source	SITE_SOURCE
Ortho Photo Number	ORTHO_NUMB
Six Inch Map Number	SIX_INCH_N
One to 5000 Map Number	1to5000no
Discovery Map Number	1to50000no
Other Groups Site Name	OTHER_NAME
Other group Site Code	OTHER_CODE
Site designations	DESIGNATIO
Townland	TOWNLAND
Solid Geology	SOLID_GEOL
Subsoil Type	SUBSOIL
River Catchment Name	CATCHMENT
Corine Landuse	CORINE
Liable to Flood	LIAB_TO_FL
Site Background Data	BACKGROUND
Type of information source on site	INFO_TYPE
Site Rare Species Present	RARE_SPP
Species Data Source	SPP_BACKGR
Site Damaging Operations	DAMAGE
Severity of Damage	DAM_SEV
GIS Shapefile Data Reference	GIS_BACKG
Polygon Source Comment	POLYGON_SO
Main Fossitt Habitat Present	FOSSITT_HABS
Total site area ha from literature	AREA_LIT
Total site length km from literature	LENGTH_LIT

4.2.2 CWS Site Boundaries

This file shows the boundaries of known wetland sites in County Clare, where such boundaries were available in digital format or could be drawn with confidence. The various attributes fields associated with this file are as follows:

CWS NAME	This contains the site name as recorded in the CWS site database.
CWS CODE(s)	The site code according to that recorded in the CWS site database. In the case of larger sites there may be a number of site codes referring to numerous sub-sites.
AREA	A calculation field which automatically calculates the area contained within the site boundary.
SOURCE	The source of the boundary is given in this field, this relates to the source of the boundary feature.
DESIGNATIO	Nature conservation designations of the site are recorded within this attribute field (i.e. NHA, SAC, SPA etc.).
X_COORD	Automatically generated field giving the central (X) coordinate of the shape.
Y_COORD	Automatically generated field giving the central (Y) coordinate of the shape.
OTHER_NAME	In some cases the site may be known by a different name depending on the source of the boundary.
OTHER_CODE	In some cases the site may be known by a different code depending on the source of the boundary.
MERGED_BOU	Boundary was compiled from a merge of more than one boundary feature.

4.2.3 CWS Polygon Habitats

This file shows the distribution and extent of the various wetland habitats recorded during the CWS throughout the county. Much of the information has been imported from third part sources. It is not possible to definitively confirm many habitat types by aerial photography therefore much of the wetland recorded during the CWS falls within the 'unknown wetland habitat' category, unless third party sources provided level 3 Fossitt habitat assignment data. The following attributes are associated with this shapefile:

FOSSITT	Full name and code of habitat according to Fossitt (2000). There is an additional category 'unknown wetland type', where it is possible to identify a wetland but not possible to assign it to a Fossitt category.
FOS_CODE_1	Alphanumeric code according to Fossitt (2000) to level 1.
FOS_CODE_2	Alphanumeric code according to Fossitt (2000) to level 2.
FOS_CODE_3	Alphanumeric code according to Fossitt (2000) to level 3.
AREA	A calculation field which automatically calculates the area covered by the habitat.
SOURCE	The source of the habitat shape is given in this field, this relates to the dataset from which the habitat information originates. The code used within this field identifies bibliographic and GIS records as presented in the main report and Appendix 1.
NAME	Where the habitat area had a name associated with it in the origin file this has been retained. This is the case with many lakes.
SEG_CD	Individual code assigned to lakes from EPA lake dataset.

4.2.4 Clare Rivers

Due to the complexity of mapping rivers accurately these are presented within a separate (linear) shapefile. The river dataset originates from the EPA and has the following attributes associated with it:

SEG_CD	Unique segment code which identifies the segment of river.
NAME	Name of river segment.
SOURCE	The source of the habitat shape is given in this field, this relates to the dataset from which the habitat information originates.
LEN	Refers to the length of river segment.
ORDER	Refers to a classification system known as the 'Strahler' stream order. It ranges from 1 upwards. 1 refers to first order streams, 2 refers to second-order stream which form when two first-order streams come together. When two second-order streams come together, they form a third-order stream etc. While the rivers have not been classified to level three in Fossitt, it generally follows that lower order streams fit into the upland eroding streams category (FW1) while higher order rivers fit into the lowland depositing streams (FW2).

4.2.5 CWS Spring Sites

Springs are mapped separately as points in an individual file. These sites are mainly extracted from the Geological Survey of Ireland Karst Features dataset. The following attributes are associated with this file:

NAME	Name of spring site.
TOWNLAND	Townland name.
FOSSITT	Fossitt habitat code.
FOS_CODE_1	Alphanumeric code according to Fossitt (2000) to level 1.
FOS_CODE_2	Alphanumeric code according to Fossitt (2000) to level 2.
FOS_CODE_3	Alphanumeric code according to Fossitt (2000) to level 3.
SOURCE	Dataset from which site originated.
X_COORD	Automatically generated field giving the (X) coordinate of the shape.
Y_COORD	Automatically generated field giving the (Y) coordinate of the shape.

4.2.6 Drainage Ditches

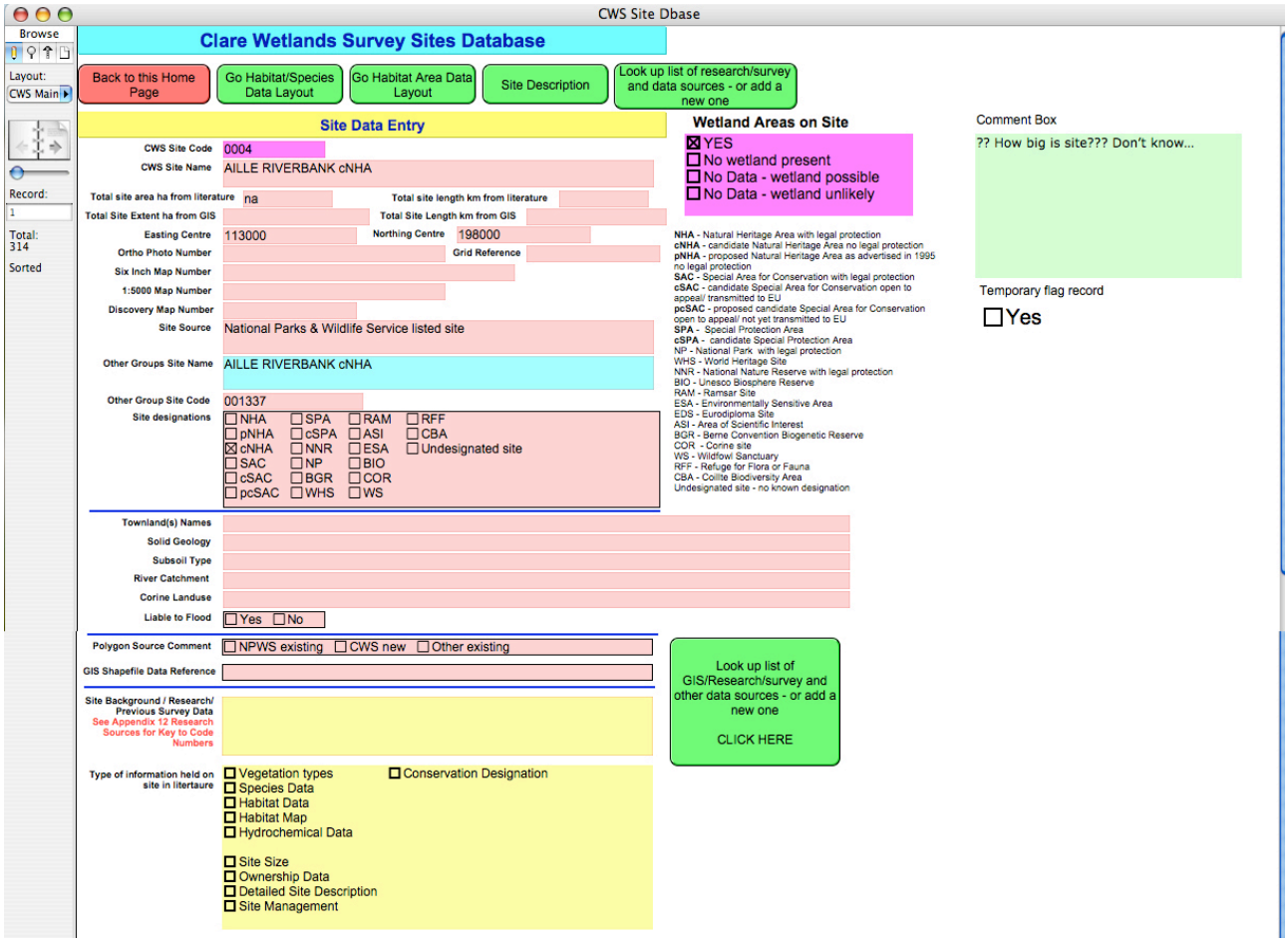
Drainage ditches are presented within a separate (linear) shapefile. Such a ubiquitous habitat type is often not mapped during habitat mapping exercises due to scale. There are occasional records of drainage ditches mapped in County Clare and these are contained within this file. The following attribute fields are attached to the file:

LENGTH	Calculation field which calculates the length of the feature.
SOURCE	Dataset from which site originated.
FOSSITT	Fossitt habitat code.
FOS_CODE_1	Alphanumeric code according to Fossitt (2000) to level 1.
FOS_CODE_2	Alphanumeric code according to Fossitt (2000) to level 2.
FOS_CODE_3	Alphanumeric code according to Fossitt (2000) to level 3.

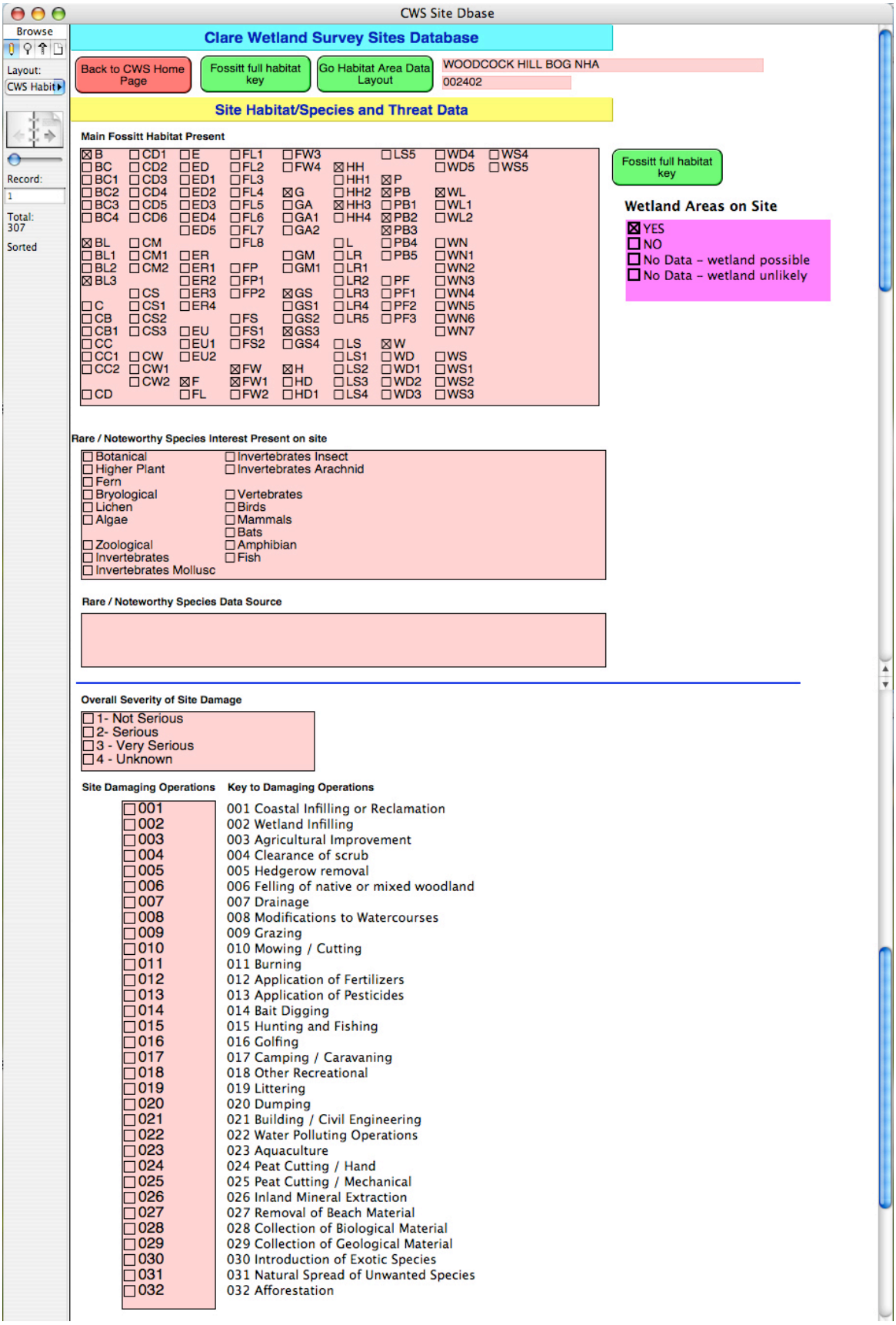
Appendix 5: CWS Site, Bibliography & GIS Database Layouts

Title Layout – CWS Site Database

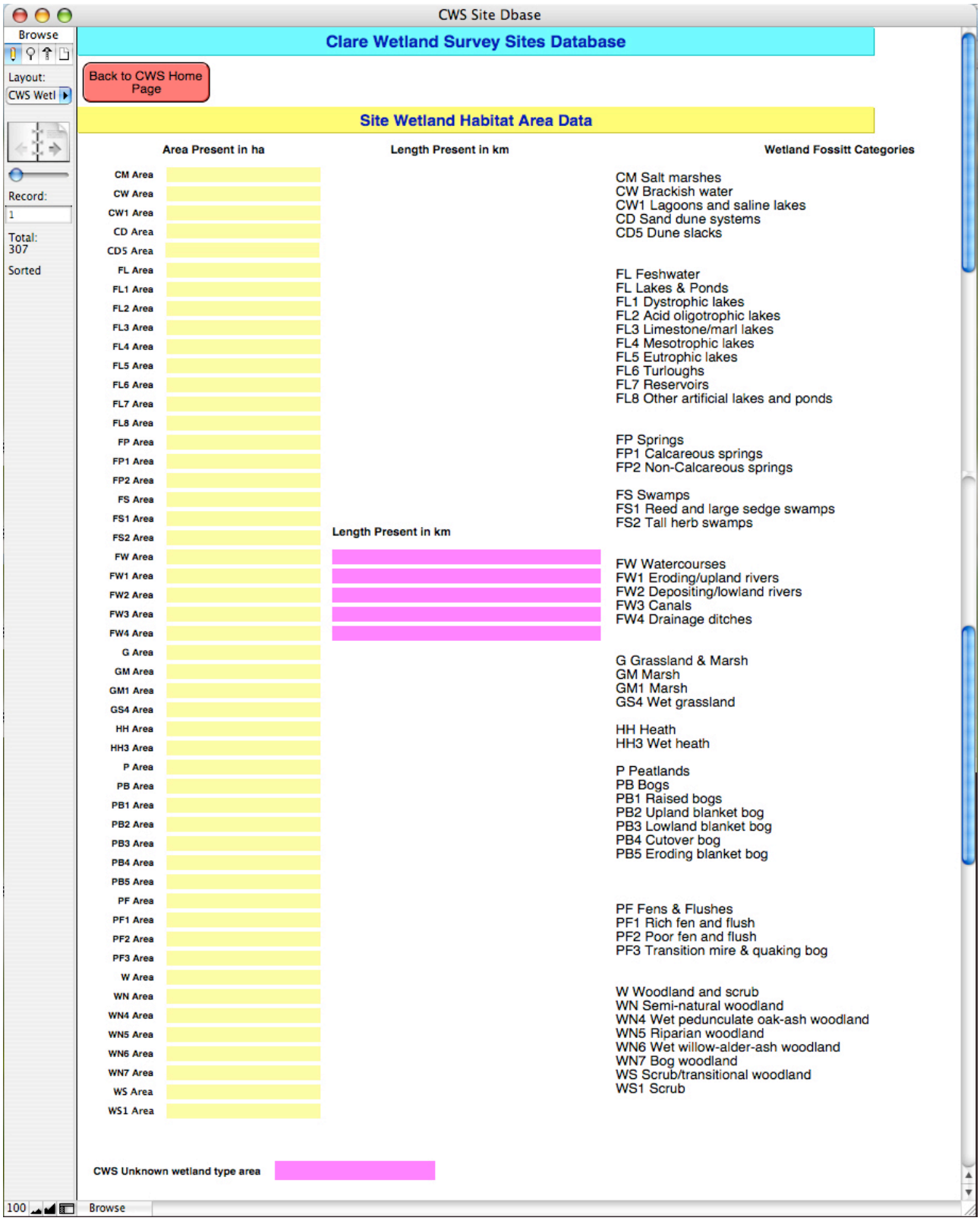
Main Data Entry Layout – CWS Site Database



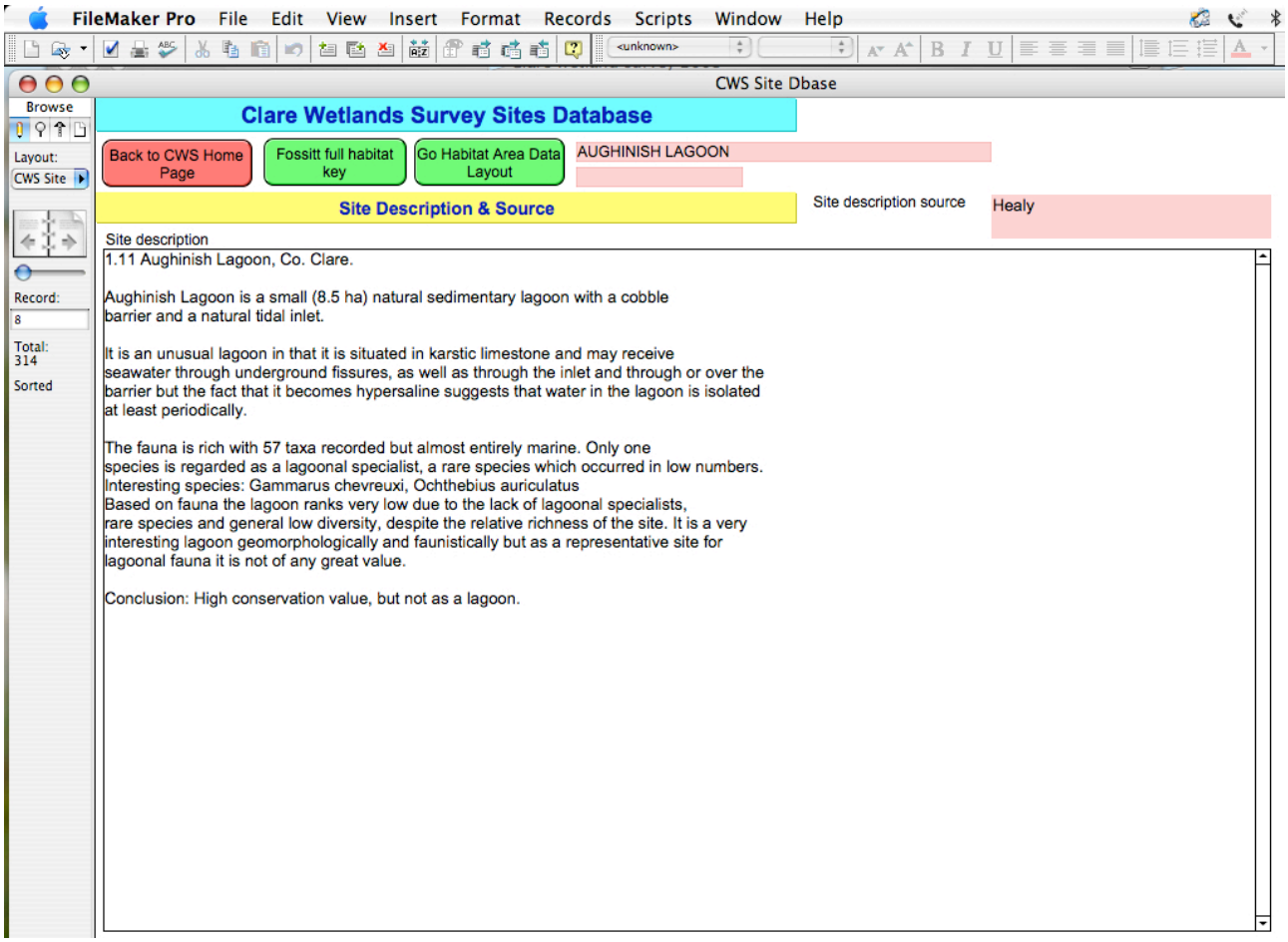
Habitat , Species & Threats Layout – CWS Site Database



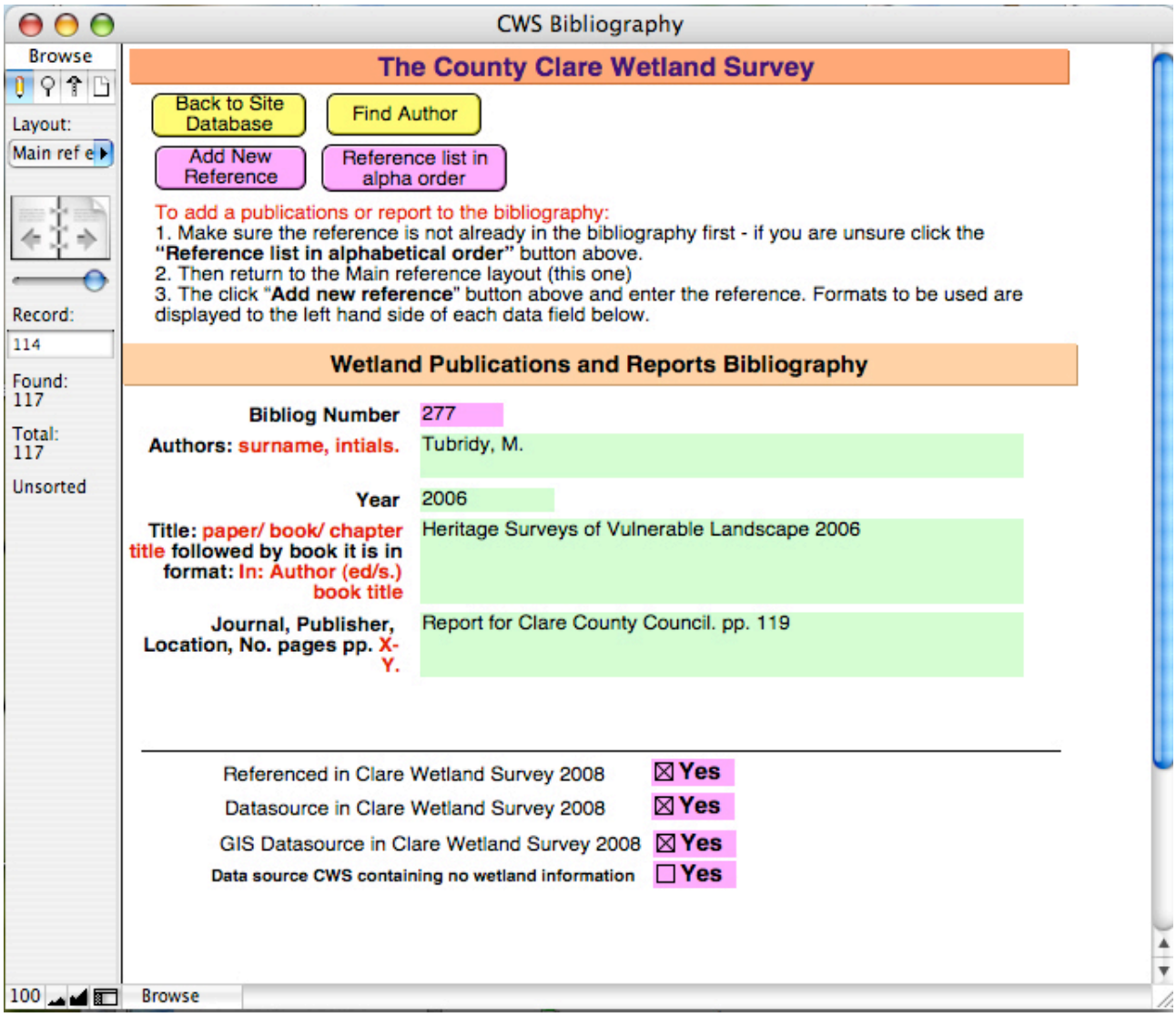
Habitat Area Layout – CWS Site Database



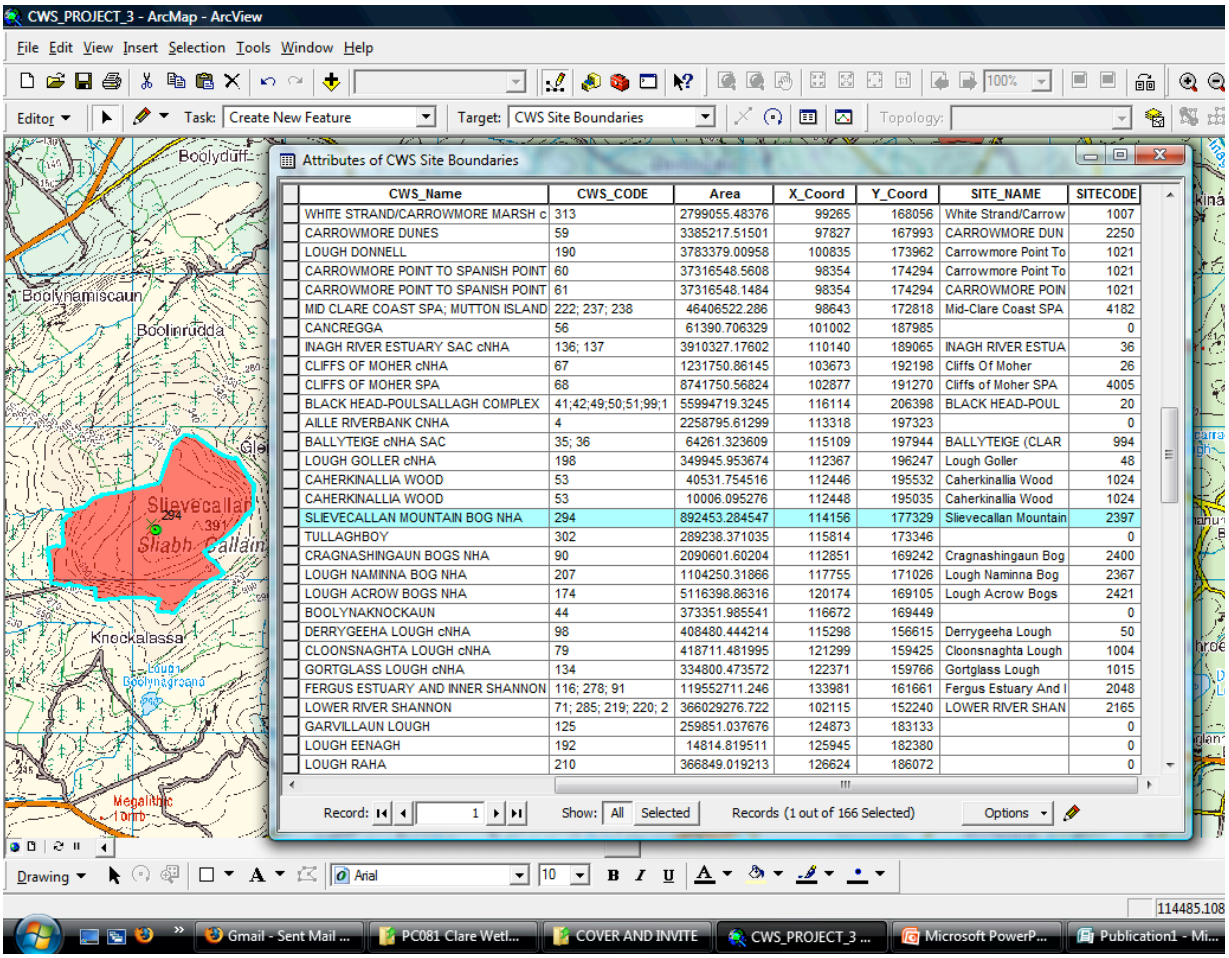
Site Description Layout – CWS Site Database



Bibliography Layout – CWS Bibliography Database



Attributes Layout – CWS GIS Database



CWS_Name	CWS_CODE	Area	X_Coord	Y_Coord	SITE_NAME	SITECODE
WHITE STRAND/CARROWMORE MARSH c	313	2799055.48376	99265	168056	White Strand/Carrow	1007
CARROWMORE DUNES	59	3385217.51501	97827	167993	CARROWMORE DUN	2250
LOUGH DONNELL	190	3783379.00958	100835	173962	Carrowmore Point To	1021
CARROWMORE POINT TO SPANISH POINT	60	37316548.5608	98354	174294	Carrowmore Point To	1021
CARROWMORE POINT TO SPANISH POINT	61	37316548.1484	98354	174294	CARROWMORE POIN	1021
MID CLARE COAST SPA; MUTTON ISLAND	222; 237; 238	46406522.286	98643	172818	Mid-Clare Coast SPA	4182
CANCREGGA	56	61390.706329	101002	187985		0
INAGH RIVER ESTUARY SAC cNHA	136; 137	3910327.17602	110140	189065	INAGH RIVER ESTUA	36
CLIFFS OF MOHER cNHA	67	1231750.86145	103673	192198	Cliffs Of Moher	26
CLIFFS OF MOHER SPA	68	8741750.56824	102877	191270	Cliffs of Moher SPA	4005
BLACK HEAD-POULSALLAGH COMPLEX	41;42;49;50;51;99;1	55994719.3245	116114	206398	BLACK HEAD-POUL	20
AILLE RIVERBANK CNHA	4	2258795.61299	113318	197323		0
BALLYTEIGE cNHA SAC	35; 36	64261.323609	115109	197944	BALLYTEIGE (CLAR	994
LOUGH GOLLER cNHA	198	349945.953674	112367	196247	Lough Goller	48
CAHERKINALLIA WOOD	53	40531.754516	112446	195532	Caherkinallia Wood	1024
CAHERKINALLIA WOOD	53	10006.095276	112448	195035	Caherkinallia Wood	1024
SLIEVECALLAN MOUNTAIN BOG NHA	294	892453.284547	114156	177329	Slievecallan Mountain	2397
TULLAGHBOY	302	289238.371035	115814	173346		0
CRAGNASHINGAUN BOGS NHA	90	2090601.60204	112851	169242	Cragnashingaun Bog	2400
LOUGH NAMINNA BOG NHA	207	1104250.31866	117755	171026	Lough Naminna Bog	2367
LOUGH ACROW BOGS NHA	174	5116398.86316	120174	169105	Lough Acrow Bogs	2421
BOOLYNAKNOCKAUN	44	373351.985541	116672	169449		0
DERRYGEEHA LOUGH cNHA	98	408480.444214	115298	156615	Derrygeeha Lough	50
CLOONSNAGHTA LOUGH cNHA	79	418711.481995	121299	159425	Cloonsnaghta Lough	1004
GORTGLASS LOUGH cNHA	134	334800.473572	122371	159766	Gortglass Lough	1015
FERGUS ESTUARY AND INNER SHANNON	116; 278; 91	119552711.246	133981	161661	Fergus Estuary And I	2048
LOWER RIVER SHANNON	71; 285; 219; 220; 2	366029276.722	102115	152240	LOWER RIVER SHAN	2165
GARVILLAUN LOUGH	125	259851.037676	124873	183133		0
LOUGH EENAGH	192	14814.819511	125945	182380		0
LOUGH RAHA	210	366849.019213	126624	186072		0

Appendix 6: CWS habitat classification scheme used for wetlands

Within the context of 2008 county Clare Wetlands Survey the following wetland habitat types as defined by the Guide to Habitats published by the Heritage Council (Fossitt 2000) were mapped and recorded when they occurred and could be identified within sites in the county (see Appendix 6a).

This Appendix also includes a description of each of these wetland habitat types, reproduced from Fossitt 2000 (see Appendix 6b).

Appendix 6a. The County Clare Wetlands Survey Wetland Habitat Types recorded and their relationship to the EU Habitats Directive.

Adapted from Fossitt (2000). *level 3 = 34 habitat types; of which 8 are priority*

Fossitt Classification Level	Fossitt Category Code and Name	EU Habitats Directive Annex 1 habitats & Natura 2000 Code	EU Habitats Directive Status
Level 1	C Coastland		
Level 2	CW Brackish water		
Level 3	CW1 Lagoons and saline lakes	*Coastal lagoons (1150)	**Priority Habitat**
Level 2	CD Sand dune systems		
Level 3	CD5 Dune Slacks	Dunes with Salix repens ssp. argentea (Salicion arenariae) (2170); Humid dune slacks (2190)	Annex 1 Habitat
Level 1	F Freshwater		
Level 2	FL Lakes & Ponds		
Level 3	FL1 Dystrophic lakes	Natural dystrophic lakes and ponds (3160)	Annex 1 Habitat
Level 3	FL2 Acid oligotrophic lakes	Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae) (3110); Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Iso`to-Nanojuncetea (3130)	Annex 1 Habitat
Level 3	FL3 Limestone/marl lakes	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. (3140)	
Level 3	FL4 Mesotrophic lakes		
Level 3	FL5 Eutrophic lakes	Natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation (3150)	Annex 1 Habitat
Level 3	FL6 Turloughs	Turloughs (3180)	**Priority Habitat**
Level 3	FL7 Reservoirs		
Level 3	FL8 Other artificial lakes and ponds		
Level 2	FP Springs		
Level 3	FP1 Calcareous springs	Petrifying springs with tufa formation (Cratoneurion) (7220)	**Priority Habitat**
Level 3	FP2 Non-Calcareous springs		
Level 2	FS Swamps		
Level 3	FS1 Reed and large sedge swamps		
Level 3	FS2 Tall herb swamps	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (6430)	Annex 1 Habitat

Fossitt Classification Level	Fossitt Category Code and Name	EU Habitats Directive Annex 1 habitats & Natura 2000 Code	EU Habitats Directive Status
Level 2	FW Watercourses		
Level 3	FW1 Eroding/upland rivers	Watercourses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation (3260)	Annex 1 Habitat
Level 3	FW2 Depositing/lowland rivers	Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation (3270)	Annex 1 Habitat
Level 3	FW3 Canals		
Level 3	FW4 Drainage ditches		
Level 1	G Grassland & Marsh		
Level 2	GM Freshwater Marsh		
Level 3	GM1 Marsh	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (6430)	Annex 1 Habitat
Level 2	GS Semi-natural grassland		
Level 3	GS4 Wet grassland	Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) (6410)	Annex 1 Habitat
Level 1	H Heath & Dense Bracken		
Level 2	HH Heath		
Level 3	HH3 Wet heath	Northern Atlantic wet heaths with Erica tetralix (4010)	Annex 1 Habitat
Level 1	P Peatlands		
Level 2	PB Bogs		
Level 3	PB1 Raised bogs	Active raised bogs (7110); Degraded raised bogs still capable of natural regeneration (7120); Depressions on peat substrates of the Rhynchosporion (7150)	**Priority Habitat**
Level 3	PB2 Upland blanket bog	Blanket bog (*if active bog) (7130)	**Priority Habitat**
Level 3	PB3 Lowland blanket bog	Blanket bog (*if active bog) (7130); Depressions on peat substrates of the Rhynchosporion (7150)	**Priority Habitat**; Annex 1 Habitat
Level 3	PB4 Cutover bog	Depressions on peat substrates of the Rhynchosporion (7150)	Annex 1 Habitat
Level 3	PB5 Eroding blanket bog		
Level 2	PF Fens & Flushes		

Fossitt Classification Level	Fossitt Category Code and Name	EU Habitats Directive Annex 1 habitats & Natura 2000 Code	EU Habitats Directive Status
Level 3	PF1 Rich fen and flush	Calcareous fens with Cladium mariscus and species of the Caricion davallianae (7210) - Priority habitat; Alkaline fens (7230)	**Priority Habitat**
Level 3	PF2 Poor fen and flush		
Level 3	PF3 Transition mire & quaking bog	Transition mires and quaking bogs (7140)	Annex 1 Habitat
Level 1	W Woodland and scrub		
Level 2	WN Semi-natural woodland		
Level 3	WN4 Wet pedunculate oak-ash woodland	Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-padion, Alnion incanae, Salicion albae) (91E0)	**Priority Habitat**
Level 3	WN5 Riparian woodland		
Level 3	WN6 Wet willow-alder-ash woodland		
Level 3	WN7 Bog woodland	Bog woodland (91D0)	**Priority Habitat**
Level 2	WS Scrub/transitional woodland		
Level 3	WS1 Scrub	Juniperus communis formations on heaths or calcareous grasslands (5130)	Annex 1 Habitat
N/A	CWS Unknown wetland type		

Appendix 6b: Freshwater habitat types descriptions

In the case of each wetland type the relevant level 1, 2 and 3 Fossitt habitat type code and descriptive information for the wetland habitats is presented.

C Coastland

This section includes habitats of the coast that are either above the level of high tides but have a strong marine influence, or those in the littoral (*intertidal*) zone that are dominated by terrestrial vascular plant communities. Vegetated strandlines are an exception as they are considered as part of the seashore under littoral sediment in the marine littoral section. Brackish water systems are included here.

CW Brackish Waters

CW1 Lagoons and saline lakes

This category includes all enclosed bodies of standing brackish water that are wholly or partially separated from the sea by banks of sand, shingle or rock, or by land barriers of rock or peat. Tidal influence is much reduced by these physical barriers or is totally absent. Water levels in lagoons generally undergo seasonal fluctuations (high in winter and low in summer) unless strictly controlled by pumping. Strong water currents are absent and this is a key feature which distinguishes lagoons from other marine water bodies. Salinity is highly variable both within and between different lagoonal systems. It fluctuates on a daily and seasonal basis, depending on tides and inputs of freshwater and, in some situations, may exhibit the full range from sea water to freshwater conditions. In addition to typical sedimentary lagoons, this category also includes brackish waters that have become impounded behind artificial barriers (usually as a result of construction), coastal lakes with natural outlets to the sea that experience some tidal exchange at high tide or during storm conditions, and other lakes that are isolated from the sea but which are slightly saline as a result of percolation of sea water or inputs from salt spray and storm waves or surges. The latter are mainly associated with fixed **dunes - CD3** and **machair - CD6.**

For a body of water to be classified as a lagoon or saline lake, there should be detectable salinity in the water (>1‰) and, if there are fluctuations in water levels associated with tides, these are always much less than in nearby marine areas. Communities of submerged aquatic plants are characteristic. Tasselweeds (*Ruppia* spp.) are usually present and occur together with marine algae at high salinities, and with Fennel Pondweed (*Potamogeton pectinatus*), Brackish Water-crowfoot (*Ranunculus baudotii*) and Spiked Water-milfoil (*Myriophyllum spicatum*) at low salinities. Green algae (*Enteromorpha spp., Cladophora spp., Chaetomorpha linum*) are common. Horned Wrack (*Fucus ceranoides*), and dense beds of eelgrasses (*Zostera* spp.) and stoneworts (including the lagoonal specialists, *Chara canescens* and *Lamprothamnion papulosum*) may also be present. A faunal community of brackish water species, some of which are lagoonal specialists, is joined or replaced by marine species at high salinity, and by insects, especially beetles and water bugs, at low salinity. Fringing salt marshes (most likely **upper salt marsh - CM2**) and **reed and large sedge swamps - FS1** may be present and should be recorded as separate habitats.

Links with Annex I: Corresponds to the priority habitat, '*coastal lagoons (1150)'.

CD Sand Dune Systems

CD5 Dune slacks

Dune slacks are nutrient-enriched wet areas that occur in hollows or depressions either behind or between dune ridges, or in blow-outs in the sand dunes. The water table is either at, or close to the surface for much of the year and dune slacks may or may not dry out in summer. Vegetation typically comprises Creeping Willow (*Salix repens*), Creeping Bent (*Agrostis stolonifera*), Common Reed

(*Phragmites australis*), sedges (*Carex* spp.), rushes (*Juncus effusus, J. maritimus*) and broadleaved wetland herbs such as Common Marsh-bedstraw (*Galium palustre*), Water Mint (*Mentha aquatica*), Silverweed (*Potentilla anserina*) and Bog Pimpernel (*Anagallis tenella*). Orchids such as *Dactylorhiza incarnata*, *Gymnadenia conopsea* and *Epipactis palustris* are common. Dune slacks that remain permanently wet are characterised by Mare's-tail (*Hippuris vulgaris*) and Water Horsetail (*Equisetum fluviatile*). Note that open bodies of standing brackish water should be considered under **lagoons and saline lakes - CW1.**

Links with Annex I: This category corresponds to the annexed habitat, 'humid dune slacks (2190)'; those with Creeping Willow (*Salix repens*) may also fit in a second annexed category, 'dunes with Salix repens ssp. argentea (*Salicion arenariae*) (2170)'.

F Freshwater

This section includes all bodies of freshwater that may be either natural, modified or entirely artificial, and that are either permanent or seasonal. Areas of land that flood temporarily in winter or during very wet periods are excluded if there is no differentiation or evidence of a shoreline or draw-down zone, and if there are no aquatic plants. Springs that are maintained by a more or less continual supply of moving water are included in this section, as are swamps. Swamps are an integral part of many freshwater bodies but may also occur in brackish waters and tidal situations. Note, however, that apart from swamps, all other brackish water and tidal habitats are excluded.

FL Lakes and Ponds

Lakes and ponds include all bodies of open or standing freshwater that lack a strong unidirectional flow of water. These can be either natural, modified or entirely artificial, as in the case of some reservoirs, ornamental lakes, or flooded quarries and gravel pits, and may be either temporary or seasonal as in the case of turloughs and some ponds. Artificial linear water bodies with no obvious connection to a wider drainage network are also included here. To distinguish a lake from a wide stretch of river, most of the water in the former should be either standing, moving imperceptibly or circulating within the basin, as opposed to moving with a strong unidirectional flow. Note that no distinction is made between lakes and ponds.

Only the area of open water, with or without floating or submerged aquatic vegetation, is included here. This is taken as the area normally occupied by a water body in situations where water levels fluctuate, or as the normal limit of flooding in the case of seasonal or temporary lakes and ponds. Swamps (FS1-2), which may include floating mats or surface scraws of vegetation, and any other peripheral wetland habitats, are excluded. Note that some tall reeds die back in winter and have a late but vigorous growing season; their full extent may not be evident before about mid-May. Any fish farming operations should be categorised separately under **fish cages and rafts - CC2.**

The classification of most open water bodies is largely based on the trophic, or nutrient status of the water. The concentrations of phosphorus and phytoplankton, which require measurements in the laboratory, have well defined categories to recognise oligotrophic, mesotrophic and eutrophic water bodies. Because the present classification is based on vegetation and not actual values of water quality parameters, this approach is only loosely applied here. **Turloughs - FL6, reservoirs - FL7 and other artificial lakes and ponds - FL8** are considered separately but may also differ in terms of their trophic status.

FL1 Dystrophic lakes

This category includes lakes and ponds that are highly acidic (pH 3.5-5.5), base-poor and low in nutrients, and where the water is brown in colour owing to inputs of humic and other acids from peat. They are usually associated with blanket bogs, mainly the lowland type, and are characterised by peaty rather than rocky margins and substrata. The transition from bog to open water is often abrupt. Among the aquatic plants that colonise these lakes are bladderworts (*Utricularia* spp.), pondweeds (*Potamogeton natans, P. polygonifolius*) and Bogbean (*Menyanthes trifoliata*). Aquatic Sphagnum mosses such as S. auriculatum and S. cuspidatum may also be present.

Links with Annex I: Corresponds to the annexed habitat, 'natural dystrophic lakes and ponds (3160)'.

FL2 Acid oligotrophic lakes

This category includes lakes and ponds that are low in nutrients, base-poor and acidic; those that are oligotrophic and base-rich should be considered under limestone/marl lakes - FL3. Most acid oligotrophic lakes are associated with areas of acidic bedrock and many have rocky margins. The substratum in shallow water is either rock, organic lake sediment, or coarse mineral material (sand and gravel). Water is often brownish in colour as a result of inputs from peaty soils or bogs in the catchments. These lakes support communities of submerged and floating aquatic plants. Small submerged aquatics such as Shoreweed (*Littorella uniflora*), Water Lobelia (*Lobelia dortmanna*) and Bulbous Rush (*Juncus bulbosus*) occur in shallow water. Quillworts (*Isoetes* spp.) may be abundant but are rarely visible as they colonise lake sediments in deep water. Floating aquatics include Bog Pondweed (*Potamogeton polygonifolius*), Alternate Water-milfoil (*Myriophyllum alterniflorum*) and Floating Club-rush (*Eleogiton fluitans*). Fringing emergent vegetation may include open stands of Common Reed (*Phragmites australis*); if extensive, reed beds should be considered under reed and large sedge swamps - FS1.

Links with Annex I: Acid oligotrophic lakes correspond to two annexed habitats, 'oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) (3110)' and 'oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoto-Nanojuncetea (3130)'.

FL3 Limestone/marl lakes

This category includes lakes and ponds of limestone areas (other than **turloughs - FL6**) that are base-rich and poor to moderately rich in nutrients (oligotrophic to mesotrophic). The water is typically clear and the lake sediment usually has a high proportion of marl, a white clayey precipitate of calcium carbonate. Marl-forming stoneworts (*Chara* spp.) are often abundant and may form dense carpets in unpolluted waters. Various-leaved Pondweed (*Potamogeton gramineus*) is also characteristic. These lakes are frequently fringed by **rich fen and flush - PF1 vegetation.**

Links with Annex I: Corresponds to the annexed habitat, 'hard oligo-mesotrophic waters with benthic vegetation of Chara spp. (3140)'.

FL4 Mesotrophic lakes

This category includes lakes and ponds that are moderately rich in nutrients, and where the water is sometimes discoloured by algae. Characteristic aquatic plants include White Water-lily (*Nymphaea alba*), Yellow Water-lily (*Nuphar lutea*), and a large number of pondweeds (*Potamogeton gramineus, P. obtusifolius, P. perfoliatus*). Stoneworts (*Chara* spp.) may also be present. The fringing and aquatic plant communities are typically more lush than those associated with oligotrophic lakes.

FL5 Eutrophic lakes

This category includes lakes and ponds that are high in nutrients and base-rich and where the water is usually discoloured or turbid, often grey to green in colour, from the abundant algae and suspended matter. Some water bodies are naturally eutrophic but most Irish lakes are eutrophic as a result of enrichment and high levels of nutrients entering the water. This category can also include hypertrophic or highly-enriched (polluted) waters. Characteristic aquatic plants of eutrophic lakes and ponds include duckweeds (*Lemna* spp.), pondweeds (*Potamogeton pectinatus, P. crispus*) and Spiked Water-milfoil (*Myriophyllum spicatum*). Submerged aquatics are usually rare or are restricted to shallow waters owing to poor light penetration. Reed beds on sheltered shores and dense stands of fringing vegetation are characteristic of eutrophic lakes and ponds; if reed beds are extensive they should be considered under reed and **large sedge swamps - FS1.**

Links with Annex I: Only those lakes that are naturally eutrophic are recognised as the annexed habitat, 'natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation (3150)'.

FL6 Turloughs

Turloughs are ephemeral lakes that occupy basins or depressions in limestone areas, and where water levels fluctuate markedly during the year. They are virtually unique to Ireland and their greatest concentration is in counties Clare, Galway and Roscommon. The general pattern is to flood in winter and dry out in summer, but there may be other sporadic rises in response to high rainfall. Turloughs normally fill through underground passages and sinkholes but some also have inflowing rivers or streams. Some turlough basins retain standing water in channels, pools or small lakes when flooding subsides. All areas within the normal limit of flooding are considered as part of the turlough habitat. The presence of the distinctive dark moss, Cinclidotus fontinaloides, on stone walls or rocks can help to establish this level.

Soils of turlough basins can include marls, peat, clays or loams. Large boulders or exposures of bedrock may also be present.

Turloughs support a range of different plant communities that comprise a mixture of aquatic, amphibious and terrestrial species. Plant communities typically form a concentric pattern around the basin; the different zones reflect differences in the extent

and duration of flooding. Wet grassland usually dominates and characteristic species include Creeping Bent (*Agrostis stolonifera*), small sedges (particularly *Carex nigra* and *C. panicea*), Silverweed (*Potentilla anserina*), Meadowsweet (*Filipendula ulmaria*), Creeping Buttercup (*Ranunculus repens*), Marsh Pennywort (*Hydrocotyle vulgaris*) and Amphibious Bistort (*Polygonum amphibium*). Permanent pools, channels and lakes may also be present and may support Common Spike-rush (*Eleocharis palustris*), Water-plantain (*Alisma plantago-aquatica*), pondweeds (*Potamogeton* spp.), and tall reeds such as Common Club-rush (*Schoenoplectus lacustris*).

Links with Annex I: Corresponds to the priority habitat, '*turloughs (*3180*)'.

FL7 Reservoirs

This category incorporates all open water bodies that are used for the storage and supply of water. It includes natural lakes where water levels fluctuate significantly and unnaturally as a result of abstraction, in addition to modified lakes with dams or retaining walls or banks. Entirely artificial water bodies, some lined with concrete, that are used as reservoirs are also included here (See also other **artificial lakes and ponds - FL8**). Other lakes where there is evidence of water abstraction (pumps, pump houses or out flowing pipes) but where there are no indications of significant water level changes are not included here. Redshank (*Polygonum persicaria*) is often common along the draw-down zone of reservoirs in lowland areas

FL8 Other artificial lakes and ponds

This category should be used for artificial or ornamental bodies of standing water that may be found in parks, demesnes, gardens or golf courses. Flooded quarries, tailings ponds and water treatment plants (with open water) should also be included. The nutrient status of these artificial water bodies is variable and may be high as in the case of hypertrophic lakes in urban parks. Moats can also be included here if there is no obvious connection to a wider drainage network.

FW Watercourses

This section includes linear channels of freshwater that are primarily associated with drainage and the movement or transport of water on the land surface. Sections of watercourses that flow underground are not considered in this classification unless they feature as part of **non-marine caves - EU1**. Linear water bodies with no obvious links to a wider drainage network (some moats and ornamental water bodies) are excluded (See **other artificial lakes and ponds - FL8**). The main subdivision in this section is between watercourses that are primarily natural (rivers) and those that are primarily artificial (canals and drainage ditches). Rivers are divided into watercourses that are mainly eroding, as in the case of upland streams, and those that are mainly depositing, as in the case of lowland rivers. No distinction is made between streams and rivers.

Rivers differ from most artificial watercourses in that they have a strong unidirectional flow of water. They are dynamic systems where water levels and flow rates can fluctuate markedly. The entire channel is included as part of the river habitat, irrespective of water levels at the time of the survey. Natural watercourses may flood beyond the limits of their banks but note that floodplains are excluded. Tidal sections of rivers that are influenced by brackish waters should be considered under **tidal rivers - CW2**, while the freshwater tidal sections should be included under **depositing/lowland rivers - FW2**. Note that large fringing swamps or reed beds should be recorded separately (See **reed and large sedge swamps - FS1**). Any mid-channel islands should be noted and classified on the basis of the habitats present.

Links with Annex I: Clear unpolluted rivers can contain the annexed habitat, 'watercourses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation (3260)'. The annexed habitat, 'rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation (3270)' can occur in association with rivers but stands are typically small and fragmented in Ireland.

FW1 Eroding/upland rivers

This category includes natural watercourses, or sections of these, that are actively eroding, unstable and where there is little or no deposition of fine sediment. Eroding conditions are typically associated with the upland parts of river systems where gradients are often steep, and water flow is fast and turbulent. Rivers in spate are included. For some rivers on the seaward side of coastal mountains, particularly in the west of Ireland, eroding conditions persist to sea level because of comparatively steep gradients over short distances, and high rainfall. Small sections of other lowland rivers may also be eroding where there are waterfalls, rapids or weirs. The beds of eroding/upland rivers are characterised by exposed bedrock and loose rock. Pebbles, gravel and coarse sand may accumulate in places, but finer sediments are rarely deposited. These rivers vary in size but are usually smaller and shallower than **depositing/lowland rivers - FW2**. Small mountain streams that dry out periodically can be included if an obvious channel persists or wetland plants are present.

The unstable rocky channels of eroding/upland rivers usually support little vegetation cover. Submerged rocks and boulders may be colonised by aquatic mosses such as Fontinalis spp. and Racomitrium aciculare. Exposed rocks and wet shaded banks may also support extensive cover of lichens and liverworts. Higher plants are generally rare or absent except in places where fine sediments are trapped. Typical species include water-crowfoots (*Ranunculus penicillatus, R. aquatilis*), Alternate Water-milfoil (*Myriophyllum alterniflorum*) and the aquatic form of Bulbous Rush (*Juncus bulbosus*). Plant and animal communities of eroding/upland rivers are influenced by a range of factors including bedrock and substratum type, nutrient status, water force, water quality, shade and human impact. Habitat conditions also vary along different stretches of a river where there are riffles, runs, pools, waterfalls and backwaters.

FW2 Depositing/lowland rivers

This category includes watercourses, or sections of these, where fine sediments are deposited on the river bed. Depositing conditions are typical of lowland areas where gradients are low and water flow is slow and sluggish. These rivers vary in size but are usually larger and deeper than those above. In a natural state these rivers erode their banks and meander across floodplains. Because of this, most have been modified to some extent to control water flow, facilitate navigation or prevent flooding and erosion. Canalised or walled sections of rivers are included here, as are natural watercourses that have been dredged or deepened, and those with artificial earth banks. If channels have been excavated to divert water away from the main watercourse, these should be considered under **canals - FW3**. Tidal sections of rivers with brackish water influence are excluded (See **tidal rivers - CW2**). Rejuvenated sections of lowland rivers associated with rapids, waterfalls and weirs should be considered under eroding/upland rivers - FW1 if eroding conditions predominate.

Plant and animal communities are influenced by numerous factors including substratum type, water force, nutrient status, water quality, channel size, water depth, human impact, disturbance and shade. Within a river channel there may be deep pools, backwaters, banks or mid-channel bars of gravel, sand or mud, in addition to vegetated islands and fringing reedbeds. The substratum of depositing/lowland rivers comprises mainly fine alluvial or peaty sediments. Vegetation may include floating and submerged aquatics, with fringing emergents in shallow water or overgrowing the banks. Floating aquatics can include water-lilies (*Nuphar lutea, Nymphaea alba*), pondweeds (*Potamogeton* spp.), water-starworts (*Callitriche* spp.) and Unbranched Bur-reed (*Sparganium emersum*). Tall emergents such as Common Club-rush (*Schoenoplectus lacustris*), Common Reed (*Phragmites australis*) and Yellow Iris (*Iris pseudacorus*) may also be present. Large areas of fringing reedbed should be considered under **reed and large sedge swamps - FS1**.

FW3 Canals

Canals are artificial linear bodies of water that were originally constructed for the purpose of navigation. They typically lack strong currents and any significant channel or bank erosion. This means that canals tend to have closer affinities with ponds than rivers. Canals can normally be distinguished from drainage ditches - FW4 by a combination of width and function. Channels that have been excavated to divert water away from the main watercourse are included in this category but canalised sections of rivers are excluded (See **depositing/lowland rivers - FW2**). Locks that are used to control water levels are considered as part of the canal habitat, but note that any built stone structures, including bridges and banks that are faced with stone, are excluded (See **stone walls and other stonework - BL1**). All canals require management and maintenance to keep them open and operational. They are readily colonised by aquatic plants and frequently support floating, submerged or emergent vegetation. Typical aquatics include water-milfoils (*Myriophyllum* spp.), water-lilies (*Nuphar lutea, Nymphaea alba*), Amphibious Bistort (*Polygonum amphibium*), bur-reeds (*Sparganium* spp.) and duckweeds (*Lemna* spp.). Canals with standing water are included here even if they are overgrown with swamp-like vegetation. Disused dry canals are excluded and should be classified on the basis of habitats they now support.

FW4 Drainage ditches

This category includes linear water bodies or wet channels that are entirely artificial in origin, and some sections of natural watercourses that have been excavated or modified to enhance drainage and control the flow of water. Drainage ditches are generally not used for navigation and are typically narrower than canals - FW3, but there may be exceptions. To be included here, drainage ditches should either contain water (flowing or stagnant) or be wet enough to support wetland vegetation. Dry ditches that lack wetland plants are not included. As with canals - FW3, drainage ditches must be maintained and cleared in order to keep them open. Those that are overgrown with vegetation are likely to be cleared intermittently. Note that water levels are also likely to undergo seasonal fluctuations. Drainage ditches may be intimately associated with hedgerows and should be recorded as a separate habitat if they meet the criteria outlined above.

FP Springs

Springs are usually very small local features that are maintained by a more or less continual supply of water from upwelling groundwater sources, or along seepage zones. They occur in upland and lowland areas and may be associated with a variety of different habitat groups such as woodland, heath, grassland or exposed rock. Springs are characterised by abundant mosses and may or may not be peat-forming.

FP1 Calcareous springs

This category is used for springs that are irrigated and kept permanently moist by water that is calcareous and oligotrophic. These springs may be associated with shallow peaty or skeletal mineral soils. There may be some precipitation of marl, or tufa formation. Calcareous springs are typically dominated by mosses, and by Cratoneuron spp. in particular; Bryum pseudotriquetrum is also characteristic. Other common components of the vegetation include grasses (*Festuca rubra, Briza media*), sedges (*Carex dioica, C. pulicaris, C. flacca, C. nigra*), Common Butterwort (*Pinguicula vulgaris*) and Marsh Horsetail (*Equisetum palustre*). The relatively rare Yellow Saxifrage (*Saxifraga aizoides*) can occur in calcareous springs and is diagnostic of this habitat.

Links with Annex I: Calcareous springs with tufa formation are recognised as the priority habitat, '*petrifying springs with tufa formation (*Cratoneurion*) (7220)'.

FP2 Non-calcareous springs

This category is used for springs that are irrigated and kept permanently moist by acidic to neutral water that is base-poor and typically oligotrophic. They may be associated with skeletal mineral or peaty soils. Vegetation is typically dominated by mosses (*particularly Sphagnum auriculatum, Calliergon sarmentosum and Polytrichum commune*), grasses (*Agrostis spp., Deschampsia caespitosa, Nardus stricta*), Bulbous Rush (*Juncus bulbosus*), and wetland species such as Marsh Violet (*Viola palustris*), Lesser Spearwort (*Ranunculus flammula*) and Marsh Pennywort (*Hydrocotyle vulgaris*).

FS Swamps

Swamps are stands of emergent herbaceous vegetation that generally occupy a zone at the transition from open water to terrestrial habitats. Water levels may fluctuate but swamps typically remain wet with the water table above ground level for most of the year. They can be associated with freshwater or brackish systems, and the water may be stagnant, slow-moving or tidal. Swamps occur along the margins of rivers, lakes, canals, lagoons and estuaries, but may also occupy more extensive flooded areas or infilling basins. Some swamps occur as floating mats of vegetation.

FS1 Reed and large sedge swamps

This category includes species-poor stands of herbaceous vegetation that are dominated by reeds and other large grasses or large, tussock-forming sedges. Most reed and large sedge swamps are overwhelmingly dominated by one or a small number of species, as in the case of reedbeds. Stands of vegetation can range from very dense to open. Typical components include Common Reed (*Phragmites australis*), Common Club-rush (*Schoenoplectus lacustris*), Reed Sweet-grass (*Glyceria maxima*), Branched Bur-reed (*Sparganium erectum*), Reed Canary-grass (*Phalaris arundinacea*), Great Fen-sedge (*Cladium mariscus*), Greater Tussock-sedge (*Carex paniculata*), Bulrush (*Typha latifolia*) and Water Horsetail (*Equisetum fluviatile*). Stands of Sea Club-rush (*Bolboschoenus maritimus*) may also occur in brackish waters. Note that a number of the possible dominants have a late growing season and their full

extent may be difficult to determine before mid-May. Unlike tall-herb swamps - FS2 below, the broadleaved herb component is minor. Vegetation typically lacks stratification as there is little or no development of an understorey element. In some situations there may be a mixture of other species such as Common Marsh-bedstraw (*Galium palustre*), Water Mint (*Mentha aquatica*), forget-me-nots (*Myosotis* spp.), Bogbean (*Menyanthes trifoliata*), Marsh Cinquefoil (*Potentilla palustris*), Wild Angelica (*Angelica sylvestris*), Meadowsweet (*Filipendula ulmaria*) or Fool's Water-cress (*Apium nodiflorum*).

FS2 Tall-herb swamps

Tall-herb swamps are comparatively species-rich stands of herbaceous vegetation that occur in wet areas where the water table is above the ground surface for most of the year, or where water levels fluctuate regularly as in the case of tidal sections of rivers. Tall or robust broadleaved herbs dominate and common components include Lesser Water-parsnip (*Berula erecta*), Fool's Water-cress (*Apium nodiflorum*), Gipsywort (*Lycopus europaeus*), Brooklime (*Veronica beccabunga*), Hemlock Water-dropwort (*Oenanthe crocata*), Hemp-agrimony (*Eupatorium cannabinum*) and Water Forget-me-not (*Myosotis scorpioides*). These swamps may also support Yellow Iris (*Iris pseudacorus*), Water-plantain (*Alisma plantago-aquatica*) and Water Horsetail (*Equisetum fluviatile*), in addition to occasional reeds, large grasses (*Glyceria maxima, Festuca arundinacea*) and sedges. Cover of the latter should, at most, be patchy or dispersed; swamps that are dominated by reeds, and other large grasses or sedges should be considered under reed and large sedge swamps - FS1 above. Tall-herb swamps may have an understorey element with a range of smaller wetland plants.

Links with Annex I: Tall-herb swamps can include pockets of the annexed habitat 'hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (6430)'. In Ireland, however, stands of the latter are usually fragmented and poorly developed.

G Grassland and Marsh

This section includes habitats where the vegetation is either dominated by grasses, or is 'grassy' in appearance with abundant small sedges or rushes. Freshwater marshes are also considered here since they are difficult to distinguish, on floristic grounds, from some types of grassland.

There are few, if any, natural grasslands in Ireland, particularly in the lowlands, as most have been modified or managed to some degree by grazing, mowing, fertiliser application or drainage. In the absence of such management, most grasslands would revert to scrub, woodland or heath. The key distinction being made in this classification is between grasslands that are improved, defined here as species-poor and intensively managed grasslands, and those that are unimproved or semi-improved. Improved grassland is by far the most widespread type and makes up a large proportion of Ireland's productive farmland. Much of it is reseeded, fertilised or heavily grazed with the result that species diversity is low. It is of comparatively little conservation interest. Grass leys that are planted as part of an arable rotation are included in this section, as are areas of amenity grassland that are improved and managed specifically for recreation, amenity or sport, as opposed to agriculture. 'Semi-natural' grasslands may receive some inputs of fertiliser (organic or artificial), but they are not intensively managed and have not recently been reseeded. Low levels of improvement and high levels of grazing can influence sward composition, reduce species diversity and lead to increased representation of 'agricultural' herbs. These are listed below in the **improved agricultural grassland - GA1 category.**

Coastal grasslands, other than those of salt marshes (CM1-2) and sand dune systems (CD1-6), are included in this section. Grassland vegetation should be primarily herbaceous. If cover of dwarf shrubs exceeds 25%, the habitat should be considered under heath. If scattered trees are prominent in areas of grassland but canopy cover is less than 30%, the habitat should be recorded as **scattered trees and parkland - WD5.**

GS Semi-natural Grassland

GS4 Wet grassland

This type of grassland can be found on flat or sloping ground in upland and lowland areas. It occurs on wet or waterlogged mineral or organic soils that are poorly-drained or, in some cases, subjected to seasonal or periodic flooding. On sloping ground, wet grassland is mainly confined to clay-rich gleys and loams, or organic soils that are wet but not waterlogged. This category includes areas of poorly-drained farmland that have not recently been improved, seasonally-flooded alluvial grasslands such as the River Shannon callows, and wet grasslands of turlough basins (See also turloughs - FL6).

Species composition varies considerably. Wet grassland often contains abundant rushes (*Juncus effusus, J. acutiflorus, J. articulatus, J. inflexus*) and/or small sedges (*Carex flacca, C. hirta, C. ovalis*), in addition to grasses such as Yorkshire-fog (*Holcus lanatus*), Creeping Bent (*Agrostis stolonifera*), Marsh Foxtail (*Alopecurus geniculatus*), Rough Meadow-grass (*Poa trivialis*) and Tufted Hair-grass (*Deschampsia caespitosa*). Purple Moor-grass (*Molinia caerulea*) may also be present but should not dominate. The proportion of broadleaved herbs is often high; those that commonly occur in wet grassland include Creeping Buttercup (*Ranunculus repens*), Marsh Thistle (*Cirsium palustre*), Silverweed (*Potentilla anserina*), Meadowsweet (*Filipendula ulmaria*), Water Mint (*Mentha aquatica*), Common Marsh-bedstraw (*Galium palustre*), Devil's-bit Scabious (*Succisa pratensis*), Lesser Spearwort (*Ranunculus flammula*) and Cuckooflower (*Cardamine pratensis*). Other common broadleaved herbs that occur on drier grasslands may also be present, depending on the degree of wetness. Wet grassland may be important for orchids such as Spotted-orchid (*Dactylorhiza maculata*). Horsetails (*Equisetum* spp.), Yellow Iris (*Iris pseudacorus*), Floating Sweet-grass (*Glyceria fluitans*) and clumps of tall reeds may be locally abundant.

Wet grassland frequently grades into **marsh - GM1** and there are many similarities in the range of species present in both habitats. To be included in the wet grassland category, the cover of grasses should exceed 50%, except in areas where rushes or small sedges predominate, and the total cover of reeds, large sedges and broadleaved herbs should be less than 50%. Among the suite of broadleaved herbs that are present, there should be a significant proportion of drier grassland species in addition to those that are more commonly associated with wetlands.

Links with Annex I: Wet grassland may contain examples of the annexed habitat, 'Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) (6410)'.

GM Freshwater Marsh

Marsh GM1

Marsh is found on level ground near river banks, lakeshores, and in other places where mineral or shallow peaty soils are waterlogged, and where the water table is close to ground level for most of the year. Unlike swamps, standing water is not a characteristic feature except, perhaps, during very wet periods or in winter months. Marsh is comparatively species-rich and supports a high proportion of wetland species in addition to the typical dominants: rushes (*Juncus* spp.), sedges (*Carex* spp.) and Meadowsweet (*Filipendula ulmaria*). Grasses such as Creeping Bent (*Agrostis stolonifera*), Tall Fescue (*Festuca arundinacea*) and Purple Moor-grass (*Molinia caerulea*) may be present but not abundant. To be considered as marsh, the proportion of sedges and grasses should not exceed 50%. The broadleaved herb component may include Water Mint (*Mentha aquatica*), Marsh Thistle (*Cirsium palustre*), Wild Angelica (*Angelica sylvestris*), Marsh Pennywort (*Hydrocotyle vulgaris*), Marsh-marigold (*Caltha palustris*), Common Valerian (*Valeriana officinalis*), Ragged-robin (*Lychnis flos-cuculi*), Purple-loosestrife (*Lythrum salicaria*), Marsh Woundwort (*Stachys palustris*) and Marsh Cinquefoil (*Potentilla palustris*). Marsh may also support horsetails (*Equisetum* spp.), Yellow Iris (*Iris pseudacorus*), reeds and other large grasses and sedges but these should not dominate. Herbs that are characteristic of drier ground are rare or absent in marshes. Mosses, particularly Calliergon and Climacium spp., may be plentiful.

Marsh differs from swamps in that the vegetation is usually more species-rich, standing water is absent for much of the year, and reeds and other tall or bulky grasses and sedges, and tall herbs are not overwhelmingly dominant in the former. The distinction between marsh and **wet grassland - GS4** is less clear but, in marsh, wetland herbs should be prominent, and species of drier ground should generally be absent. If there is greater than 50% cover of grasses and sedges, the habitat should be considered under grassland or, if it is a peat-forming system, under fens and flushes. Marsh is not a peat-forming habitat.

Links with Annex I: Marsh may contain pockets of the annexed habitat, 'hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (6430)'.

H Heath & Dense Bracken

HH Heath

Heath includes areas where the vegetation is open and there is at least 25% cover of dwarf shrubs, or where mosses dominate in the case of some montane areas. If the underlying soil is peat, peat depths of less than 0.5 m are usually, but not always, indicative of heath. Trees and larger shrubs may be present but should not be abundant; low-growing Western Gorse (*Ulex gallii*) and Juniper (*Juniperus communis*) are exceptions as they may be components of heath. Note that any areas of heath on sand dunes should be considered under fixed dunes - CD3 in the coastland section; all other types of heath in coastal areas

are included here.

HH3 Wet heath

Vegetation with at least 25% cover of dwarf shrubs on peaty soils and shallow wet peats that typically have an average depth of 15-50 cm. Wet heath can occur in upland and lowland areas and is widespread on the lower slopes of hills and mountains that are either too dry or too steep for deep peat accumulation. It can grade into, or form intimate mosaics with **upland blanket bog - PB2**, **lowland blanket bog - PB3** or **dry siliceous heath - HH1** with minor changes in slope and topography. Wet heath is typically dominated by Ling (*Calluna vulgaris*) and Cross-leaved Heath (*Erica tetralix*), but can also be dominated by Purple Moor-grass (*Molinia caerulea*) and/or sedges. Other common species include Bell Heather (*Erica cinerea*), Crowberry (*Empetrum nigrum*), Deergrass (*Trichophorum caespitosum*), Heath Rush (*Juncus squarrosus*) and Green-ribbed Sedge (*Carex binervis*). Moss and lichen cover may be high in areas of undamaged wet heath. Typical mosses include Hylocomium splendens, Dicranum scoparium, Rhytidiadelphus loreus and Polytrichum commune. Sphagnum mosses (particularly *S. papillosum, S. subnitens and S. capillifolium*) may also be present.

Wet heath differs from dry siliceous heath - HH1 in that Cross-leaved Heath (*Erica tetralix*), Purple Moor-grass (*Molinia caerulea*) and Deergrass (*Trichophorum caespitosum*) are usually abundant in the former. Wet heath differs from **upland blanket bog - PB2** in that Heath Rush (*Juncus squarrosus*), Green-ribbed Sedge (*Carex binervis*) and mosses other than Sphagnum are usually present in the former. The absence of Black Bog-rush (*Schoenus nigricans*) distinguishes wet heath from **lowland blanket bog - PB3**. The depth of peat can also be used to differentiate these habitats, particularly when they occur in a degraded condition. Peat, or peaty soils, are either absent or very shallow (<15 cm) in the case of dry heath (siliceous or calcareous types), while peat depths in excess of 50 cm are usually, but not exclusively, indicative of blanket bogs.

Links with Annex I: Corresponds to the annexed habitat, 'northern Atlantic wet heaths with Erica tetralix (4010)'.

HH4 Montane heath

This category is used for vegetation with a substantial cover of dwarf shrubs and/or mosses that occurs at high altitudes on mountains and in other very exposed locations in the uplands or on the coast. Montane heath is usually associated with shallow mineral soils or peats that are eroding and unstable. It can also be found on areas of loose rock and coarse sediment on mountain tops and ridges. High rainfall and humidity mean that montane heath is kept very wet even if soils are free-draining or rocky. Vegetation is characterised by stunted and wind-contoured dwarf shrubs such as Crowberry (*Empetrum nigrum*), Ling (*Calluna vulgaris*) and Bearberry (*Arctostaphylos uva-ursi*) and/or prostrate shrubs such as Dwarf Willow (*Salix herbacea*) and Juniper (*Juniperus communis*). Montane heath may also be dominated by mosses. Other components of the vegetation can include low-growing grasses (*Deschampsia flexuosa, Festuca vivipara, F. ovina, Nardus stricta*), Heath Rush (*Juncus squarrosus*), Stiff Sedge (*Carex bigelowii*), Heath Bedstraw (*Galium saxatile*) and Sheep's Sorrel (*Rumex acetosella*), in addition to clubmosses (*Huperzia selago, Diphasiastrum alpinum*) and mosses (particularly *Racomitrium lanuginosum, Polytrichum alpinum and Dicranum fuscescens*). Montane heath may also have extensive and varied carpets of lichens. Vegetation cover is rarely complete but should exceed 50%. If the total area of exposed rock is greater than 50%, the habitat should be considered in the appropriate exposed rock category. Note that **eroding blanket bog - PB5** is treated as a separate category. Montane heath differs from other types of heath in terms of its wind-contoured and stunted growth form, and its species composition.

Links with Annex I: Corresponds to the annexed habitat, 'Alpine and Boreal heaths (*4060*)'.

P Peatland

Peatlands are subdivided into two main types, bogs and fens. Bogs are ombrotrophic (rain-fed) peatlands where almost all inputs of water to the system are derived from precipitation and where acid, oligotrophic peat deposits accumulate. Fens are minerotrophic peatlands that, in addition to precipitation, are fed by groundwater or moving surface waters. They have a higher nutrient status than bogs and can be either acid or base-rich. Flushes, which may or may not form peat, are included with fens as they support

similar vegetation communities. The category cutover bog - PB4 is mainly associated with bogs but should also be used in situations where peat has been extracted from fens. Any peatland areas that are dominated by trees or shrubs, including conifer plantations, are excluded.

Note that intertidal or subtidal peat deposits are not included in this section of the classification but should be considered under the littoral or sublittoral rock categories in the marine section or, in the case of salt marshes that have developed on intertidal peats, in the coastland section.

PB Bogs

This section includes ombrotrophic (rain-fed) bogs where acid, oligotrophic peat has accumulated in areas of impeded drainage and/or high rainfall and humidity. The two main types are raised bog and blanket bog. Blanket bog is further subdivided into upland and lowland (Atlantic) types and the boundary between the two is taken as 150m above sea level. However, this should be loosely applied as the distinction is also based on vegetation and other characteristics, including geographical location; lowland blanket bog in Ireland is confined to Atlantic seaboard counties.

Comparatively few raised bogs remain intact and in good condition in Ireland. A large proportion of the original raised bog resource has been damaged or destroyed by peat extraction, drainage and burning. The same is true of upland and lowland blanket bog where large expanses of the habitat resource have also been lost or degraded through overgrazing and afforestation. Damaged and degraded areas of bog are not distinguished as separate categories in this classification, except in the case of **cutover bog - PB4** and **eroding blanket bog - PB5**. Note that in relation to overgrazing, damage is considered severe if 5-10% of an area is bare or eroding, or very severe if this figure exceeds 10%. Peat depths can be used to differentiate blanket bog and heath in situations where the vegetation cover has been altered or removed (e.g. overgrazed or burnt). As a general rule, peat depths of greater than 0.5 m are indicative of blanket bog while those of less than 0.5 m are indicative of heath, but there are exceptions. Charred woody remains of dwarf shrubs provide evidence of recent fires. Any areas of bogs that have been planted with conifers should be classified as **conifer plantation - WD4.**

PB1 Raised bog

Raised bogs are accumulations of deep acid peat (3-12 m) that originated in shallow lake basins or topographic depressions. The name is derived from the elevated surface, or dome, that develops as raised bogs grow upwards from the surface; the domed effect is often exaggerated when the margins of a bog are damaged by turf cutting or drainage, and are drying out. Raised bogs are most abundant in the lowlands of central and mid-west Ireland. Exploitation has been extensive and no Irish raised bogs remain completely intact. Excavated face banks, whether active or inactive, are a common feature around the margins. Only the areas of high bog are included in this definition of the habitat, raised bog, and the condition of the high bog can range from very good to poor. Any areas where part of the bog has been removed should be considered under **cutover bog - PB4**. In a natural state, raised bogs are circled by a wetland fringe, known as the lagg zone, which is usually characterised by fen communities. In Ireland, most laggs have been lost through drainage and land reclamation; any remnants should be categorised separately on the basis of the habitats present.

The surface of a relatively intact raised bog is typically wet, acid and deficient in plant nutrients, and supports specialised plant communities that are low in overall diversity. The vegetation is open and Sphagnum mosses dominate the ground layer. Small-scale mosaics of plant communities are characteristic and reflect the complex microtopography of hummocks and hollows on the bog surface. Raised bogs are driest at the margins and wetness generally increases towards the centre of the peat mass where well-developed pool systems are most likely to occur. Dry areas and hummocks usually support Ling (*Calluna vulgaris*), Hare's-tail Cottongrass (*Eriophorum vaginatum*), Deergrass (*Trichophorum caespitosum*), Cross-leaved Heath (*Erica tetralix*), lichens (*Cladonia* spp.), and Sphagnum (*S. capillifolium, S. imbricatum, S. papillosum*) and other mosses (*Dicranum scoparium, Leucobryum glaucum*). Wet areas and pools are characterised by Common Cottongrass (*Eriophorum angustifolium*), White Beak-sedge (*Rhynchospora alba*), Bog Asphodel (*Narthecium ossifragum*), sundews (*Drosera* spp.), Bogbean (*Menyanthes trifoliata*), bladderworts (*Utricularia* spp.) and Sphagnum mosses (*S. cuspidatum, S. auriculatum*). Raised bogs may also contain soaks and flushed areas (*wet or dry*) where the supply of nutrients over time is increased through concentrated surface flows, or where there are links with groundwater or the underlying mineral substratum. Slight mineral enrichment enhances habitat and species diversity. Flushed areas can be recorded separately on the basis of the habitats present, or as an integral part of the raised bog habitat.

When damaged by peat extraction or drainage, the bog surface is relatively dry, pools are rare or absent, cover of Sphagnum is greatly reduced and Ling (*Calluna vulgaris*) increases in abundance. The

effect is normally greatest around the margins and wetness may increase towards the centre of the bog. Trees such as Downy Birch (*Betula pubescens*) and Scots Pine (*Pinus sylvestris*) frequently invade the drier cut margins, but may also occur in flushed areas.

Links with Annex I: Raised bogs correspond to the priority habitat, '*active raised bogs (7110)' if they are still capable of peat formation, or if peat formation has temporarily ceased. 'Degraded raised bogs still capable of natural regeneration (7120)' are also listed as an annexed habitat. These are damaged bogs where it is judged that the peat-forming capability can be restored within 30 years. The annexed habitat, 'depressions on peat substrates of the Rhynchosporion (7150)' occurs in pockets as a sub-habitat of raised bog.

PB2 Upland blanket bog

Upland blanket bog occurs on flat or gently sloping ground above 150 m and is widespread on hills and mountains throughout Ireland. The 150 m limit serves to distinguish upland from lowland blanket bog but is loosely applied. Peat depths vary and normally fall in the range of 1-2 m, but can be much deeper in pockets. Vegetation is typically dominated by Deergrass (*Trichophorum caespitosum*), cotton grasses (*Eriophorum* spp.) and dwarf shrubs such as Ling (*Calluna vulgaris*), Cross-leaved Heath (*Erica tetralix*) and Bilberry (*Vaccinium myrtillus*). Purple Moor-grass (*Molinia caerulea*) and Crowberry (*Empetrum nigrum*) may be locally abundant. Cover of Sphagnum mosses is usually high in areas of undamaged bog. Upland blanket bog can be extremely wet where it occurs on level terrain and may have surface drainage features that are typical of **lowland blanket bog - PB3**, but without any abundance of Black Bog-rush (*Schoenus nigricans*). Upland blanket bog may be difficult to distinguish from **wet heath - HH3** as a number of key species are common to both habitats. They may also grade from one to the other, or form intimate mosaics with changes in slope or topography. Peat depths in excess of 0.5 m are usually indicative of blanket bog. Heath Rush (*Juncus squarrosus*) and Green-ribbed Sedge (*Carex binervis*) may occur in **wet heath - HH3** but not in upland blanket bog.

Only the area of uncut bog should be included here; **cutover bog - PB4** is considered as a separate habitat. The uncut bog may include areas that are severely damaged or degraded from overgrazing. Levels of damage are not assessed in this classification. Note, however, that damage is considered severe if over 5% of an area of bog is bare or eroding. Areas of bog that are heavily eroded (below the rooting zone of plants) should be considered under **eroding blanket bog - PB5.**

Links with Annex I: Blanket bogs that are still capable of peat formation correspond to the priority habitat, 'blanket bogs (*if active bog) (7130)'. The annexed habitat, 'depressions on peat substrates of the Rhynchosporion (7150)' occurs in pockets as a sub-habitat of blanket bog.

PB3 Lowland blanket bog

Lowland blanket bog, also known as Atlantic or oceanic blanket bog, is more restricted in its distribution than the upland type and is largely confined to wetter regions along the western seaboard where the annual rainfall exceeds 1250 mm. Described as a climatic peat type, it occurs on flat or gently sloping ground below 150 m. Peat depths vary considerably (1.5-7 m) depending on the underlying topography, and are usually intermediate between those of **raised bog - PB1** and upland **blanket bog - PB2**. The vegetation of lowland blanket bog is typically 'grassy' in appearance and is characterised by abundant Black Bog-rush (*Schoenus nigricans*), Purple Moor-grass (*Molinia caerulea*), cotton grasses (*Eriophorum* spp.), Deergrass (*Trichophorum caespitosum*) and White Beak-sedge (*Rhynchospora alba*). Heathers (*Calluna vulgaris, Erica* spp.) are common but cover is generally less extensive than in **upland blanket bog - PB2**. Cover of dwarf shrubs is reduced in areas that are overgrazed. Broadleaved herbs can include sundews (*Drosera* spp.), Heath Milkwort (*Polygala serpyllifolia*), Lousewort (*Pedicularis sylvatica*) and Pale Butterwort (*Pinguicula lusitanica*). Bog-myrtle (*Myrica gale*) may be locally abundant. Sphagnum mosses and mucilagenous algae, collectively known as Zygogonium ericetorum, may also be present; the latter increases in abundance in overgrazed areas where Sphagnum mosses are rare or absent. Wet areas of intact lowland blanket bog are characterised by a variety of surface drainage features which may include scattered pools and channels, small peat-basin lakes, streams, peat gullies and swallow holes that lead to underground drainage systems. Many of these support aquatic plants such as bladderworts (*Utricularia* spp.), Water Lobelia (*Lobelia dortmanna*) and, locally, Pipewort (*Eriocaulon aquaticum*). Lowland blanket bog may form intimate mosaics with areas of **wet heath - HH3** and dry **siliceous heath - HH1.**

As is the case with upland blanket bog, only the areas of uncut bog are included in this category; where part of the bog has been removed through turf cutting or any other form of peat extraction, this should be recorded as **cutover bog - PB4**. Areas of bog that are eroding should be considered under **eroding blanket bog - PB5.**

Links with Annex I: As for upland **blanket bog - PB2** above.

PB4 Cutover bog

This category should be used in situations where part of the original mass of peat has been removed through turf cutting or other forms of peat extraction. Areas of high bog that have been exploited using Difco cutters, or 'sausage' machines, are included only if the surface vegetation has been removed. Cutover can be associated with all peat-forming systems, including fens and some areas of **wet heath - HH3**. Turf cutting activity is characterised by vertical face banks or rectangular peat ramparts where the cutover section is at a distinctly lower level than the uncut high bog. These banks vary in height, depending in part on the depth of peat, and remain in evidence for a long time after turf cutting ceases. Old turf banks may be overgrown with vegetation. Cutover bog occurs on a much larger scale in the case of industrial or commercial peatlands where peat is harvested mechanically (sod, milled or moss peat production). Areas of bog that are actively being worked are included in this category, as are areas of abandoned or exhausted cutover.

Cutover bog is a variable habitat, or complex of habitats, that can include mosaics of bare peat and revegetated areas with woodland, scrub, heath, fen and flush or grassland communities. The nature of the recolonising vegetation depends on numerous factors including the frequency and extent of disturbance, hydrology, the depth of peat remaining, and the nature of the peat and the underlying substratum. Standing water is usually present in drains, pools or excavated hollows. Some large areas of cutover bog have been reclaimed as farmland or planted with trees, particularly conifers. If the regenerating habitats of cutover bog cover a sizeable area and can easily be fitted elsewhere in the classification, this should be done. The full extent of the cutover may be difficult to establish as it frequently grades into other marginal habitats or farmland.

Links with Annex I: The annexed habitat, 'depressions on peat substrates of the Rhynchosporion (7150)' can occur in pockets on cutover bog, mostly in association with areas of cutover raised bog.

PB5 Eroding blanket bog

This category should be used in situations where part of the original peat mass has been lost through erosion, as opposed to extraction (See **cutover bog - PB4**), and where sizeable areas of bare peat are exposed. Eroding blanket bog is most commonly associated with upland areas, and mountain peaks and ridges in particular. Causes are numerous; some erosion may have occurred as a natural process but, over the last two decades, overgrazing by livestock (particularly sheep) has been a major contributory factor. Eroding blanket bog is often characterised by networks of channels and gullies that have cut down through the protective layer of vegetation to expose the underlying peat. As erosion continues, these channels widen, deepen and coalesce until eventually the rocky substratum is reached. Some small blocks of the original bog, known as peat haggs, may remain.

To be categorised as eroding blanket bog, a substantial proportion of the original bog surface should be missing and peat should have eroded below the rooting zone of the surface vegetation. In such situations, the process is likely to be irreversible, or recovery very slow, even if damaging activities cease. If erosion has occurred to such an extent that large areas of the rocky substratum are exposed, the habitat should be considered elsewhere in the classification. This also applies to formerly eroded areas where most of the peat has been removed but where the underlying mineral or peaty substratum has been extensively recolonised by vegetation. Peatlands damaged by bog bursts can be included here if sizeable areas of bare peat are exposed.

PF Fens and Flushes

Fens are peat-forming systems that differ from bogs in that they are fed by groundwater or moving surface waters. They occur in river valleys, poorly-drained basins or hollows, and beside open stretches of water (lake margins or river floodplains). Fens may also be associated with the fringes or other parts of acid bogs where there is enrichment of the water supply. Any areas of fen that have been modified by turf cutting should be considered under **cutover bog - PB4**. Flushes are usually smaller features that are maintained by the movement or seepage of water. They occur on slopes and may or may not be peat-forming. Some flushes feed into fens while others may be associated with a range of different habitat types including bogs, woodlands and grasslands. Flushes in bogs are usually characterised by changes in the vegetation that are brought about by an enhanced supply of nutrients. Note that springs are considered in the **freshwater section (FP1-2)**.

Fens and flushes are divided into 'rich' (basic) and 'poor' (acid) types depending on the origin and nature of the water supply. A third category, transition mire and **quaking bog - PF3**, is also distinguished because it has vegetation characteristics that are intermediate between rich and poor fen categories.

PF1 Rich fen and flush

Rich fens and flushes are fed by groundwater or flowing surface waters that are at least mildly base-rich or calcareous, and are usually found over areas of limestone bedrock. The substratum is waterlogged peat (except in the case of some flushes) and this usually has a high mineral content. Vegetation is typically dominated by Black Bog-rush (*Schoenus nigricans*) and/or small to medium sedges such as Carex viridula, C. nigra, C. dioica and C. panicea. Other prominent components of the vegetation include rushes, particularly Blunt-flowered Rush (*Juncus subnodulosus*), Purple Moor-grass (*Molinia caerulea*), Marsh Pennywort (*Hydrocotyle vulgaris*), Lesser Spearwort (*Ranunculus flammula*), Water Mint (*Mentha aquatica*), Common Marsh-bedstraw (*Galium palustre*), Grass-of-parnassus (*Parnassia palustris*), Common Butterwort (*Pinguicula vulgaris*) and Devil's-bit Scabious (*Succisa pratensis*). Rich fen and flush can be important for orchids such as Epipactis palustris and Dactylorhiza spp. A well-developed moss layer with Campylium stellatum, Scorpidium scorpioides and Drepanocladus revolvens is also characteristic. The tops of Black Bog-rush (*Schoenus nigricans*) tussocks are relatively dry and may support plants such as heathers (*Calluna vulgaris, Erica tetralix*), Tormentil (*Potentilla erecta*), Bog-myrtle (*Myrica gale*) and Bog Asphodel (*Narthecium ossifragum*).

Rich fens and flushes may have some patchy cover of Common Reed (*Phragmites australis*), Bulrush (*Typha latifolia*), or tussock-forming species such as Great Fen-sedge (*Cladium mariscus*) and Greater Tussock-sedge (*Carex paniculata*). If large areas are dominated by species-poor or monodominant stands of tall herbaceous plants, they should be considered under **reed and large sedge swamps - FS1**. Fens may contain patches of scrub or woodland, or bodies of open water with aquatics such as Bogbean (*Menyanthes trifoliata*). If the surface is quaking and very wet, and the vegetation comprises some species that may also be found in acid bogs, consider the category **transition mire and quaking bog - PF3.**

Links with Annex I: This category corresponds to two annexed habitats, 'alkaline fens (7230)' and '*calcareous fens with Cladium mariscus and species of the Caricion davallianae (7210)'. The latter is a priority habitat that describes stands of species-rich alkaline fen vegetation in which Great Fen-sedge (*Cladium mariscus*) is dominant.

PF2 Poor fen and flush

This category includes peat-forming fens and flushes that are fed by groundwater or flowing surface waters that are acid. Flushes that are acidic but not peat-forming should also be considered here. In most cases the substratum is acid peat which has a higher nutrient status than that of ombrotrophic bogs. The vegetation of poor fens and flushes is typically dominated by sedges (particularly *Carex rostrata, C. nigra, C. curta, C. lasiocarpa and C. echinata*) and/or rushes (*Juncus effusus, J. articulatus, J. acutiflorus*). Other common components include Common Cottongrass (*Eriophorum angustifolium*), Velvet Bent (*Agrostis canina*), Purple Moor-grass (*Molinia caerulea*), Yorkshire-fog (*Holcus lanatus*) and broadleaved herbs such as Marsh Violet (*Viola palustris*), Bogbean (*Menyanthes trifoliata*), Heath Bedstraw (*Galium saxatile*), Tormentil (*Potentilla erecta*) and Marsh Cinquefoil (*Potentilla palustris*). There may be some limited cover of dwarf shrubs. Extensive carpets of mosses including, in particular, Sphagnum palustre, S. recurvum, S. auriculatum, Calliergon stramineum and Polytrichum commune, are characteristic.

Although poor fen and flush is not listed in Annex I of the Habitats Directive, it is very limited in extent in Ireland and should be regarded as being of special conservation importance (C. Ó Críodáin, pers. comm.).

PF3 Transition mire and quaking bog

Transition mires and quaking bogs are extremely wet peat-forming systems with characteristics that are intermediate between poor and rich fens. For this reason, they are considered as a separate habitat but they may occur within, or on the fringes of other peat-forming systems. Transition mires and quaking bogs are usually associated with the wettest parts of a bog or fen and can be found in wet hollows, infilling depressions, or at the transition to areas of open water. Vegetation frequently forms a floating mat or surface scraw over saturated, spongy or quaking peat. Standing water may occur in pools or along seepage zones. The vegetation typically comprises species that are characteristic of bog, fen and open water habitats. Small to medium sedges, mainly Carex spp. (particularly *Carex diandra, C. lasiocarpa, C. limosa and C. viridula*), usually dominate and may occur together with White Beak-sedge

(*Rhynchospora alba*), cotton grasses (*Eriophorum angustifolium*, and the much rarer *E. gracile*), Creeping Bent (*Agrostis stolonifera*), Purple Moor-grass (*Molinia caerulea*), and a range of broadleaved wetland herbs such as Bogbean (*Menyanthes trifoliata*), Marsh Pennywort (*Hydrocotyle vulgaris*), Lesser Spearwort (*Ranunculus flammula*), Marsh Cinquefoil (*Potentilla palustris*) and Marsh Lousewort (*Pedicularis palustris*). Extensive moss cover is characteristic; Sphagnum spp., Calliergon spp. and Scorpidium scorpioides are usually abundant.

Links with Annex I: Corresponds to the annexed habitat, 'transition mires and quaking bogs (7140)'

W Woodland and Scrub

This section groups habitats in which the predominant structural element of the vegetation is provided by trees, shrubs or brambles. It includes almost all types of woodland and scrub - natural, semi-natural or planted - in urban and rural situations, with the exception of woodland or scrub associated with sand dunes (See **dune scrub and woodland - CD4**) and commercial orchards or tree nurseries (See **horticultural land - BC2**). Linear boundary features that are dominated by trees and shrubs are also included in this section.

Woodland is defined here as any area that is dominated by trees, as opposed to shrubs, and where the canopy height is greater than 5 m, or 4 m in the case of woodland in wetland areas or on bogs. The canopy may be open but should be distinct. Scrub or transitional woodland includes areas that are dominated by shrubs, brambles and stunted or immature trees, and where the canopy height is less than that outlined above for woodland. Note that birches (*Betula* spp.), Hazel (*Corylus avellana*) and some willows (*Salix* spp.) can occur both as trees and shrubs. Sessile Oak (*Quercus petraea*) may also occur in stunted form in exposed locations. Areas that are dominated by young or sapling trees (*with the exception of most stands of planted conifers*) are categorised as **immature woodland - WS2**. The categories, **hedgerows - WL1** and **treelines - WL2**, should be used for any linear strips of woodland or scrub that are less than 4 m wide.

The main subdivision in the woodland section is between semi-natural woodlands and all other woodland types, including commercial plantations. Natural or 'ancient' woodland vegetation is now very rare in Ireland and most stands of trees have been modified and managed to some extent by humans over centuries. Because of this, the term 'semi-natural' is generally used for stands that resemble the potential natural woodland cover. To be considered as semi-natural, woodland should be dominated by native trees, the understorey should be reasonably well-developed, and there should be no systematic removal of timber, dead wood or fallen trees. Stands that originate from planting in the past may be included if they are now regenerating naturally, as may stands that were formerly coppiced. Some common non-native broadleaved trees that occur in Irish woodlands include Beech (*Fagus sylvatica*), Sycamore (*Acer pseudoplatanus*), limes (*Tilia* spp.), Horse Chestnut (*Aesculus hippocastanum*), Spanish Chestnut (*Castanea sativa*) and Hornbeam (*Carpinus betulus*). Yew (*Taxus baccata*) and Scots Pine (*Pinus sylvestris*) are the only conifers that can be considered native to Ireland; the latter has been widely re-introduced following a major decline and possible extinction in prehistoric times.

Seven types of semi-natural woodland are recognised. Most other woodland stands, except conifer plantations, can be classified in three general woodland categories that are subdivided on the basis of the different proportions of broadleaved trees and conifers that are present. They include various stands of native and non-native trees that were planted for a variety of reasons including commercial timber or energy production, landscaping, shelter or conservation in rural and urban areas. Broadleaved and mixed plantations are included, as are other stands of trees that may have originated naturally but do not meet the criteria for semi-natural woodland above. In the case of broadleaved or conifer woodland categories, the term 'mixed' should be used in the title if a number of different species contribute significantly to the canopy. Conifer plantations are considered separately and are defined here as dense stands of planted conifers where the overriding influence is commercial timber production. The proportion of conifers should exceed 75%. All other plantations should be considered in the general woodland categories.

WN Semi-natural Woodland

WN4 Wet pedunculate oak-ash woodland

This type of woodland is associated with areas that are flooded or waterlogged in winter but which dry out in summer. It occurs on periodically-flooded alluvial sites that are well above the limits of regular inundation, and on drumlins and other sites with heavy, poorly-drained clay soils that are subject to waterlogging. Woodland is dominated by Pedunculate Oak (*Quercus robur*) and/or Ash (*Fraxinus excelsior*); other common components include Hazel (*Corylus avellana*), Hawthorn (*Crataegus*

monogyna), Holly (*Ilex aquifolium*) and willows (*Salix* spp.). Alder (*Alnus glutinosa*) can be locally abundant. The ground flora typically comprises Meadowsweet (*Filipendula ulmaria*), Primrose (*Primula vulgaris*), Enchanter's-nightshade (*Circaea lutetiana*), Ivy (*Hedera helix*), Bramble (*Rubus fruticosus agg.*), Remote Sedge (*Carex remota*), Golden-saxifrage (*Chrysosplenium oppositifolium*) and Ramsons (*Allium ursinum*). When flooding subsides in alluvial sites, exposed channels and depressions may remain wet or waterlogged. Alder (*Alnus glutinosa*) is often prominent in these situations.

Links with Annex I: On alluvial sites, this type of woodland corresponds to the priority habitat, '*alluvial forests with Alnus glutinosa and Fraxinus excelsior (*Alno-padion, Alnion incanae, Salicion albae*) (91E0)'. The term 'residual' means that only small stands remain in Europe; these need not be of ancient origin.

WN5 Riparian woodland

This category includes wet woodlands of river margins (gallery woodland) and low islands that are subject to frequent flooding, or where water levels fluctuate as a result of tidal movement (in the lower reaches of rivers). Riparian woodland is dominated by stands of willows that may include native (*Salix cinerea, S. purpurea, S. triandra*) and non-native (*Salix fragilis, S. alba, S. viminalis*) species. Alder (*Alnus glutinosa*) is occasional. The field layer is characterised by broadleaved herbs such as Nettle (*Urtica dioica*), Creeping Buttercup (*Ranunculus repens*), Wood Dock (*Rumex sanguineus*), Meadowsweet (*Filipendula ulmaria*), Wild Angelica (*Angelica sylvestris*), Hemlock Water-dropwort (*Oenanthe crocata*) and Hedge Bindweed (*Calystegia sepium*). Stands of Reed Canary-grass (*Phalaris arundinacea*) are common. Indian Balsam (*Impatiens glandulifera*), an introduced species, is locally abundant. These woodlands often reveal an accumulation of river borne debris, including dead vegetation and plastic, when water levels are low. A fine coating of grey mud on vegetation and tree bases that are regularly submerged and emersed is also characteristic. Willows were widely coppiced and used for basket-making in the past; old Osier (*Salix viminalis*) beds are included in this category but any actively coppiced areas should be considered under **short rotation coppice - WS4**.

WN6 Wet willow-alder-ash woodland

This broad category includes woodlands of permanently waterlogged sites that are dominated by willows (*Salix* spp.), Alder (*Alnus glutinosa*) or Ash (*Fraxinus excelsior*), or by various combinations of some or all of these trees. It includes woodlands of lakeshores, stagnant waters and fens, known as carr, in addition to woodlands of spring-fed or flushed sites. Carr is dominated by Rusty Willow (*Salix cinerea ssp. oleifolia*) and Alder (*Alnus glutinosa*). The field layer comprises Creeping Bent (*Agrostis stolonifera*), Meadowsweet (*Filipendula ulmaria*), Common Marsh-bedstraw (*Galium palustre*), Purple-loosestrife (*Lythrum salicaria*) and Skullcap (*Scutellaria galericulata*). Mosses such as Climacium dendroides, Calliergon cordifolium and Homalia trichomanoides are characteristic. Carr occurs on organic soils and fen peats that are subject to seasonal flooding but remain waterlogged even when flood waters recede.

Woodlands of flushed or spring-fed sites are typically dominated by Alder (*Alnus glutinosa*) or Ash (*Fraxinus excelsior*) and the ground flora is often 'grassy' in appearance with abundant Remote Sedge (*Carex remota*) and Creeping Bent (*Agrostis stolonifera*). Other common components of the field layer include Bramble (*Rubus fruticosus agg.*), Creeping Buttercup (*Ranunculus repens*), Meadowsweet (*Filipendula ulmaria*), Common Marsh-bedstraw (*Galium palustre*), Yellow Pimpernel (*Lysimachia nemorum*) and Lady-fern (*Athyrium filix-femina*). This type of woodland occurs on mineral soils or fen peats, and may occasionally be associated with river banks or lakeshores. Note that **riparian woodland - WN5** is treated as a separate category.

Also included in this category are woodlands of calcareous spring-fed hollows that are characterised by a mixture of trees including willows (*Salix* spp.), Alder (*Alnus glutinosa*), Ash (*Fraxinus excelsior*) and Downy Birch (*Betula pubescens*). Greater Tussock-sedge (*Carex paniculata*) dominates the field layer and tussocks may support species of drier land. Common Reed (*Phragmites australis*) may be abundant in open wet areas. The ground surface is often treacherous and water-filled hollows and channels typically support aquatic plants.

WN7 Bog woodland

This category includes woodlands of intact ombrotrophic bogs, bog margins and cutover bog. Bog woodland typically occurs on deep acid peat that is relatively well-drained in the upper layers and is commonly associated with former turf cutting activity or drainage. It may also occur in areas of cutover bog where most of the peat has been removed. Downy Birch (*Betula pubescens*) is the usual dominant and may form pure stands. Other trees and shrubs can include Holly (*Ilex aquifolium*), Rowan (*Sorbus aucuparia*), Scots Pine (*Pinus sylvestris*), oaks (*Quercus* spp.) and willows (*Salix* spp.). Dwarf shrubs such as Ling (*Calluna vulgaris*) or Bilberry (*Vaccinium myrtillus*) may occur in the field layer, usually in

association with Bracken (*Pteridium aquilinum*), Bramble (*Rubus fruticosus agg.*), Ivy (*Hedera helix*), Purple Moor-grass (*Molinia caerulea*) and Honeysuckle (*Lonicera periclymenum*).

Woodland of waterlogged acid peat in hollows or depressions in areas of upland woodland on siliceous rocks should also be included in this category. Downy Birch (*Betula pubescens*) and/or willows (*Salix* spp.) dominate and the ground flora is characterised by extensive cover of mosses (*Sphagnum and Polytrichum* spp.), in addition to grasses (*Molinia caerulea, Anthoxanthum odoratum*), Star Sedge (*Carex echinata*), Soft Rush (*Juncus effusus*) and ferns (*Dryopteris dilatata, Blechnum spicant*).

Links with Annex I: Since the Annex I habitat, '*bog woodland (91D0)', refers to woodland of intact raised bog, examples of this priority habitat are very rare in Ireland.

WS Scrub/Transitional Woodland

WS1 Scrub

This broad category includes areas that are dominated by at least 50% cover of shrubs, stunted trees or brambles. The canopy height is generally less than 5 m, or 4 m in the case of wetland areas. Scrub frequently develops as a precursor to woodland and is often found in inaccessible locations, or on abandoned or marginal farmland. In the absence of grazing and mowing, scrub can expand to replace grassland or heath vegetation. Trees are included as components of scrub if their growth is stunted as a result of exposure, poor soils or waterlogging. If tall trees are present, these should have a scattered distribution and should not form a distinct canopy. This category does not include areas that are dominated by young or sapling trees (<5 or 4 m in height) or young conifer plantations (See **immature woodland - WS2** or **conifer plantation - WD4**). Linear boundary features of scrub that are less than 4 m wide should be considered under **hedgerows - WL1.**

Scrub can be either open, or dense and impenetrable, and it can occur on areas of dry, damp or waterlogged ground. Common components include spinose plants such as Hawthorn (*Crataegus monogyna*), Blackthorn (*Prunus spinosa*), Gorse (*Ulex europaeus*), Juniper (*Juniperus communis*), Bramble (*Rubus fruticosus agg.*) and erect or scrambling roses (*Rosa* spp.), in addition to a number of willows (*Salix* spp.), small birches (*Betula* spp.) and stunted Hazel (*Corylus avellana*). Scrub may also contain Bog-myrtle (*Myrica gale*) and Broom (*Cytisus scoparius*). The field layer is often impoverished and poorly-developed but, in some situations, may be similar to that of woodland. Low-growing Western Gorse (*Ulex gallii*) and prostrate Juniper (*Juniperus communis*) can also be components of heath. Note that any areas that are dominated by non-native shrubs should be excluded (See **ornamental/non-native shrub - WS3**).

Links with Annex I: Stands of juniper scrub correspond to the annexed habitat, 'Juniperus communis formations on heaths or calcareous grasslands (*5130*)'.

Appendix 7: CWS Glossary of Terms

ABIOTIC - Of or relating to the non-living components of a habitat or ecosystem.

ACIDIFICATION - The detrimental effect of acid rain on soils and freshwater.

AFFORESTATION - The planting of trees (usually conifers) over an area of previously unplanted round.

ALTITUDE - Vertical height above sea level.

ALLUVIAL - Of or relating to silty deposits transported by water, or occurring on river flood plains.

AMPHIBIANS – A vertebrate group whose members spend part of their life cycle in water and part on land e.g. Frog.

ANNEX 1 - of the EU Habitats Directive, lists habitats including priority habitats for which SACs have to be designated.

ANNEX 2 - of the EU Habitats Directive is a list of species for which SACs have to be designated.

ANNUAL PLANT - Plant that completes its life cycle within a single growing season.

AQUATIC ENVIRONMENT – Rivers, streams, lakes, ponds, springs and features that depend on natural waters e.g. marsh, bogs and wetlands.

ArcGIS A comprehensive desktop Geographic Information System (GIS) software package developed by ESRI used to carry out many GIS operations.

ASIs - Areas of Scientific Interest. Areas that were identified in the 1970s as being of conservation interest. The NHA designation developed from ASIs.

ATTRIBUTE – Non-spatial information about a geographic feature in a GIS, usually stored in a table (or spreadsheet) and linked to the feature by a unique identifier. For example, attributes of a wetland site might include its name, area, and soil type.
ATTRIBUTE FIELD – A column on an attribute table containing specific data such as area or site name on a number of features (rows).

ATTRIBUTE TABLE - Tabular file containing rows and columns. In GIS, **attribute tables** are associated with a class of geographic features, such as wells or roads. Each row represents a geographic feature, such as a river, a wetland site etc.

BASE POOR SOILS - Soils that only slowly release the dissolved chemicals or minerals contained within them.

BASIN - A depressed area of the Earth's surface, in which sediments accumulate.

BIODIVERSITY – A general term used to describe all aspects of biological diversity, including: the number of species present in a given environment; the genetic diversity present within a species; the number of different ecosystems present within a given environment.

BIOTOPE - An environmental region, defined by certain conditions characteristic organisms that typically inhabit it. Combination of the physical habitat and its recurring community of animals and plants.

BIOTIC - Of or relating to the living components of a habitat or ecosystem.

BIRDS DIRECTIVE (Council Directive 79/ 409/ 2nd April 1979) - Under this Directive Ireland is required to conserve the habitats of two categories of wild birds: 1) Listed rare and vulnerable species and 2) Regularly occurring migratory species. The Directive also obliges Ireland to conserve wetlands, especially those of international importance and regulates the hunting and trading of wild birds. It was transposed into Irish legislation by the EU (Natural Habitats) Regulations, 1997.

BLANKET BOG - Bogs which carpet the landscape, following the underlying topography. They can cover extensive areas along the west coast and on uplands throughout the country.

BOG - General term for ombrotrophic mire or peatland (but sometimes used colloquially for other wetland type e.g. marsh, fen). A peat filled or covered area.

BORD NA MÓNA - Irish peat extraction board, founded by the Irish state in 1946.

BOULDER - Large rock that is greater than 256 mm in diameter.

BRACKISH - Where salinity is intermediate between that of freshwater and sea water.

BRYOPHYTES - A group of simple non-vascular spore-bearing green plants comprising the mosses, liverworts and hornworts.

CALCAREOUS - Rich in calcium salts (lime-rich), or pertaining to limestone or chalk.

CALCICOLOUS - Organisms that have an affinity for habitats that are rich in calcium (lime-loving).

CALLOW - Wetland areas at edge of large rivers, that were or are still seasonally regularly flooded. May contain fen vegetation, but often with a peat layer less than 40 cm deep.

CATCHMENT - An area of land draining to a defined point. The term river catchment refers to the area of land that drains into a particular river system.

CENTROID – The central point of an shape such as a polygon.

CLAY - Very fine sediment particles that are less than 0.004 mm in diameter - component of mud.

COLONISATION - The entry and spread of a species into an area, habitat or population from which it was formerly absent.

COMMONAGE – An area of land which are undivided but are owned by more than one person / or the rights to use the land are owned by more than one person.

COMMUNITY - a well-defined assemblage of plants and/or animals, clearly distinguishable from other such assemblages.

CONSERVATION STATUS - The sum of the influences acting on a habitat and its typical species that may affect its long term distribution, structure and functions. Also refers to the long-term survival of its typical species within the European territory of the Member States.

CORINE - An information and mapping system, developed within the context of the Commission of the European Communities biotope project, which is used as a tool for the description of sites of importance for nature conservation in Europe. It catalogues recognisable communities of flora and fauna. The primary objective of this catalogue is to identify all major communities whose presence contributes to the conservation significance of a site. Included in this list of communities are interesting but rare natural or near-natural communities as well as the more widespread semi natural ones.

CUTAWAY BOG – Areas of bog which have been systematically cut, by mechanical means. Any peat remaining has no economic value. Underlying mineral soil or marl layer or bedrock often exposed. Cutaway areas are normally a mosaic of cut areas, drainage ditches, flooded area, uncut higher banks of peat, scrub, grassland etc.

CUTOVER BOG – Areas of bog which have been previously cut, although not down to the marl layer or bedrock. Often using traditional hand-cutting methods. Cutover areas are normally a mosaic of cut areas, face banks, pools, drainage ditches, uncut areas of peat, scrub, grassland etc.

DRAW-DOWN ZONE - Area exposed when water levels are reduced, normally as a result of abstraction in the case of reservoirs, or of drying out in the case of ponds.

DIVERSITY - see biodiversity.

DOMESTIC PURPOSES - Used in relation to the cutting of peat. Peat that is cut for domestic purposes is not for commercial sale and is cut at the rate of one year's supply for a household per year.

DRUMLIN - Streamlined, oval-shaped hill formed by glacial activity and usually comprising unsorted sediment, or till.

DYSTROPHIC – shallow lake that is a dark brown colour due to the presence of organic material, and are of low biological productivity and have poor light penetration.

ECOLOGY - The study of the interactions between organisms, and their physical, chemical and biological environment.

EDAPHIC - Of the soil, or influenced by the nature of the soil.

ENVIRONMENT – The biological and physical conditions in which an organism lives.

EPA – Environmental Protection Agency.

EMERSED - Above the level of the water, or exposed to air.

EPIBIOTA - Surface-dwelling animals and plants.

EPIFAUNA - Surface-dwelling animals.

EROSION - The processes whereby the materials of the Earth's crust are dissolved, or worn away and simultaneously moved from one place to another by natural agencies which include weathering, solution, corrosion and transportation.

EUROPEAN BIRDS DIRECTIVE (79/ 409/ 2nd April 1979) - See Birds Directive.

EUTROPHIC – Biological effects of an increase in plant nutrients on aquatic systems.

ESKER - Long, sinuous, steep-sided ridge, comprising layers of sediments (cross-bedded sands and gravels) laid down by glacial melt waters.

ESRI - Environmental Systems Research Institute. ESRI is the company that makes Arc/INFO, Arc/View and many other related software for GIS.

EUTROPHIC - Having high levels of primary productivity or nutrients.

FAUNA - Animal life.

FAVOURABLE CONSERVATION STATUS - The conservation status of a natural habitat will be taken as "favourable" when: its natural range and areas it covers within that range are stable or increasing, and the specific structure and functions which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable.

FEN - General term for minerotrophic mires, formed under the influence of groundwater.

FLORA - plant life.

FORMATION – A geological term for a body of rocks having easily recognised boundaries that can be traced in the field, and large enough to be represented on a geological map as a practical and convenient unit for mapping and description.

GEOGRAPHIC INFORMATION SYSTEM (GIS) - GIS is a system of hardware and software used for storage, retrieval, mapping, and analysis of geographic data. Practitioners also regard the total GIS as including the operating personnel and the data that go into the system. Spatial features are stored in a coordinate system (latitude/longitude, state plane, UTM, etc.), which references a particular place on the earth. Descriptive attributes in tabular form are associated with spatial features. Spatial data and associated attributes in the same coordinate system can then be layered together for mapping and analysis. GIS can be used for scientific investigations, resource management, and development planning.

GEOMORPHOLOGY – The study of the form and structure of the landscape, which is shaped by the underlying geology.

GIS – see Geographic Information System (GIS)

GLEY - Soil type subject to water logging because of the high content of impermeable clays.

GRAVEL - Sediment particles that are between 4-16 mm in diameter.

HABITAT - Refers to the environment defined by specific abiotic and biotic factors, in which a species lives at any stage of its biological cycle. In general terms it is a species home. In the Habitats Directive this term is used more loosely to mean plant communities and areas to be given protection.

HABITATS DIRECTIVE - (Council Directive 92/43/EEC). The Directive on the conservation of Natural Habitats and of Wild Flora and Fauna. This Directive seeks to legally protect wildlife and its habitats. It was transposed into Irish legislation by the EU (Natural Habitats) Regulations, 1997.

HAND CUTTING OF PEAT - Refers to traditional cutting of peat using a slean or spade.

HERBACEOUS - Of or relating to non-woody plants or vegetation.

HUMIC ACID - Dark brown acid derived from humus or partially decomposed organic material in soils, particularly peats.

HUMMOCK - A small hillock/mound. Often used to describe the surface of active bogs where the ground forms a pattern of mounds, hollows and pools. Such hummocks commonly comprise bog mosses.

HYDROLOGY - The movement of water through a catchment area including freshwater and seawater inputs, water level changes and drainage mechanisms which are all influenced by the underlying geology.

HYPERTROPHIC - Over-enriched with nutrients, polluted.

IMMERSED - Submerged by water.

IPCC - Irish Peatland Conservation Council. Non-governmental organisation established in 1982 to promote the protection of Irish bogs and fens.

LAGG - Fringing wetland area around raised bogs where groundwater mixes with bog water, and where vegetation communities are transitional between bog and fen.

LATITUDE – The angular distance measured in degrees north or south of the equator.

LICHENS – An organism that consists of a fungus growing in close association (symbiosis) with an alga.

LINES – A feature that is linear such as a river or a hedgerow, which are difficult to map spatially due to scale are often stored in the GIS in this format.

LOAM - Friable or crumbly soil comprising sand, silt, clay and organic matter.

MANAGEMENT - a) Controlling processes within a site (this can be actively carrying out work or can be doing nothing), preferably in accordance with a conservation plan. - b) The practical implementation of the management plan. - c) Undertaking any task or project identified in the management plan, including the identification of new opportunities.

MapInfo - A commonly used desktop GIS software package produced by the MapInfo Corporation**.** Similar basic functionality and capabilities as ArcGIS.

MapInfo TABLE – Similar to the shapefile concept but used with MapInfo.

MARGINAL VEGETATION - At or near the margin or border, often used to describe the vegetation at the edge of a lake or river.

MARL - White calcareous clay or precipitate with a high proportion of soft calcium carbonate, usually found as an alluvial deposit.

MARSH - Wet grassy habitats, with more or less permanent standing water at or near ground level, with little or no peat formation. Generally quite species rich.

MECHANICAL PEAT EXTRACTION - Refers to the use of machinery to cut peat. This includes extrusion cutting such as by sausage machine (e.g. Difco) or any other type of mechanical cutter (e.g. Hopper).

MESOTROPHIC – freshwater lake systems containing moderate concentrations of mineral nutrients, such as phosphorous, calcium and nitrogen. Having moderate levels of primary productivity or nutrients (intermediate between oligotrophic and eutrophic).

MICROTOPOGRAPHY - Very small-scale variations in the height and roughness of the ground surface.

MINEROTROPHIC MIRE - A peatland system that is fed by ground water.

MIRE - A general term applied to peat producing ecosystems. cf. bog, peatland.

MONITORING – A repeat or repeats of a survey using the same methodology. Designed to look for or measure specific changes and the rate or extent of change. Used to check the "health" quantity or quality of a habitat or species.

MONTANE - Of or relating to mountains.

MOOR - Shallow acid peatland less than 40 cm peat depth, often resting on iron pan and podzol; and dominated by ericaceous vegetation.

MOR HUMUS - Organic soil that is acid and comprises layers of plant litter.

MORAINE - Ridge or mound of unsorted mineral material deposited by glaciers.

MOSAIC - Used to describe habitats that occur together and cannot easily be mapped separately. Complex pattern or patchwork of habitats or species occurring in intimate associations.

MUD - Silt/clay fraction where sediment particles are less than 0.063 mm in diameter.

MULTIPLE PRIVATE OWNERSHIP- Lands that are divided into areas which are privately owned. There must be more than one private landowner under this heading. (lands in commonage are not described under this heading).

NATIONAL PARKS AND WILDLIFE SERVICE (NPWS) – the section of the Environment Infrastructure and Services division of the Department of Environment, Heritage and Local Government with responsibility for nature conservation and implementation of Government conservation policy as enunciated by the Minister for the Environment, Heritage and Local Government.

NATURA 2000 - A network of sites across the European Community, selected for the purpose of conserving natural habitats and species of plants and animals which are rare, endangered or vulnerable in the European Community. SACs and SPAs form the Natura 2000 network.

NATURAL HABITAT - Can be aquatic or terrestrial areas distinguished by geographic, abiotic and biotic features, whether entirely natural or semi-natural.

NATURAL HERITAGE AREA (see also NHA types below) - The basic designation for wildlife conservation is the Natural Heritage Area (NHA). This is an area considered important for the habitats present or which holds species of plants and animals whose habitat needs protection. Some of these sites are small, such as roosting areas for rare bats; others can be large such as a blanket bog or a sand dune system. To date, 75 raised bogs have been given legal protection, covering some 23,000 hectares. A further 73 blanket bogs, covering 37,000ha are also designated as NHAs. Under the Wildlife Amendment Act (2000), NHAs are legally protected from damage from the date they are formally **proposed** for designation.

pNHA - Proposed Natural Heritage Areas which were published on a **non-statutory** basis in 1995, but have not since been statutorily proposed or designated. These sites are of significance for wildlife and habitats. Some of the pNHAs are tiny, such as a roosting place for rare bats. Others are large - a woodland or a lake, for example. The pNHAs cover approximately 65,000ha and designation will proceed on a phased basis over the coming years.

Prior to statutory designation, pNHAs are subject to limited protection, in the form of:

Rural Environment Protection Scheme (REPS) plans which require conservation of pNHAs and operate for a period of 5 years

Forest Service requirement for NPWS approval before they will pay afforestation grants on pNHA lands

Recognition of the ecological value of pNHAs by Planning and Licensing Authorities.

cNHA - Candidate Natural Heritage Area is the name given to wildlife sites that are proposed to NPWS by third parties for consideration as NHAs. Prior to designation these site require survey and evaluation for their wildlife value. If they are considered of national conservation value they may enter the formal NHA designation process. These sites have no legal protection until they are taken up into the formal NHA designation process.

NNR - National Nature Reserve. Areas set aside for their conservation value by the Minister for the Department of Environment, Heritage and Local Government.

NOTABLE SPECIES - Plants or animals which are worthy of mentioning either because they are particularly typical of a habitat, or because they are rare/ scarce/ atypical.

NPWS - National Parks and Wildlife Service (see above).

OLIGO – Prefix denoting few or little.

OLIGOTROPHIC - Applied to waters that are relatively low in nutrients, as in lakes which are low in dissolved minerals and which can only support limited plant growth. Having low levels of primary productivity or nutrients.

OMBROTROPHIC - Rain-fed, of or relating to vegetation or ecosystems that receive most of their nutrients from precipitation.

OSI – Ordnance Survey of Ireland.

PEAT - Organic soil material saturated by water, composed of the partial decomposed remains of plants and mosses.

PEAT CUTTING BY HAND - See hand cutting of peat.

PEAT CUTTING BY MACHINE - See mechanical peat extraction.

PEBBLE - Sediment particle, or stone, that is between 16-64 mm in diameter.

PERIPHERY - Distant from the centre, on the fringe/edge.

pH - A quantitative expression for the acidity or alkalinity of a solution or soil. The scale ranges from 0-14: pH 7 is neutral, less than 7 is acidic and greater than 7 is alkaline.

PLATEAU - A wide, mainly level area of elevated land.

PHYTOSOCIOLOGY - Study and classification of plant communities based primarily on floristic considerations.

PODZOL - Acid soil with an organic layer over a highly leached mineral layer.

POINTS – Some features such as freshwater springs or a site location are represented by a point. are difficult to map spatially due to scale and are often stored in the GIS in this format.

POLYGON - An feature that closes on itself to make a circle or any closed irregular shape. An example of a set of data that would be stored in the GIS in this format would be a bog, a lake or a field.

PRECIPITATION - Water moving from the atmosphere to the ground in the form of rain, fog, mist, snow or hail.

PRIORITY HABITAT - A subset of the habitats listed in Annex I of the EU Habitats Directive. These are habitats which are in danger of disappearance and whose natural range mainly falls within the territory of the European Union. These habitats are of the highest conservation status and require measures to ensure that their favourable conservation status is maintained.

RARE - An ecological term applied to distribution of species when assessed on a national grid reference system. The assessment is made on the basis of the number of occupied 10 km National Grid squares. A species is described as rare if has been recorded in to 3-10, 10 km squares.

RED DATA BOOK – A register of threatened species that includes definitions of degrees of threat.

RED DATA BOOK (lower plants) - This Red Data Book deals with Stoneworts which are recognised as a separate class, Characea, of the Green Algae Chlorophyta). Many of these species are threatened by loss of habitat or pollution.

RED DATA BOOK 1 (vascular plants) This Red Data Book deals with rare and threatened flowering plants and ferns of Ireland with an account of their present distributions and conservation status.

RED DATA BOOK 2 (mammals, birds, amphibians and fish) - identifies those species threatened in Ireland or those species whose populations are considered to be of international importance, though not necessarily threatened in Ireland. It details the current state of Irish vertebrates and provides a concise summary of the various legislation for each species.

RIPARIAN - Of or relating to a river bank.

SACs - Special Areas of Conservation have been selected from the prime examples of wildlife conservation areas in Ireland. Their legal basis from which selection is derived is The Habitats Directive (92/43/EEC of the 21st May 1992). SAC's have also been known as cSAC's which stands for "candidate Special Areas of Conservation", and pcSAC's which stands for "proposed candidate Special Areas of Conservation."

SCIENTIFIC MONITORING - this is carried out by the monitoring section of the NPWS, whose function here is to ensure that the favourable conservation status of the site is maintained and where possible improved.

SEDIMENT - Solid particles that can originate by the weathering and erosion of pre-existing rock, by chemical precipitation from water, or by the breakdown of organisms.

SEDIMENTARY - Formed by the deposition of sediment, i.e. rock particles or chemical precipitate, or pertaining to the process of sedimentation.

SHAPEFILE - A set of files that contain a set of points, arcs, or polygons (or *features*) that hold tabular data and a spatial location. The tabular data makes up the attribute table (see below). This file format is used in ArcGIS software.

SILICEOUS - Of or relating to rocks or sediments that contain silica and are acid.

SILT - Fine sediment particles that are between 0.004-0.063 mm in diameter - component of mud.

SINKHOLE - Steep-sided, enclosed depression linking to underground drainage systems in a limestone region.

SLACK - Wet depression in a sand dune system or, in the case of rivers, a backwater.

SLIVER POLYGON - A extremely small polygon, usually of elongated shapes, that results from errors in data capture and overlay analysis when identical linear objects fail to register. It is also known as a spurious polygon.

SPAs - Special Protection Areas for Birds are areas which have been designated to ensure the conservation of certain categories of birds. Ireland is required to conserve the habitats of two categories of wild birds under the European Birds Directive (Council Directive 79/ 409/ 2nd April 1979). The NPWS is responsible for ensuring that such areas are protected from significant damage.

SPECIES - the lowest unit of classification normally used for plants and animals.

STRATEGY - A course of action or a broad approach towards achieving an objective. It is the general thrust of management towards achieving an objective. It is a description of how the objective is to be achieved.

SUBMERSED - Submerged or covered by water.

SURVEY - a) Study/visit to produce an inventory of what is present / record a situation.- b) Establishing a baseline (study).

SUSTAINABLE - The highest rate at which a renewable resource can be used without reducing its supply (without causing damage to the resource).

TILL - Unsorted sediments laid down directly by glacier ice without the intervention of water.

TRANSITION MIRE – Acidophilous vegetation intermediate between poor fen and ombrotrophic (rain-fed) bog.

TROPHIC - Of or relating to nutrient levels or nutrition.

TUFA - Deposit or precipitate of calcium carbonate around calcareous springs.

TURBARY – Refers to the right to harvest turf.

VASCULAR PLANTS - Higher plants with specialised conducting tissue, including angiosperms (flowering plants), ferns and clubmosses.

VERTEBRATES - Animals with backbones.

VERY RARE - an ecological term which is applied to distribution of species when assessed on a national grid reference system. The assessment is made on the basis of the number of occupied 10 km National Grid squares. Very Rare applies to 1-2, 10 km squares in this context.

Appendix 8: The County Clare Wetlands Survey Site List held within the CWS Site Database

The list is sorted alphabetically by site name and formatted so as to print on A4 page.

Data presented for each site includes: CWS site code, CWS Site name, Grid reference, Site designation, NHA/SAC/SPA site code and Fossitt wetland types recorded on the site.

For a complete list of all data held on each site (with the exception of detailed site descriptions) within the CWS site database see the Excel file (CWS_total_dbase_site_data_export.xls) included on the CWS Project CD Rom. For an explanation of the data columns in the Excel file see CWS Report Appendix 4.

Appendix 8. The County Clare Wetlands Survey Site List held within the CWS Site Database

For a complete list of all data held on each of the sites within the CWS Site Database see the Excel file (CWS_total_dbase_site_data_export.xls) included on the CWS Project CD Rom.

In alphabetical order by site name.

CWS Site Code	CWS Site Name	Site designations	Easting Centre	Northing Centre	Main Fossitt Habitat Present
4	AILLE RIVERBANK cNHA	cNHA	113000	198000	F; FW
5	ANNAGEERAGH RIVER - LOWLAND	Undesignated site	105500	171080	F; FW; WN; GS; GS4; WS; WS1; WN6
6	ANNAGEERAGH RIVER - UPLAND	Undesignated site	114000	175000	F; FW; FW1
7	ARDSOLLUS RIVER	Undesignated site	139248	171169	F; FL
8	ARDUAN LOUGH	Undesignated site	148709	170972	PF1; PF3; PF; P; FL3; FL4; FS1; FS; FL; F; PB
9	ATTYQUIN LAKE COMPLEX cNHA	cNHA; SPA	141888	190458	GM1; PF; PF1; F; FL; G; GM; GS4; P; GA; GA1; GS; W; WN; WS1; WS
10	AUGHINISH BAY	ASI; cNHA; SAC	131000	212000	CW1; CW; C
11	AUGHINISH LAGOON	SAC; cNHA	131000	212000	C; CW; CW1
12	AYLE LOWER BOG NHA	NHA	154112	183141	F; FL; FL1; FW; FW2; FW4; G; GS4; P; PB; PB1; PB4; PF; PF2; WN7; GA; GA1; GS; GS1; W; WD4; WN; WS; WS1
13	BALLEEN LOUGH	Undesignated site	123532	175320	FL4; FL; F; FS1; FS; FS2; GM; GM1
14	BALLYALLIA LAKE cNHA	cNHA; ASI; COR; WS	134000	181000	WS1; WS; WN2; WN; WL1; WL; WD5; WD1; WD; W; GS; GA2; GA1; GA; ER2; ER; BL3; BL1; BL; B; GS4; GM1; GM; G; FW4; FW2; FW; FS1; FS; FL5; FL; F
15	BALLYALLIA LAKE SAC	SAC; ASI; COR	134000	181000	PF1; F; FL; FL5; FS; FS1; FW; FW2; FW4; G; GM; GM1; GS4; B; BL; BL3; E; ER; ER2; GA; GA1; GA2; GS; W; WD; WD5; WL; WL1; WN2; WN; WS1; WS
16	BALLYALLIA LOUGH SPA	SPA; ASI	133775	180892	PF1; F; FL; FL5; FS; FS1; FW; FW2; FW4; G; GM; GM1; GS4; B; BL; BL3; E; ER; ER2; GA; GA1; GA2; GS; W; WD; WD5; WL; WL1; WN2; WN; WS1; WS
17	BALLYBAN TURLOUGH cNHA	cNHA	120800	194100	BL3; BL; B; GS4; G; FW; FL6; FL; F
18	BALLYBEG LOUGH cNHA	cNHA	133200	173900	PF; PF1; P; F; FL; FS; GM; FS2; FS1
19	BALLYCAR LOUGH cNHA	cNHA; ASI; COR	141418	169129	GM1; PF1; PF3; F; FL; FL3; FS; FS1; FW4; FW; G; GM; GS4; P; PF; B; BL; BL1; BL3; E; ED; ED1; GA; GA1; GS; GS1; H; HD; HD1; W; WD; WD1; WS; WS1
20	BALLYCULLINAN LAKE cNHA	cNHA; ASI; COR	128979	186085	GM1; PF1; FP1; FS; FS1; FS2; F; FL; FL3; FW; FW2; FW4; G; GM; GS4; P; PF; B; BL; BL1; E; ER; ER2; GA; GA1; GS; GS1; W; WN; WN2; WS; WS1
21	BALLYCULLINAN LAKE SAC	SAC; ASI; COR	128979	186085	GM1; PF1; FP1; FS; FS1; FS2; F; FL; FL3; FW; FW2; FW4; G; GM; GS4; P; PF; B; BL; BL1; E; ER; ER2; GA; GA1; GS; GS1; W; WN; WN2; WS; WS1
22	BALLYCULLINAN, OLD DOMESTIC BUILDING cNHA	cNHA	129864	185629	G; B; BL; BL3; GS; W; WL; WL1; WS; WS1; PF1; PF; P
23	BALLYCULLINAN, OLD DOMESTIC BUILDING SAC	SAC	129864	185629	G; B; BL; BL3; GS; W; WL; WL1; WS; WS1; PF1; PF; P
24	BALLYCUNNEENN LOUGH	Undesignated site	143235	163354	PF3; PF; P
25	BALLYDOORA	Undesignated site	123000	199000	F; FL
26	BALLYEIGHTER LOUGHS	pNHA; SAC	134711	192096	F; FL; PF; P; GM; PF1; GM1; G; FS; FS1; PB; PB4
27	BALLYLEANN LOUGH	Undesignated site	124906	159301	PF3; PF; P; FL4; FL; F; FS1; FS; PB
28	BALLYMACAUGH LOUGH	SAC	128291	191302	FS1; FS; F; PF1; PF; P
29	BALLYMACHILL LOUGH cNHA	cNHA	137043	180100	PF1; P; PF; F; FL; GS; PB4; FS
30	BALLYMACLOON LOUGH	Undesignated site	143498	173726	PF1; PF; P; FL; FS1; FS; F
31	BALLYMULCASHEL LOUGH	cNHA; pNHA	149342	170114	PF1; PF; P
33	BALLYOGAN LOUGH cNHA	cNHA; ASI; COR; SAC	137000	190000	PF1; PF3; BL1; BL3; GA1; GM1; GS; PB4; WD4; WS; WS1; ER2; FL; FS; FS1; FW4; F; FW; G; GM; GS4; P; PB; PF; B; BL; E; ER; GA; W; WD; FL3; FS2

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34	BALLYOGAN LOUGH SAC	SAC; ASI; COR	137470	191284	PF1; PF3; BL1; BL3; GA1; GM1; GS; PB4; WD4; WS; WS1; ER2; FL; FS; FS1; FW4; F; FW; G; GM; GS4; P; PB; PF; B; BL; E; ER; GA; W; WD
35	BALLYTEIGE (CLARE) cNHA	cNHA; NNR	115109	197944	PF2; WS1; WS; WL1; WL; W; HH; H; GS; PF; P; GS4; G; FW4; F
36	BALLYTEIGE (CLARE) SAC	SAC; NNR	115109	197944	PF2; WS1; WS; WL1; WL; W; HH; H; GS; PF; P; GS4; G; FW4; F
37	BALLYVAUGHAN TURLOUGH cNHA	cNHA; ASI	122300	207200	F; FL; FL6; G; B; BL; BL1; E; ER; ER2; GA; GA1; GS; GS1; W; WN; WN2; WS; WS1
38	BALLYVAUGHAN TURLOUGH SAC	SAC	122300	207200	F; FL; FL6; G; B; BL; BL1; E; ER; ER2; GA; GA1; GS; GS1; W; WN; WN2; WS; WS1
39	BALLYVELAGHAN TURLOUGH	SAC	127990	211400	FL6; FL; F
40	BALLYVORGAL SOUTH EXPOSURE cNHA	cNHA	150991	169005	WS1; WS; WD4; WD; W; GS; ER; E; GS4; G; FW1; FW; F
41	BLACK HEAD-POULSALLAGH COMPLEX cNHA	cNHA; COR	111116	205965	F; FP; FP1; FS; FS1; FS2; FW; FW4; G; GM; GM1; GS4; P; PB; PB4; PF; PF1; B; BL; BL1; BL3; C; CD3; CD2; CD5; CS; CS1; E; ER; ER2; EU; EU1; GA; GA1; GA2; GS; GS1; GS2; GS3; H; HD; HD1; HH; HH2; L; LR; LR1; LR5; LS; LS1; LS2; W; WD; WD1; WD4; WN; WN2; WS; WS1
42	BLACK HEAD-POULSALLAGH COMPLEX SAC	SAC; COR	111116	205965	F; FP; FP1; FS; FS1; FS2; FW; FW4; G; GM; GM1; GS4; P; PB; PB4; PF; PF1; B; BL; BL1; BL3; C; CD3; CD2; CD5; CS; CS1; E; ER; ER2; EU; EU1; GA; GA1; GA2; GS; GS1; GS2; GS3; H; HD; HD1; HH; HH2; L; LR; LR1; LR5; LS; LS1; LS2; W; WD; WD1; WD4; WN; WN2; WS; WS1
43	BLANE BRIDGE BOG	Undesignated site			P; PB; PB4
44	BOOLYNAKNOCKAUN	Undesignated site	116780	169554	P; PB; PB2; PB4
45	BOW RIVER BRIDGE	Undesignated site	166574	187000	F; FW
47	BUNAHOW LOUGH cNHA	cNHA; SPA	144200	192800	PF1; P; PF; F; FL; FS; FS1; FS2
48	BURREN NATIONAL PARK	NP	133436	195543	
49	CAHER RIVER	pNHA; SAC	117315	207000	F; FW
50	CAHER RIVER - LOWLAND	SAC; pNHA	114000	208465	F; FW; FS; FP; FS1
51	CAHER RIVER - UPLAND	pNHA; SAC	117237	206000	F; FW; FW1; FS; W; FP
52	CAHERFADDA	pNHA	124770	193520	
53	CAHERKINALLIA WOOD cNHA	cNHA; ASI	112446	195532	P; PB; PB3; E; ED; ED1; ER; ER1; WN; WN1; W
54	CAHIRCALLA WOOD cNHA	cNHA	131724	175387	WS1; WS; WN; WD1; WD; W; GS1; GS; GA; GA1; ER2; ER; ED1; ED; E; BL1; BL; B; WN6; GS4; G; FL; F
55	CAIRNHILL COMPLEX cNHA	cNHA	131500	178820	G; GS4; B; BL; BL3; E; ED; ED1; ER; ER2; EU; EU1; GS; GS1; W; WL; WL1; WS; WS1
56	CANCREGGA	SPA	100882	187866	G; GS4; GM
57	CAPPANEASTA	Undesignated site	140795	191868	PF1; PF; P; PB
58	CARRAN TURLOUGH	pNHA; SAC	128200	198560	WS; WN; W; GS; ER2; ER; E; PB4; PB; GS4; G; FS; FL6; FL; F; PF; PF1; FP1; FP
59	CARROWMORE DUNES SAC	SAC	98896	168339	L; LR; LR1; LR2; LR4; LS; LS2; GS; CS3; CS; CD5; CD3; CD2; CD1; CD; CB1; CB; C; G; F; CW2; CW
60	CARROWMORE POINT TO SPANISH POINT AND ISLANDS cNHA	SPA; cNHA	100000	175000	CW; CW1; CW2; F; FP; FP1; FS; FS1; FW; FW2; FW4; G; GM; GM1; GS4; B; BL; BL1; BL3; C; CB; CB1; CD; CD1; CD2; CD3; CS; CS1; CS2; CS3; E; ER; GA; GS1; GS; H; HH; HH1; L; LR; LR1; LS; LS2

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61	CARROWMORE POINT TO SPANISH POINT AND ISLANDS SAC	SAC	100000	175000	CW; CW1; CW2; F; FP; FP1; FS; FS1; FW; FW2; FW4; G; GM; GM1; GS4; B; BL; BL1; BL3; C; CB; CB1; CD; CD1; CD2; CD3; CS; CS1; CS2; CS3; E; ER; GA; GS1; GS; H; HH; HH1; L; LR; LR1; LS; LS2
62	CASTLE LAKE TURLOUGH	cNHA	149194	169643	GS; W; WD; WD1; WN; WN2; WS; WS1; WS2; BL3; BL1; BL; B; WN6; GS4; GM1; GM; G; FW4; FW2; FW; FS1; FS; F; FL
63	CASTLE LOUGH TURLOUGH	pNHA; SAC	134470	198180	F; FL; FL6; FS; FW; G; GS4; P; PB; E; ER; ER2; GS; H; HH
64	CASTLEQUARTER	SAC; pNHA	138000	191400	PF1; PF; P; PB3; PB; FS1; FS; F; FL3; FL
65	CASTLETOWN LOUGH	Undesignated site	138692	177803	PF1; PF; P; FL; F; FS1; FS; FS2; GM; G
66	CLIFDEN HOUSE (COROFIN)	pNHA	126400	188900	WN; WD; W; BL3; BL; B; F; FL
67	CLIFFS OF MOHER cNHA	cNHA; ASI; RFF	103000	191000	F; FW; FW2; G; GM; GM1; HH3; P; PB; PB4; B; BL; BL1; BL3; C; CS; CS1; CS2; E; ED; ED1; GS; GS2; GS3; H; HH; L; LR; LR1; LS; LS1
68	CLIFFS OF MOHER SPA	SPA; ASI; RFF	103000	191000	F; FW; FW2; G; GM; GM1; HH3; P; PB; PB4; B; BL; BL1; BL3; C; CS; CS1; CS2; E; ED; ED1; GS; GS2; GS3; H; HH; L; LR; LR1; LS; LS1
69	CLOGHER - FORTANEBEG	Undesignated site	152995	179262	PF2; PF; P
70	CLONBRICK LOUGH & CASTLE BOG	Undesignated site	149700	171800	FS; FS1; F; FL; P; PB; PB4; GM
71	CLOON RIVER	Undesignated site	116735	157742	F; FW
72	CLOONAMIRRAN WOOD cNHA	cNHA; ASI	172483	187390	F; FW; FW4; P; PB; PB3; WN7; BL; BL3; B; W; WN
73	CLOONAWEE LOUGH	Undesignated site	137509	178308	PF1; PF; P
74	CLOONCONEEN POOL	SAC	83597	149737	C; CW; CW1
75	CLOONCOOSE LOUGH	Undesignated site	150758	181751	PF; P
76	CLOONDANNAGH LOUGH cNHA	cNHA; SPA	150200	183000	PF1; PF3; P; PF; F; FL; FS; FS1; PB; PB4
77	CLOONEY LOUGH	Undesignated site	142200	178700	F; FL; FS; FS1; GM; GM1
78	CLOONLOUM MORE BOG NHA	NHA	152612	176725	F; FL; FL1; G; GM; GM1; GS4; GS; P; PB; PB1; PB4; W; WD; WD4; WS; WS1
79	CLOONSNAGHTA LOUGH cNHA	cNHA	121500	159400	W; WL; WL1; WN; WS; WS1; HH; H; GA; GA1; E; ED; ED1; BL; BL1; BL3; B; WN7; P; PB; HH3; GS4; GM1; GM; G; FW4; FS1; FS; FL2; FL; F
80	CLOONTEEN LOUGH	Undesignated site	134107	182510	F; FL; FS; FS1; G
81	COOLAGH RIVER cNHA	cNHA			F; FW; FW1; G; GS4; GS; P; PB; B; BL; BL3; E; EU; EU1; GA; GA1; W; WD; WD4; WS; WS1
82	COOLNATULLAGH	Undesignated site	131200	203000	PF; P
83	COOLORTA TURLOUGH	Undesignated site	134000	196000	F; FL; FL6
84	COOLREASH LOUGH	SAC; NP	132960	194522	PF1; PF; P; FL3; FL; F; FL6; FS1; FS
85	COOLREASH LOUGH	Undesignated site	132000	194000	F; FL
86	COROFIN WETLANDS SPA	SPA			WS; WS1; WD4; W; WD; GS; G; GA1; GA; PF; P; PB; PB4; GS4; GM; FW2; FW; FS; FS1; F; FL
87	CORRACLOON MORE (WATERFALLS)	Undesignated site	159419	190997	F; FW; FW1
88	CRAGGAN WEST	SAC	119350	203300	P; PB
89	CRAGMURNIA LOUGH	Undesignated site	154462	180579	P; PB; F; FL
90	CRAGNASHINGAUN BOGS NHA	NHA	113166	168337	PF3; PB2; PB3; F; FL; FL1; FL2; FW; FW4; GS4; GS; G; HH3; HH; P; PB; PB1; PB4; PF; E; ED; ED1; ER; ER1; H; HH1; W; WS
91	CRATLOE CREEK	pNHA; ASI; SAC	151538	158841	L; LR; LS; FW4; FW; F
92	CREEHAUN TURLOUGH	SAC	132938	194224	FL6; FL; F

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In alphabetical order by site name.

CWS Site Code	CWS Site Name	Site designations	Easting Centre	Northing Centre	Main Fossitt Habitat Present
93	CREEVOSHEEDY BOG cNHA	cNHA			F; FW; FW4; G; GS4; P; PB; PB4; WN7; BL; BL3; GS; W; WD; WD4; WN; WS; WS1
94	CREGG LOUGH cNHA	cNHA	174491	189173	WS1; WS; WN; W; F; FL
95	DANES HOLE, POULNALECKA cNHA	cNHA	152978	171892	F; FW; FW2; FW4; G; GS4; B; BL; BL3; E; EU; EU1; GA; GA1; GS; W; WL; WL1; WL2; WN; WN1; WS; WS1; WS2; WS5
96	DANES HOLE, POULNALECKA SAC	SAC	152978	171892	F; FW; FW2; FW4; G; GS4; B; BL; BL3; E; EU; EU1; GA; GA1; GS; W; WL; WL1; WL2; WN; WN1; WS; WS1; WS2; WS5
97	DERRYFADDA	Undesignated site	160837	161097	P; PB; PB1
98	DERRYGEEHA LOUGH cNHA	cNHA	115298	156615	W; WL; WL1; WN; WN2; WS; WS1; GS; ER; ER2; E; BL3; BL; B; WN7; WN6; PB4; PB; P; GS4; GM1; GM; G; FW4; FW; FS1; FS; F; FL; PF3; PF; FL2; FL4
99	DOBHACH BHRAININ	Undesignated site	116000	210000	P; PB
100	DOON LOUGH cNHA	cNHA	143630	190164	PF1; PF; P
101	DOON LOUGH NHA	NHA	155086	174250	F; FL; FL1; FS; FS1; FW4; FW; FW2; G; GM; GM1; GS4; GS; P; PB; PB1; PF; PF1; WN6; WN; B; BL; BL1; BL3; GA; GA1; W; WD; WD1; WD2; WS; WS1
102	DOONAGORE LOUGH	Undesignated site	107599	194521	F; FL
103	DROMOLAND LOUGH cNHA	cNHA; ASI	138688	170853	PF1; GM1; PF3; FS1; F; FL; FL4; FS; G; GM; P; PF; W; WS; WS1; FL3; WN6; WN; FW4; FW
104	DROMORE WOODS AND LOUGHS cNHA	cNHA; COR; NNR	135832	186810	F; FL; FL5; FL6; FS; FS1; FW; FW4; FW2; G; GM; GM1; GS4; GS; P; PB; PB4; PF; WN6; WN; W; BL; B; BL1; BL3; E; ER; ER2; GA; GA1; GS1; H; HD; HD1; WD; WD1; WD2; WN2; WS; WS1
105	DROMORE WOODS AND LOUGHS SAC	SAC; COR; NNR	135832	186810	F; FL; FL5; FL6; FS; FS1; FW; FW4; FW2; G; GM; GM1; GS4; GS; P; PB; PB4; PF; WN6; WN; W; BL; B; BL1; BL3; E; ER; ER2; GA; GA1; GS1; H; HD; HD1; WD; WD1; WD2; WN2; WS; WS1
106	DRUMCAVAN LOUGH	SAC	129837	186671	PF1; PF; P
107	DRUMCLIFF	Undesignated site	131960	179630	F; FL; FL6
108	DRUMCULLAUN LOUGH	Undesignated site	119000	182000	F; FL
109	EAST BURREN COMPLEX cNHA	cNHA; COR	130000	200000	F; FL; FL3; FL4; FL6; FP; FP1; FS; FS1; FS2; FW; FW2; FW4; G; GM; GM1; GS4; GS; HH4; HH; H; P; PB; PB4; PF; PF1; WN6; WN; W; BL; B; BL1; BL3; E; ED; ED1; ED3; ER; ER2; ER4; EU1; EU; GA; GA1; GS1; GS2; GS3; HD; HD1; HH2; WD; WD2; WD4; WN2; WS; WS1
110	EAST BURREN COMPLEX SAC	SAC; COR	130000	200000	F; FL; FL3; FL4; FL6; FP; FP1; FS; FS1; FS2; FW; FW2; FW4; G; GM; GM1; GS4; GS; HH4; HH; H; P; PB; PB4; PF; PF1; WN6; WN; W; BL; B; BL1; BL3; E; ED; ED1; ED3; ER; ER2; ER4; EU1; EU; GA; GA1; GS1; GS2; GS3; HD; HD1; HH2; WD; WD2; WD4; WN2; WS; WS1
111	FAHEE TURLOUGH	SAC; cNHA	129530	190380	FL6; FL; F
112	FARRIHY LOUGH cNHA	cNHA	91000	164000	CW; CW1; F; FS; FS1; FW; FW4; G; GM; GM1; GS4; GS; B; BL; BL1; C; CS; CS3; GA; GA1; L; LR; LR3; LS; LS2; W; WS; WS1
113	FAUNRUSK LOUGH	SAC; cNHA	135003	183825	PF1; PF; P
114	FEENAGH	Undesignated site	119000	206000	P; PB
115	FENLOE LAKE	Undesignated site			F; FL
116	FERGUS ESTUARY AND INNER SHANNON, NORTH SHORE	pNHA	133500	160000	WS; WN; WL; W; L; LR; LS; GS; GA1; GA; G; ER; ED3; ED; E; C; BL3; BL1; BL; B; GS4; FW4; FW; F; FS

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117	FERGUS RIVER	pNHA; SAC	133904	179983	F; FW; PF; P; PF3
118	FIN LOUGH (CLARE) cNHA	cNHA; ASI	143000	169000	PF1; GM1; FS; FS1; F; FL; FL3; FW; FW4; G; GM; GS4; GS; HH3; HH; H; P; PB; PB1; PF; WN7; WN; W; B; BL; BL1; BL3; E; ER; ER2; GA; GA1; WD; WD1; WS; WS1; WN6; GS1
119	FINAVARRA-BALLYVAUGHAN COAST	pNHA	126000	211000	WS; W; LS2; LS; LR; L; HD1; HD; H; GS; GA1; GA; G; ER2; ER; ED3; ED; E; CS2; CS; CS3; CD; C; BL3; BL1; BL; B; CW; CW1; CM
120	FIR LOUGH	Undesignated site	162967	183200	PF3; PF; P; FL4; FL5; FL; F; FS1; FS; PB
121	FORMOYLE	Undesignated site	116000	207000	F; FW
122	GALWAY BAY COMPLEX cNHA	cNHA; COR	130000	220000	GM1; PF1; FS; FS1; CM; CM1; CM2; CS; CS2; F; FL; FL6; FW; FW2; FW4; G; GM; GS4; GS; P; PF; WN6; WN; W; B; BC; BC1; BL; BL1; BL3; C; CB; CB1; CD; CD1; CD2; CD3; CS3; E; ED; ED1; ED3; ED5; ER; ER2; GA; GA1; GA2; GS1; GS2; H; HD; HD1; HH; HH2; L; LR; LR2; LR3; LR4; LS; LS1; LS2; LS3; WD; WD1; WL; WL1; WL2; WN2; WS; WS1
123	GALWAY BAY COMPLEX SAC	SAC; COR	130000	220000	GM1; PF1; FS; FS1; CM; CM1; CM2; CS; CS2; F; FL; FL6; FW; FW2; FW4; G; GM; GS4; GS; P; PF; WN6; WN; W; B; BC; BC1; BL; BL1; BL3; C; CB; CB1; CD; CD1; CD2; CD3; CS3; E; ED; ED1; ED3; ED5; ER; ER2; GA; GA1; GA2; GS1; GS2; H; HD; HD1; HH; HH2; L; LR; LR2; LR3; LR4; LS; LS1; LS2; LS3; WD; WD1; WL; WL1; WL2; WN2; WS; WS1
124	GARRANNON WOOD cNHA	cNHA; ASI	149437	160729	W; WD; WD1; WL; WN; WN1; WN2; WS; WS1; WS2; WS4; BL; B; BL1; WN6; FW4; FW; F
125	GARVILLAUN LOUGH	Undesignated site	124837	182922	F; FL; FL2; GS4; GS; G
126	GLENDREE BOG cNHA	cNHA; SPA	151000	188000	PF2; PF1; FS; FS1; F; FL; FL2; FW; FW1; P; PB; PB2; PB4; PF; E; ED; ED1; ER; ER1; H; HH; HH1; W; WS; WS1
127	GLENDREE BOG SAC	SAC	151000	188000	PF2; PF1; FS; FS1; F; FL; FL2; FW; FW1; P; PB; PB2; PB4; PF; E; ED; ED1; ER; ER1; H; HH; HH1; W; WS; WS1
128	GLENINAGH SPRING		117303	211455	FP1; FP; F
129	GLENOMRA WOOD cNHA	cNHA; ASI; SAC	161011	167605	W; WL; WN; WN1; WS; WS1; WS5; GS; H; HD; HD1; BL3; BL; B; WN7; P; PB; PB1; GS4; GM1; GM; G; FW; FW1; F
130	GLENOMRA WOOD SAC	SAC; ASI	161011	167605	W; WL; WN; WN1; WS; WS1; WS5; GS; H; HD; HD1; BL3; BL; B; WN7; P; PB; PB1; GS4; GM1; GM; G; FW; FW1; F
131	GLENQUIN TURLOUGH	NP; SAC	131860	196050	FL6; FL; F
132	GORTACULLIN BOG NHA	NHA	155376	170706	PF2; PB2; PB4; F; FW; FW1; FW4; G; GS4; GS; HH3; HH; H; P; PB; PF; HH1; W; WS; WS1
133	GORTAVRULLA	Undesignated site	159627	189995	F; FW
134	GORTGLASS LOUGH cNHA	cNHA; ASI	122371	159766	F; FL; FL2; FS; FW; FW4; G; GM; GM1; GS4; GS; P; PB; PB3; PB4; W; WN; WS; WS1
135	GORTLECKA TURLOUGH	NP; SAC	131900	195000	FL6; FL; F
136	INAGH RIVER ESTUARY cNHA	cNHA; WS	110140	189065	CM; CM1; CM2; CW; CW2; F; FS; FS1; FW; FW2; FW4; G; GS4; GS; WN6; B; BL; BL1; BL3; C; CD; CD1; CD2; CD3; E; ED; ED4; GA; GA1; GA2; L; LR; LS; LS1; LS2; LS3; W; WD; WD1; WL; WL1; WN; WS; WS1; CB1
137	INAGH RIVER ESTUARY SAC	SAC; WS	110140	189065	CM; CM1; CM2; CW; CW2; F; FS; FS1; FW; FW2; FW4; G; GS4; GS; WN6; B; BL; BL1; BL3; C; CD; CD1; CD2; CD3; E; ED; ED4; GA; GA1; GA2; L; LR; LS; LS1; LS2; LS3; W; WD; WD1; WL; WL1; WN; WS; WS1

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138	INCHICRONAN LOUGH cNHA	cNHA; ASI; COR	139000	186000	PF1; GM1; FS; FS1; F; FL; FW; FW4; G; GM; GS4; GS; P; PB; PB4; PF; WN6; WN; W; B; BL; BL1; BL2; BL3; E; ED; ED5; ER; ER2; GA; GA1; GS2; WN2; WS; WS1
139	INCHIQUIN LAKE	pNHA; ASI; SAC	127000	189800	W; WD; H; HD; HD1; GS; GA; GA1; G; GS4; FW; FS; F; FL; PF; PF3; FS1; FL3; PF1
140	INGHID (LOUCID) BRIDGE	Undesignated site	140000	191000	PB; P
141	INISHDEA	SAC	129666	165727	GM; GS4; G
142	INISHMORE	Undesignated site	135239	184549	PF1; PF; P
143	INNER GALWAY BAY SPA	SPA	130000	220000	CM; CM1; CM2; CW; CW1; CW2; F; FL; FL6; FS; FS1; FW; FW2; FW4; G; GM; GM1; GS; GS4; P; PF; PF1; WN6; WN; W; B; BC; BC1; BL; BL1; BL3; C; CB; CB1; CD; CD1; CD2; CD3; CS; CS2; CS3; E; ED; ED1; ED3; ED5; ER; ER2; GA; GA1; GA2; GS1; GS2; H; HD; HD1; HH2; L; LR; LR2; LR3; LR4; LS; LS1; LS2; LS3; WD; WD1; WL; WL1; WL2; WN2; WS; WS1
144	KEEVAGH - RINNEEN	Undesignated site	140778	175130	PF1; PF; P; FS1; FS; F; GS4; GS; G
145	KENNEDY'S LOUGH	Undesignated site	137805	185632	PF1; PF; P; GS4; GS; G; FL4; FL; F
146	KILBRECKAN LOUGH cNHA	cNHA	136640	176124	PF1; PF3; P; PF; F; FL; FS; FS1
147	KILCORNEY TURLOUGH	Undesignated site	122340	199400	FL6; FL; F
148	KILFENORA	Undesignated site	118000	192000	P; PB
149	KILGORY LOUGH	Undesignated site	154100	178000	F; FL
150	KILLEANY TURLOUGH	Undesignated site	116550	200930	FL6; FL; F
151	KILLEENMACOOG TURLOUGH	Undesignated site	135320	201300	FL6; FL; F
152	KILLIAN	SAC; cNHA	136303	185533	PF1; PF; P
153	KILMACDUAGH	pNHA; SAC	139500	200700	
155	KILONE LOUGH NEAR ABBEY	SAC	132000	173000	F; FL
157	KNOCKALISHEEN MARSH	pNHA; SAC	156523	160480	F; FL; FS; FW; FW4; G; GS4; GS; B; BL; BL3; GA; GA1; W; WL; WS
158	KNOCKAUNROE TURLOUGH I	pNHA; SAC	131400	194180	F; FL; FL6; FS; G; GS4; GS; P; PB; PB4; E; ER; ER2; PF; PF1
159	KNOCKAUNROE TURLOUGH II	SAC	130700	193450	F; FL; FL6
160	KNOCKAUNS MOUNTAIN	pNHA	112291	203011	GS; ER; ER2; E; BL3; BL1; BL; B; P; PB; FW4; FW; F
161	KNOCKAVOARHEEN cNHA	cNHA	118500	198500	F; FW; FW2; G; GS4; GS; HH3; HH; H; P; PB; PB4; PB1; B; BL; BL3; GA; GA1; W; WD; WD4; WS; WS1
162	KNOCKNAGROAGH TURLOUGH	Undesignated site	122800	206850	FL6; FL; F
163	KNOCKNALARABARNAGH	Undesignated site	108000	194000	P; PB
164	LACKAREAGH TURLOUGH	SAC	131561	196472	FL6; FL; F
165	LATOON BRIDGE	Undesignated site	138000	172000	CW2; CW; C
166	LICKEEN LOUGH	Undesignated site	117590	190994	F; FL
168	LISKET TURLOUGH cNHA	cNHA	120500	194000	GA; G; GA1; GS; BL3; BL; B; GS4; GM1; GM; FL6; F; FL
169	LOCH AN TEASCTHA	Undesignated site	141000	171000	F; FL
171	LOCH NACALLY	SAC	150897	188121	P; PB
172	LOOP HEAD	pNHA; ASI; SPA	68720	147120	CM; F; FL; FS; G; B; BL; BL1; C; CS; CS1; CS2; GA; GA1; H; HH; HH3
173	LOOP HEAD SPA	SPA; ASI	68000	140000	CM; F; FL; FS; G; B; BL; BL1; C; CS; CS1; CS2; GA; GA1; H; HH; HH3
174	LOUGH ACROW BOGS NHA	NHA	120174	169105	PF2; PF3; PB2; PB3; F; FL; FL1; FL2; FW; FW1; FW4; G; P; PB; PB4; PF; B; BL; BL3; E; ER; ER1; GS; GS3; H; HH; HH1; W; WD; WD4; WS; WS1

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175	LOUGH ALEENAUN TURLOUGH	pNHA; SAC	124740	195440	WS; WN; W; GS; ER2; ER; E; GS4; G; FW; FL6; F; FL
176	LOUGH ALEWNAGHTY	COR; pNHA; cNHA; SP	176000	191400	PF1; PF; P; FS1; FS; F
177	LOUGH ARDNAMURRAY	Undesignated site	138199	179855	PF1; PF; PF3; FL3; FS1; FS; FL; F; FS2
178	LOUGH ATEDAUN	pNHA; ASI; SAC	129649	188472	F; FL; FL6; FS; FW; FW4; G; GS4; GS; B; BL; BL1; E; ER; W; WL; PF; PF1; P
179	LOUGH ATORICK AND BLEACH RIVER cNHA	cNHA	161911	196587	W; WD; WD4; FW; FW1; FL2; FL; F
180	LOUGH ATORICK DISTRICT BOGS NHA	NHA	161972	194078	PF3; F; FL; FL1; FL2; FS; FS2; FW4; FW; HH3; HH; H; P; PB; PB3; PB4; PF; B; BL; BL3; W; WS; WS1
181	LOUGH BRIDGET	Undesignated site	156000	180000	F; FL; FS; FS1; GM; FS2; W; WN6; WN
182	LOUGH BUNNY	pNHA; ASI; NP; SAC	137000	196200	F; FL; PF; PF1; P; G; GS; GS1; FS; FS1; FS2; FL3
183	LOUGH CAUM	Undesignated site	118704	181618	P; PF
184	LOUGH CLEGGAN cNHA	cNHA; ASI	131775	180682	F; FL; FS; FS1; FW; FW2; FW4; G; GM; GM1; GS4; GS; B; BL; BL1; BL3; GA; GA1; GA2; W; WN; WN2; WS; WS1
185	LOUGH CULLAUN	SAC	131400	190700	F; FL; GS; GS1; FS; FS1; PF; PF1; P; G; PB4; PB; PF3
186	LOUGH CULLAUNYHEEDA cNHA	cNHA	148500	174500	PF1; GM1; FS; FS1; F; FL; PF; P; WN; WN6
187	LOUGH DERG (SHANNON) SPA	SPA	178000	192000	F; FL; FL3; FL4; FP; FP1; FS; FS1; FS2; FW; FW2; FW4; G; GM; GM1; GS4; GS; HH3; HH; H; P; PB; PB1; PB4; PF; PF1; WN7; WN; W; B; BL; BL1; BL3; E; ED; ED1; ER; ER1; ER2; GA; GA1; GA2; HD; HD1; HH2; WD; WD1; WD2; WD4; WL; WN1; WN2; WS; WS1
188	LOUGH DERG cNHA	cNHA; COR	178000	192000	F; FL; FL3; FL4; FP; FP1; FS; FS1; FS2; FW; FW2; FW4; G; GM; GM1; GS4; GS; HH3; HH; H; P; PB; PB1; PB4; PF; PF1; WN7; WN; W; B; BL; BL1; BL3; E; ED; ED1; ER; ER1; ER2; GA; GA1; GA2; HD; HD1; HH2; WD; WD1; WD2; WD4; WL; WN1; WN2; WS; WS1
189	LOUGH DERG, SOUTH WEST AREA	pNHA	169000	184000	
190	LOUGH DONNELL	ASI; SAC; pNHA	100000	171000	F; FL; FS; FW; FW4; G; GM; GM1; GS4; GS; L; LR; LS; C; CW; CW1
191	LOUGH EA	Undesignated site	149850	188624	F; FL
192	LOUGH EENAGH	Undesignated site	125950	182390	F; FL
193	LOUGH GASH TURLOUGH cNHA	cNHA	139210	167820	F; FL; FL6; FS; FS2; FW; FW2; G; GM; GM1; GS4; GS; E; ER; GA; GA1; W; WD; WD1; WS; WS1
194	LOUGH GASH TURLOUGH SAC	SAC	139210	167820	W; WD; WD1; WS; WS1; GS; GA1; GA; G; E; ER; GS4; GM1; GM; FW4; FS2; FS; FL6; F; FL
195	LOUGH GEALAIN TURLOUGH	SAC; NP	131450	194730	FL6; FL; F
196	LOUGH GEORGE	SAC	134250	191400	F; FL; GS; GS1; FS; FS1; PF; PF1; P; PB; PB4; W
197	LOUGH GIRROGA cNHA	cNHA; SAC	134800	179700	PF1; P; PF; F; FL; FS; FS1; G
198	LOUGH GOLLER cNHA	cNHA	112367	196247	F; FL; FS; FS1; FW
199	LOUGH GORTEEN, CRATLOE	Undesignated site	148865	161926	F; FL
200	LOUGH GRANEY cNHA	cNHA	155596	193161	F; FL; G; GS4; GS
201	LOUGH GRANEY WOODS cNHA	cNHA; ASI	155529	193090	FP; F; FW; FW4; G; WN6; WN; W; WL; WN1
202	LOUGH KEAGH	Undesignated site	110009	181094	P; PB
203	LOUGH KEAGH TURLOUGH	SAC	132018	188245	F; FL; FL6
204	LOUGH LUACH	Undesignated site	106080	193650	P; PB
205	LOUGH LUIRK	SAC	128000	207000	F; FL

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206	LOUGH MURREE & FINAVARRA	ASI; SAC; cNHA	126000	211000	F; FL; C; CW; CW1
207	LOUGH NAMINNA BOG NHA	NHA	117755	171026	PF2; HH1; HH3; PB2; PB4; WS; WS1; W; H; HH; PB; P; FL2; FL; F; FL1
208	LOUGH NANILLAUN	Undesignated site	145954	170350	PF1; PF; P; GS4; GS; G
209	LOUGH O'GRADY cNHA	cNHA	161500	183500	F; FL; FS; FS1; FS2; FW; FW2; FW4; G; GM; GM1; GS4; GS; P; PB; PB4; WN4; WN5; WN6; WN7; B; BL; BL1; BL3; GA; GA1; W; WD; WD1; WL; WL1; WN; WN2; WS; WS1
210	LOUGH RAHA	Undesignated site	126630	185965	F; FL
211	LOUGH RASK EAST	Undesignated site	124012	208135	C; CW; CW1
212	LOUGH RASK WEST	Undesignated site	122922	208056	C; CW; CW1
213	LOUGH SKEARDEEN	SAC	138896	199053	PF1; PF; P; FL3; FL6; FL; F; FS1; FS; GS4; GS; G
214	LOUGHANILLOON BOG NHA	NHA	156000	182000	W; WD; WD2; WL; WN; WS; WS1; GS; B; BL; BL3; WN7; PF2; PF; PB4; PB; P; PB1; GS4; G; FW4; FW; FW2; FS1; FS; FL4; FL; F
215	LOUGHATORICK SOUTH	COR; NHA ; SPA; SAC	168000	193000	PF2; PF; P; PB2; PB; FS1; FS; F; HH; H
216	LOUGHATORICK SOUTH BOG cNHA	COR; cNHA; SPA; SAC	167000	194000	F; FS; FS1; FW; FW1; G; GM; GM1; HH3; HH; H; P; PB; PB2; PB4; PF; PF2; B; BL; BL3; HH1; W; WD; WD4; WS; WS1
217	LOUGHATORICK SOUTH BOG SAC	SAC; COR	167000	194000	F; FS; FS1; FW; FW1; G; GM; GM1; HH3; HH; H; P; PB; PB2; PB4; PF; PF2; B; BL; BL3; HH1; W; WD; WD4; WS; WS1
218	LOUGHOUNROE	SAC	136710	185319	PF1; PF; P; FL3; FL4; FS1; FS2; FS; FL; F
219	LOWER RIVER SHANNON cNHA	cNHA	130000	160000	W; WD; WD1; WD4; WL; WL1; WN; WN1; WN2; WS; WS1; L; LR; LR1; LR2; LR5; LS; LS1; LS2; LS4; HH; H; HD; HD1; HH1; GS3; GS; GA2; GA1; GA; G; ER2; ER1; ER; ED5; ED4; ED3; ED2; ED1; ED; E; CS3; CS2; CS1; CS; CD3; CD2; CD1; CD; CC; CC1; CB1; CB; C; B; BL; BL1; BL3; WN7; WN6; WN5; PF; PB4; PB1; PB; P; HH3; GM1; GM; FW4; FW3; FW2; FW1; FW; FS2; FS1; FS; FL8; FL7; F; FL
220	LOWER RIVER SHANNON SAC	SAC	130000	160000	W; WD; WD1; WD4; WL; WL1; WN; WN1; WN2; WS; WS1; L; LR; LR1; LR2; LR5; LS; LS1; LS2; LS4; HH; H; HD; HD1; HH1; GS3; GS; GA2; GA1; GA; G; ER2; ER1; ER; ED5; ED4; ED3; ED2; ED1; ED; E; CS3; CS2; CS1; CS; CD3; CD2; CD1; CD; CC; CC1; CB1; CB; C; B; BL; BL1; BL3; WN7; WN6; WN5; PF; PB4; PB1; PB; P; HH3; GM1; GM; FW4; FW3; FW2; FW1; FW; FS2; FS1; FS; FL8; FL7; F; FL
221	MAGHERA MOUNTAIN BOGS NHA	NHA	146251	187949	PF2; PF3; PB2; HH3; F; FL; FL1; FL2; FW; FW4; G; GS4; GS; HH; H; P; PB; PB1; PB5; PB4; PF; B; BL; BL1; E; ED; ED4; ED5; ER; GS3; HH1; W; WD; WD4; WS; WS1
222	MID-CLARE COAST SPA	SPA	100000	175000	CW; CW1; CW2; F; FP; FP1; FS; FS1; FW; FW2; FW4; G; GM; GM1; GS4; GS; B; BL; BL1; BL3; C; CB; CB1; CD; CD1; CD2; CD3; CS; CS1; CS2; CS3; E; ER; GA; GA1; GS1; H; HH; HH1; L; LR; LR1; LS; LS2
224	MONEEN MOUNTAIN cNHA	cNHA; COR	126500	207500	W; WN; WN2; WS; WS1; LS4; LS; L; HH2; HH; HD1; HD; H; GS1; GS; GA1; GA; G; EU1; EU; ER2; ER1; ER; E; ED3; ED2; ED; C; BL3; BL; B; BL1; HH4; GS4; FS1; FS; FP1; FP; FL6; FL; F; CW1; CW; CM; CM2
225	MONEEN MOUNTAIN SAC	SAC; COR	126500	207500	W; WN; WN2; WS; WS1; LS4; LS; L; HH2; HH; HD1; HD; H; GS1; GS; GA1; GA; G; EU1; EU; ER2; ER1; ER; E; ED3; ED2; ED; C; BL3; BL; B; BL1; HH4; GS4; FS1; FS; FP1; FP; FL6; FL; F; CW1; CW; CM; CM2
226	MONMORE BOG	SAC; pNHA	94682	163340	P; PB; PB1; PB4
227	MONREAGH - RATHWILLADOON	Undesignated site	140372	193487	PF1; PF; P

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In alphabetical order by site name.

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228	MOOGHAUN LOUGH	Undesignated site	141219	171473	PF1; PF; P; FL3; FL4; F; FL; FS1; FS
229	MOUNT CALLAN OAKWOOD, INAGH cNHA	cNHA			F; FW; FW1; W; WN; WN1
230	MOYREE RIVER SYSTEM cNHA	cNHA; COR	138000	190000	F; FL; FS; FS1; FS2; FW; FW2; FW4; G; GM; GM1; GS4; GS; P; PB; PB4; PF; PF1; PF3; WN6; WN; W; B; BL; BL1; BL3; E; ER; ER2; EU; EU1; GA; GA1; GS1; H; HD; HD1; HH; HH2; WD; WD4; WL; WL1; WL2; WN2; WS; WS1; WS2
231	MOYREE RIVER SYSTEM SAC	SAC; COR	138000	190000	F; FL; FS; FS1; FS2; FW; FW2; FW4; G; GM; GM1; GS4; GS; P; PB; PB4; PF; PF1; PF3; WN6; WN; W; B; BL; BL1; BL3; E; ER; ER2; EU; EU1; GA; GA1; GS1; H; HD; HD1; HH; HH2; WD; WD4; WL; WL1; WL2; WN2; WS; WS1; WS2
232	MOYRIESK - FINANAGH LOUGHS	Undesignated site	139769	178034	PF1; PF; P
233	MUCKANAGH LOUGH	SAC	137000	193000	F; FL; FS; FS1; PF; PF1; P; PB4; GS; G; GS4
234	MUCKINISH LAGOON	SAC	127291	210445	C; CW; CW1
235	MUCKINISH LOUGH TURLOUGH	SAC	127560	208750	FL6; FL; F
236	MULLAGH MORE	pNHA; ASI; NP; SAC	131000	194000	FL6; FL; F
237	MUTTON ISLAND (CLARE)	pNHA; ASI	97000	174000	GS; G; F; FL
238	MUTTON ISLAND (CLARE) SPA	SPA; ASI	97000	174000	F; FL; GS; G
239	NEWGROVE HOUSE cNHA	cNHA	145000	180700	W; WD; WL; EU; EU2; GA; GA1; GS; E; BL3; BL; B; GS4; G; FW4; FW; F
240	NEWGROVE HOUSE SAC	SAC	145000	180700	W; WD; WL; EU; EU2; GA; GA1; GS; E; BL3; BL; B; GS4; G; FW4; FW; F
241	NEWHALL AND EDENVALE COMPLEX cNHA	cNHA; COR	132000	173000	F; FL; FL5; FP; FP1; FS; FS1; FW; FW1; FW4; G; GS4; GS; WN6; B; BL; BL3; BL1; E; ER; ER2; EU; EU1; GA; GA1; H; HD; HD1; W; WD; WD1; WL; WL1; WN2; WN; WS; WS1
242	NEWHALL AND EDENVALE COMPLEX SAC	SAC; COR	132000	173000	F; FL; FL5; FP; FP1; FS; FS1; FW; FW1; FW4; G; GS4; GS; WN6; B; BL; BL3; BL1; E; ER; ER2; EU; EU1; GA; GA1; H; HD; HD1; W; WD; WD1; WL; WL1; WN2; WN; WS; WS1
243	NEWQUAY	Undesignated site	126000	212000	C; CM
244	NEWTOWN	Undesignated site	126000	212000	P; PF
245	NOOAN TURLOUGH & FEN	Undesignated site	132270	185310	FL6; FL; F; PF1; PF; P
246	O'BRIEN'S BIG LOUGH cNHA	cNHA	141000	182500	PF1; P; PF; FS; FS1; F; GM; GM1
249	OLD DOMESTIC BUILDING, RYLANE cNHA	cNHA	143580	182508	B; BL; BL3; FP1; FP; F
250	OLD DOMESTIC BUILDINGS, RYLANE SAC	SAC	143580	182508	B; BL; BL3; FP1; FP; F
251	OUTER SHANNON ESTUARY	pNHA			
252	OWENAGARNEY/RATTY RIVER	SAC	146000	161000	FS; FS1; F; CM; C
253	OYSTERMAN'S MARSH NHA	NHA	141332	185339	PF1; HH3; PB3; FS1; FL2; F; FL; FL1; FS; FW; FW4; G; GS; GS4; HH; H; P; PB; PB4; PF; PF3; WN7; B; BL; BL1; BL3; E; ER; ER1; EU; EU2; GA; GA1; HD; HD1; HH1; W; WD; WD4; WN; WN1; WS; WS1
254	PARTEEN	Undesignated site	157700	160200	C; CW; CW2
255	POLL AN IONAIN CAVE cNHA	cNHA			B; BL; BL3; E; F; FW; FW1; G; EU; EU1; W; WL; WL1; WS; WS1
256	POLLAGOONA BOG cNHA	cNHA; SPA	164175	196088	W; WD; WD4; WS; WS5; PB4; PB2; PB; P; FW1; FW; F
257	POLLAGOONA BOG SAC	SAC	164175	196088	W; WD; WD4; WS; WS5; PB4; PB2; PB; P; FW1; FW; F
259	POULADATIG CAVE cNHA	cNHA	130191	176158	F; FW; FW2; FW4; G; GS4; GS; B; BL; BL1; E; EU; EU1; GA; GA1; W; WL; WL1; WS; WS1

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In alphabetical order by site name.

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260	POULADATIG CAVE SAC	SAC	130191	176158	F; FW; FW2; FW4; G; GS4; GS; B; BL; BL1; E; EU; EU1; GA; GA1; W; WL; WL1; WS; WS1
261	POULAHOYLE LOUGH	Undesignated site	143134	172314	PF1; PF; P
262	POULAVALLAN AND GLEN OF CLAB	pNHA; ASI; SAC	129000	202291	W; WN; GS; ER; E; BL3; BL1; BL; B; G; FW; F
263	POULEENACOONA TURLOUGH	SAC	136610	202210	FL6; FL; F
265	POULNASHERRY BAY	pNHA; ASI	94000	157000	LS; LS2; L; GS; C; GS4; G; CM1; CM
266	POULROE TURLOUGH	SAC	138024	196280	FL6; FL; F
267	RANNAGH WEST	SAC	127215	201165	PF1; PF; P
269	RATTY RIVER CAVE cNHA	cNHA	148028	168438	F; FW; G; B; BL; BL3; E; EU; EU1; GA; GA1; W
270	RATTY RIVER CAVE SAC	SAC	148028	168438	F; FW; G; B; BL; BL3; E; EU; EU1; GA; GA1; W
271	RED BOG - O'BRIENSBRIDGE cNHA	cNHA	165893	167848	P; PB; PB1
272	RINECAHA	SAC	136622	193867	PF1; PF; P; FL3; FL; F; FS1; FS; PB
273	RINNAMONA LOUGH AND FEN	pNHA; SAC	129630	194240	FL6; FL; F; FP; FP1; FL3; FS; FS1; P; PF; PF1
274	RINROE HOUSE	Undesignated site	132000	192000	PF; P
275	RINSKEA SHORE, LOUGH DERG	pNHA; ASI	178343	190097	PF1; PF; P
276	RIVER FERGUS ESTUARY	pNHA; ASI; SAC	135000	170000	GS4; GS; G
277	RIVER SHANNON	pNHA			
278	RIVER SHANNON AND RIVER FERGUS ESTUARIES SPA	SPA	130000	160000	C; CM; CM1; CM2; CW; CW1; CW2; F; FL; FL7; FL8; FS; FS1; FS2; FW; FW1; FW2; FW3; FW4; G; GM; GM1; GS4; GS; HH3; HH; H; P; PB; PB4; PB1; PF; WN5; WN6; WN7; WN; W; B; BL; BL1; BL3; CB; CB1; CC; CC1; CD; CD1; CD2; CD3; CS; CS1; CS2; CS3; E; ED; ED1; ED2; ED3; ED4; ED5; ER; ER1; ER2; GA; GA1; GA2; GS3; HD; HD1; HH1; L; LR; LR1; LR2; LR5; LS; LS1; LS2; LS4; WD; WD1; WD4; WL; WL1; WN1; WN2; WS; WS1
279	ROADFORD	Undesignated site	108222	197180	F; FW
280	ROSLARA LOUGH	Undesignated site	152500	182300	F; FL; FS; FS1
281	ROSROE LOUGH cNHA	cNHA	145000	170000	PF1; GM1; FS; FS1; F; FL; FW; FW2; FW4; G; GM; GS4; GS; P; PF; WN6; WN; W; B; BL; BL1; E; ER; ER2; GA; GA1; GS1; H; HD; HD1; HH; WD; WD4; WL; WL1; WL2; WN1; WS; WS1; FL3; PB; PB1; WN7
282	SCARRIF RIVER MOUTH	pNHA	166126	183687	GM; PF; P; G; F; FL
283	SCATTERY ISLAND	pNHA	97000	152000	L; LS; C; CW1; CW
284	SHANDANGAN LOUGH	SAC	130012	190830	F; FL
285	SHANNON AIRPORT LAGOON	SAC; SPA; cNHA	135000	162000	C; CW; CW1
286	SHANVALLY LOUGH	SAC	129615	186369	PF1; PF; P
287	SKAGHVICKINCROW	Undesignated site	117243	181404	P; PB
288	SKEHEEN LOUGH	Undesignated site	147009	169475	PF1; PF; P
289	SLIEVE AUGHTY MOUNTAINS cNHA	cNHA; NNR; SPA	149671	183667	WS5; WS1; WS; WD4; WD; W; HH1; HH; H; GS3; GS; G; ER1; ER; E; BL3; BL; B; PF2; PF; PB4; PB2; PB; P; HH3; FW4; FW1; FW; FS1; FS; FL2; FL1; FL; F
290	SLIEVE AUGHTY MOUNTAINS SPA	SPA; NNR	149671	183667	WS5; WS1; WS; WD4; WD; W; HH1; HH; H; GS3; GS; G; ER1; ER; E; BL3; BL; B; PF2; PF; PB4; PB2; PB; P; HH3; FW4; FW1; FW; FS1; FS; FL2; FL1; FL; F

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In alphabetical order by site name.

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291	SLIEVE BERNAGH BOG cNHA	cNHA	164539	178934	F; FL; FW; FW1; FW4; G; GS4; GS; HH3; HH; H; P; PB; PB2; PB3; PB4; B; BL; BL3; E; ER; GS3; HH1; W; WD; WD4; WL; WL1; WS; WS1
292	SLIEVE BERNAGH BOG SAC	SAC	164539	178934	F; FL; FW; FW1; FW4; G; GS4; GS; HH3; HH; H; P; PB; PB2; PB3; PB4; B; BL; BL3; E; ER; GS3; HH1; W; WD; WD4; WL; WL1; WS; WS1
293	SLIEVE ELVA	Undesignated site	115058	204402	P; PB
294	SLIEVECALLAN MOUNTAIN BOG NHA	NHA	114156	177329	PF2; PB2; F; FW4; G; HH3; HH; H; P; PB; PB4; PF; PF1; B; BL; BL3; GS; GS3; W; WD; WD4; WS; WS1
295	ST.SENAN'S LOUGH cNHA	cNHA; ASI	104840	154250	PF3; GM1; FS; FS1; W; WL; WL1; WS; WS1; H; HD; HD1; GS; B; BL; BL1; PF; PB; P; PB4; GS4; GM; G; FW4; FW; FL2; FL; F
296	STONEPARK LOUGH	Undesignated site	135760	181773	PF1; PF; P; PF3; FL; FS1; FS; F; GM; FS2; FL4; GS4; GS; G
297	TEMPLEBANNAGH LOUGH & BOG	Undesignated site	138000	194000	P; PB; F; FL
298	TERMON LOUGH cNHA	cNHA; SAC	140448	196974	F; FL; FL6; FS; G; GM; GM1; GS4; GS; B; BL; BL3; E; ER; ER2; GA; GA1; W; WS; WS1; FS1
299	TERMON LOUGH SAC	SAC	140448	196974	F; FL; FL6; FS; G; GM; GM1; GS4; GS; B; BL; BL3; E; ER; ER2; GA; GA1; W; WS; WS1; FS1
3	TOMEENS CAVE cNHA	cNHA			W; WL; WL1; WL2; EU; EU1; GA; GA1; G; E; B; BL; BL3; FW; F
300	TOWN LOUGH	Undesignated site	146313	168757	PF1; PF; P; FL; F; FS1; FS; FS2; GM; G; GS4
301	TRAVAUN-SKAGHARD TURLOUGH	SAC; NP	135550	196770	FL6; FL; F
302	TULLAGHABOY	Undesignated site	116064	173353	P; PB
303	TULLAHER LOUGH AND BOG cNHA	cNHA; ASI; COR	94671	162770	F; FL; FL1; FS; FS1; FW; FW4; G; GM; GM1; GS4; GS; P; PB; PB1; PB4; PF; PF2; PF3; WN6; WN; W; WN7; B; BL; BL1; BL3; GA; GA1; GS1; H; HD; HD1; WS; WS1
304	TULLAHER LOUGH AND BOG SAC	SAC; ASI; COR	94671	162770	F; FL; FL1; FS; FS1; FW; FW4; G; GM; GM1; GS4; GS; P; PB; PB1; PB4; PF; PF2; PF3; WN6; WN; W; WN7; B; BL; BL1; BL3; GA; GA1; GS1; H; HD; HD1; WS; WS1
305	TURKENAGH	NHA	166000	192000	P; PB
306	TURLOUGH	Undesignated site	128500	205100	FL6; FL; F
307	TURLOUGHMORE	pNHA; SAC	134751	199804	W; WL; WS; GS; ER2; ER; E; G; FL6; F; FL
308	TURLOUGHMORE II	Undesignated site	147480	176360	FL6; FL; F
309	TURLOUGHNAGULLAUN cNHA	cNHA	128161	204586	F; FL; FL6; G; GS4; GS; E; ER; ER2; W; WN; WS
310	UNNAMED LOCH	SAC; cNHA	151067	188587	F; FL
311	WATT'S LAKE, MULLACH MOR	Undesignated site	132000	195000	F; FL; FL3
312	WHITE HALL CREEK	Undesignated site	157400	159800	GM; G
313	WHITE STRAND/CARROWMORE MARSH cNHA	cNHA	99500	168500	F; FS; FW; FW4; G; GM; GM1; GS4; GS; B; BL; BL1; BL3; C; CD; CD2; CD3; CD5; E; ED; ED1; ED4; L; LR; LR1; LS; LS2
314	WOODCOCK HILL BOG NHA	NHA	152140	163187	W; WL; GS; GS3; HH; H; BL3; BL; B; PB3; PB2; PB; P; HH3; G; FW1; FW; F

The County Clare Wetlands Survey 2008 CD ROM

by Patrick Crushell & Peter Foss

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3. CWS Non-wetland Site Database (Requires Filemaker Pro 8.0v2)
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4. Selected Excel tables to accompany the County Clare Wetlands Survey Report including appendices; Size: 300 kb

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