9.0 AIR & CLIMATE

SCOPE OF STUDY

9.1 This chapter provides an air and climate impact assessment for the proposed Meenaboll landfill site.

9.2 The proposed landfill site will be designed to accept residual municipal waste and commercial waste with a proportion of biodegradable material in the waste in filled.

9.3 The air quality impacts on the surrounding area could be caused by four different types of emissions that occur during landfill site activities and are as follows:

- Landfill gas;
- Airborne pollutants;
- Dust; and
- Odour.

For inspection purposes only.
Consent of copyright owner required for any other use.

9.4 The aim of this assessment is therefore to estimate the extent of gas emissions that may arise during the operation of the waste management facility and their potential impact on the surrounding environment in terms of lateral migration, atmospheric dispersion and global warming; and to propose appropriate mitigation measures.

9.5 This chapter consists of the following:

- General definition of the Potential Emission Sources from landfill site activities;
- Description of the existing environment in the vicinity of the proposed site in terms of climate and ambient air quality;
- Prediction of landfill gas and airborne emissions resulting from the proposed landfill area and an assessment of their impacts on the surrounding environment; and
- Identification of both short-term construction and long-term operational emission sources and mitigation measures that are to be employed during the operation of the proposed landfill to moderate air quality impacts.

POTENTIAL EMISSION SOURCES

9.6 This section provides general information on the potential emissions that can occur during landfill site activities. This will address aspects such as landfill gas, flare gas, traffic fumes, dust and odours.

EPA Export 25-07-2013:16:19:30

Landfill Gas

9.7 Landfill gas is produced by the decomposition of the organic fraction of waste materials deposited in landfill sites. The main constituents of landfill gas are Methane (CH_4) and Carbon Dioxide (CO_2), with numerous trace gases also present in low concentrations. The majority of the trace gases are Non Methane Volatile Organic Compounds (NMVOC's).

9.8 The rate of decomposition varies from site to site, depending on the types of waste accepted and operational procedures. The speed and degradation of waste and the amount of landfill gas produced is a function of the physical dimensions of the site and conditions within the site, such as depth, temperature, moisture content, pH, waste density and nutrient content.

9.9 There are five stages in the decomposition of waste. Landfill gas will not be produced until the third stage is reached.

- **Phase I**: Aerobic decomposition of biodegradable materials; entrained atmospheric oxygen is converted to carbon dioxide.
- **Phase II**: Anaerobic decomposition commences as oxygen is used up; carbon dioxide concentration increases and some hydrogen is produced; no methane is produced at this stage.
- **Phase III**: Anaerobic methane production commences and rises to a peak; concentration as carbon dioxide declines; hydrogen production ceases.
- **Phase IV**: Steady methane and carbon dioxide generation in proportions of between 50-70% and 30-50% respectively.
- **Phase V**: Steady decline in generation of methane and carbon dioxide; gradual return to aerobic conditions.

Consent of copyright owner required for any other use.
For inspection purposes only.

9.10 The progression from Stage I to Stage III typically takes between 3 to 18 months and it is approximated that 50% of the available landfill gas will be generated within 5 to 15 years of the waste being deposited. However, traces of landfill gas may still be produced after the closure of the landfill site.

9.11 Table 9.1 illustrates the typical landfill gas composition published by the Environmental Protection Agency.

EPA Export 25-07-2013:16:19:30

Table 9.1 Typical Landfill Gas Composition

Component	Typical Volume (%)	Max Volume (%)
Methane	63.8	88.0
Carbon Dioxide	33.6	89.3
Oxygen	0.16	20.9
Nitrogen	2.4	87.0
Hydrogen	0.05	21.1
Carbon Monoxide	0.001	0.09
Ethane	0.005	0.0139
Ethene	0.018	
Acetaldehyde	0.005	
Propane	0.002	0.0171
Butanes	0.003	0.023
Helium	0.00005	
Higher Alkanes	<0.05	0.07
Unsaturated Hydrocarbons	0.009	0.048
Halogated Hydrocarbons	0.00002	0.032
Hydrogen Sulphide	0.00002	35.0
Organosulphur compounds	0.00001	0.028
Alcohols	0.00001	0.0127
Others	0.00005	0.023

Source: Environmental Protection Agency (EPA), Landfill Manuals, Landfill Site Design (2000)

For inspection purposes only.
Consent of copyright owner required for any other use.

Flare Gas

9.12 The purpose of a flare system is to burn landfill gas that might otherwise be vented into the atmosphere. This serves to reduce air emissions, control odours, and prevent off-site migration. A landfill gas flare can reduce the uncontrolled migration of landfill gas, decrease greenhouse gas emissions and contributes to the broader objectives of sustainable development. The main gas emissions that will need to be considered from the flaring system are as follows:

- **Carbon dioxide (CO_2)**

  The carbon dioxide is generated from the combustion of the methane, as illustrated to this reaction:

  $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

- **Hydrogen chloride/Hydrogen Fluoride (HCl/HF)**

  Landfill gas contains small amounts of halogenated organic compounds. When combusted these will generate gases, including hydrogen chloride. The concentration of this gas will depend upon the landfill gas composition.

EPA Export 25-07-2013:16:19:30

- **Nitrogen oxides (NOx)**

  The principal oxide of nitrogen formed in combustion processes is nitric oxide (NO). Some NO may be converted to nitrogen dioxide (NO_2), the mixture being referred to as NOx.

- **Sulphur Oxides (SOx)**

  The oxides of sulphur are formed from the oxidation of trace quantities of sulphur compounds in landfill gas.

- **Carbon monoxide (CO)**

  Carbon monoxide is the primary product of hydrocarbon oxidation and its concentration decreases by a relatively slow reaction, which forms CO_2. This is the ultimate product of carbon fuel combustion and its formation can not be avoided. Carbon monoxide can also be emitted from combustion plant as a consequence of incomplete combustion.

Traffic Fumes

9.13 Traffic fumes arise from vehicles associated with the construction and operation of the site. The compounds released into the air by vehicles give rise to a variety of environmental effects over different geographical ranges and time periods. The combustion of a hydrocarbon fuel in air produces mainly carbon dioxide (CO_2) and water vapour. However combustion engines are not 100% efficient, and some of the fuel is not burnt or only partially burnt, which results in the formation of organic compounds, carbon monoxide (CO) and particulates. In addition, at the high temperatures and pressures found in the combustion chamber, some of the nitrogen in the air and fuel is oxidised, forming nitric oxide (NO) and nitrogen dioxide (NO_2). These compounds are covered by the Air Quality standards described in section 9.30.

Consent of copyright owner required for any other use.
For inspection purposes only.

Dust

9.14 Dust is generally described as particulate matter in the size range 1 – 75µm. PM_{10} (particulates of a 10µm diameter or less) have the greatest impact on health issues and is therefore considered in the Air Quality Standards applicable in Ireland. There are a number of activities on a landfill site that could give rise to dust emissions, as follows:

- construction works;
- depositing of waste;
- depositing of cover materials; and
- general vehicle traffic within the site.

Odour

9.15 The main source of odour in traditional landfill sites is from landfill gas emissions, but can also arise from the storage and recirculation of leachate in landfill sites and the deposition of malodorous wastes. Modern engineered sites are now design and operated to a high standard to mitigate against these potential odours.

EPA Export 25-07-2013:16:19:30

9.16 The landfill gas composition includes a range of trace compounds, including oxygenated and sulphonated organics and inorganics such as hydrogen sulphide (0 – 2% dry volume), mercaptans, hydrocarbons and aliphatic organic acids. These compounds are indicative of the early anaerobic stages of the waste degradation process. Several of these components are odorous with varying odour threshold concentrations, producing unpleasant/nuisance odours in the vicinity of landfill sites.

9.17 Hydrogen sulphide is a flammable gas, with a characteristic odour of 'rotten eggs'. It is perceptible in air at concentrations greater than 0.47parts per billion (ppb) (0.66µg/m^3).

9.18 Mercaptans (thiols) is the collective name for group of compounds containing the functional group –SH (sulphur hydrogen), such as methyl mercaptans (methanethiol) (CH3SH). Each mercaptan has varying characteristics. Methyl mercaptan for example, is a flammable gas, with a characteristic odour of 'rotten cabbage'. It is perceptible in air at concentrations greater than 2.1ppb (4.2µg/m^3). Ethyl mercaptan, which has similar characteristics to methyl mercaptan, has an odour threshold concentration of 1ppb (2.5µg/m^3).

9.19 Odour threshold levels for odorous components, which indicate the lowest concentration of a vapour or gas in air that can be detected by smell, are summarised in Table 9.2.

9.20 Organic acids have varying characteristics. The most common, acetic acid, is perceptible in air at concentrations greater than 1,000 ppb (2,500µg/m^3).

For inspection purposes only.
Consent of copyright owner required for any other use.

Table 9.2 Odour thresholds of specific compounds of interest

Compound	Odour threshold
Hydrogen Sulphide (H_2S)	0.66 µg/m^3 (0.4 ppb)
Methyl mercaptan	0.04 µg/m^3 (0.02 ppb)
Butyric acid	1 µg/m^3 (0.27 ppb)

(Ruth, Jon H. (1986) Odour Thresholds and Irritation Levels of Several Chemical Substances: A Review. Am. Ind. Hyg. Assoc. J., 47, 142-151)

EPA Export 25-07-2013:16:19:30

DESCRIPTION OF EXISTING ENVIRONMENT

9.21 The proposed site is situated in a remote area, approximately 2km from the Letterkenny to Glenties road. The proposed site is currently in use for second-growth forestry.

9.22 The site is situated to the south west of Letterkenny with the closest occupied house being more than 2km distant. The site is surrounded by elevated areas and therefore hidden from view from road traffic on the R250.

Existing Climate

9.23 The meteorology of the Meenaboll area is typical of site on the western seaboard of Ireland. The area in the immediate vicinity of the site is rural and there is no evidence of a significant microclimate. The rainfall however is estimated to be up to 1,600mm per year due to the elevated nature of the proposed site.

9.24 Meteorological data, with the exception of rainfall, from the Malin Head weather station was selected to represent the weather in the proposed landfill site area and are summarised in the tables below. The Malin Head weather station is situated at the most northerly point on the island of Ireland, at the top of the Inishowen peninsula in County Donegal. The nearest town is Carndonagh, which is 19 km south southeast of the station.

For inspection purposes only.
Consent of copyright owner required for any other use.

EPA Export 25-07-2013:16:19:30

MALIN HEAD Monthly and Annual Mean and Extreme Values (1961-1990)													
TEMPERATURE (°C)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Year**
Mean Daily Max.	7.6	7.5	8.7	10.3	12.7	15.0	16.2	16.6	15.3	13.0	9.8	8.4	**11.8**
Mean Daily Min.	3.2	2.9	3.7	5.0	7.1	9.6	11.4	11.4	10.1	8.3	5.2	4.2	**6.8**
Mean	5.4	5.2	6.2	7.6	9.9	12.3	13.8	14.0	12.7	10.7	7.5	6.3	**9.3**
Absolute Max.	13.9	13.8	19.0	19.5	24.7	25.0	27.0	25.3	23.2	19.6	16.0	15.1	**27.0**
Absolute Min.	-6.2	-6.2	-4.4	-1.8	-0.5	2.6	5.6	5.2	2.0	1.0	-2.5	-5.5	**-6.2**
Mean no. of days with air frost	3.4	3.3	1.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.8	**11.0**
Mean no. of days with ground frost	9.6	9.8	7.4	4.3	1.0	0.0	0.0	0.0	0.1	0.3	3.7	6.7	**42.9**

MALIN HEAD Monthly and Annual Mean and Extreme Values (1961-1990)													
RELATIVE HUMIDITY (%)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Year**
Mean at 0900UTC	83	82	81	79	79	81	84	84	83	83	82	83	**82**
Mean at 1500UTC	80	77	76	76	76	78	80	79	78	78	79	81	**78**

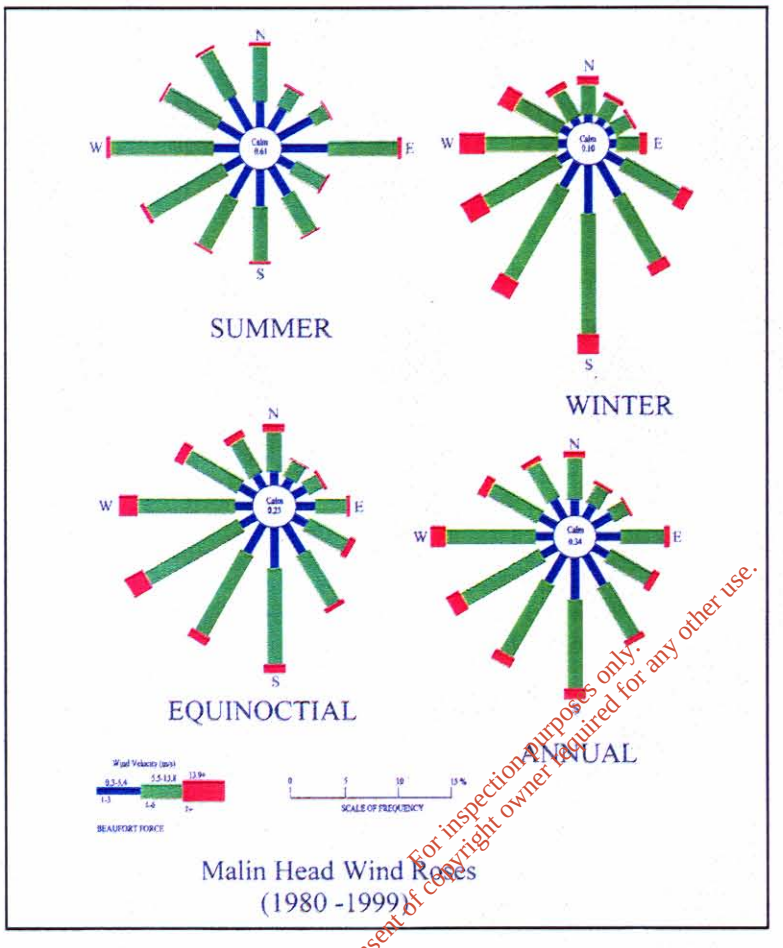
MALIN HEAD Monthly and Annual Mean and Extreme Values (1961-1990)													
SUNSHINE (Hrs)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Year**
Mean daily duration	1.2	2.2	3.1	5.1	6.2	5.7	4.3	4.3	3.5	2.4	1.5	0.9	**3.4**
Greatest daily duration	7.5	9.2	11.1	14.1	15.5	16.2	16.1	14.8	11.9	9.4	7.6	6.7	**16.2**
Mean no. of days with no sun	11	7	6	3	2	2	3	3	4	6	8	12	**67**

For inspection purposes only.
Consent of copyright owner required for any other use.

MALIN HEAD Monthly and Annual Mean and Extreme Values (1961-1990)													
RAINFALL (mm)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Year**
Mean Monthly Total	114.4	76.3	85.9	58.4	59.2	64.4	72.4	91.3	102.1	118.0	114.9	103.2	**1060.6**
Greatest Daily Total	36.9	24.1	26.3	36.1	29.8	32.5	26.2	41.5	53.5	63.2	56.1	33.5	**63.2**
Mean no. of days with ≥ 0.2mm	22	17	21	17	17	18	19	20	21	22	22	23	**237**
Mean no. of days with ≥ 1.0mm	19	13	16	12	12	13	13	15	16	18	18	18	**182**
Mean no. of days with ≥5.0mm	9	6	7	4	4	4	5	6	7	8	8	7	**76**

EPA Export 25-07-2013:16:19:30

9.25 The long-term patterns for wind direction and speed were obtained from the nationally verified meteorological data collected in Malin Head. The predominant winds measured at this site were from the south and south westerly directions and with speeds of 5.5 to 13.8 m/s. Annual wind roses for Malin Head are shown below.



Malin Head Wind Roses
(1980 -1999)

Consent of copyright owner required for any other use.
For inspection purposes only.

9.26 The climate can affect the local air quality in terms of pollutant migration. Indeed, the dispersion of airborne gas and particulates occurs in the atmospheric boundary layer, which is the region within the troposphere that is affected by the surface of the earth in terms of roughness, heating and cooling, and can extend up to about 2.5km above the earth's surface.

9.27 The atmospheric boundary layer is significantly influenced by meteorology and the main factors are the amount of insulation and the strength and direction of the winds.

9.28 The boundary layer stability, and consequently, the characteristics of the pollutant dispersion, can be categorised into 7 classes by *Pasquill* and *Gifford*, with the main ones listed and detailed below.

EPA Export 25-07-2013:16:19:30

Convective Conditions

9.29 In general, very convective conditions, Pasquill Class A, occur on hot, sunny days with light winds (1-2m/s). Such conditions are infrequent, typically occurring for <1% of the time, however they do not facilitate the natural dispersion of pollutants and can present a serious risk in terms of air quality.

Neutral Conditions

9.30 Neutral meteorological conditions, Pasquill Class D, commonly prevail in cloudy conditions with medium to strong wind speeds (5-7m/s), which cause vigorous mixing of the lower atmosphere and therefore a potential breakdown of existing pollutants. Neutral conditions occur over a wide range of times of day and times of year.

Stable Conditions

9.31 Very stable conditions, Pasquill Class F-G, occur on clear calm nights with strong cooling of the ground. Temperature inversions usually occur; that is, the temperature increases with height above the ground. Very stable conditions generally occur a few percent of the time, and can lead to localised air quality problems.

For inspection purposes only.
Consent of copyright owner required for any other use.

EXISTING AIR QUALITY

9.32 In order to predict the effects on air quality of the construction, operation and restoration of the proposed landfill, the existing levels of air quality were determined.

9.33 The local baseline air quality was assessed from on site sampling information provided by the Environmental Protection Agency (EPA) and are summarised in Table 9.7. The monitoring undertaken by the EPA was based throughout Ireland mainly in sensitive urban areas such as Dublin and Cork, which contain large volumes of traffic. The monitoring locations were divided into four different air quality zones:

- Zone A (Greater Dublin);
- Zone B (Cork City);
- Zone C (16 urban areas with population greater than 15,000) and
- Zone D (Areas not in Zones A, B and C).

9.34 Monitoring levels from zone D were assessed to best represent rural background levels for isolated area and therefore were considered to evaluate the likely baseline air quality in the vicinity of the landfill site.

9.35 These baseline levels were compared with existing Irish Air Quality Standards, referenced in the EPA Air Quality Monitoring Annual Report (1999), and are listed below.

EPA Export 25-07-2013:16:19:30

Table 9.7 Baseline Levels of Air Pollutants

Pollutant	Year	Annual Mean Concentration[1]	Location
PM_{10} (Annual Mean) ($\mu g/m^3$)	2001	19	Mullingar (urban)
NO_2 (Mean Hourly Mean ($\mu g/m^3$))	2001	3	Kilkitt (rural)
		9	Glashaboy (rural)
SO_2 (Mean Hourly Mean) ($\mu g/m^3$)	2001	4	Kilkitt (rural)
		8	Askeaton (rural)
CO (8-Hour Running Mean) (mg/m^3)	2001	0.36	Mullingar (urban)
Benzene (Annual Mean) ($\mu g/m^3$)	2001	0.4	Mullingar (urban)

Note: [1]Concentration based on the Air Quality Monitoring, Annual Report 2001, Environmental Protection Agency (EPA)

Sulphur Dioxide and Black Smoke

9.36 The air quality standards follow the EC Directive 80/779/EEC on air quality limit values for SO_2 and suspended particulates as black smoke, as shown in the Table 9.8.

For inspection purposes only.
Consent of copyright owner required for any other use.

Table 9.8 Air Quality Standards for Sulphur Dioxide (SO_2) and Smoke

	Limit Value for SO_2 ($\mu g/m^3$)	Associated Smoke ($\mu g/m^3$)	Limit Value for Smoke ($\mu g/m^3$)
Annual Median of Daily Mean Values	80	>40	80
	120	= or <40	
Winter Median of Daily Mean Values	130	>60	130
	180	= or <60	
98-percentile of Daily Mean Values	250	>150	250
	350	= or <150	
Not more than three consecutive days	250	>150	250
	350	= or <150	

Particulates

9.37 The Irish standard for Particulate Matter PM_{10} is 50 $\mu g/m^3$, corresponding the daily mean limit value established in the Air Quality Daughter Directive 1999/30/EC, (CEC, 1999).

EPA Export 25-07-2013:16:19:30

Nitrogen Dioxide

9.38 The EC Directive 85/203/EEC on air quality standards for nitrogen dioxide (NO_2) sets a limit value of 200 $\mu g/m^3$ in respect of the 98th percentile of hourly values in the calendar year. The Irish Air Quality standard for NO_2 was based on the European Directive (DoE, 1988). This Directive also prescribes guide values of 135 $\mu g/m^3$ for the 98th percentile limit of 50 $\mu g/m^3$ in respect of the annual median.

Carbon Monoxide

9.39 For carbon monoxide (CO), the European Commission (EC, 1998) has proposed a limit value of 10 mg/m^3 (8.7 ppm) applied to the maximum daily eight-hour mean selected by examining eight-hour running averages. However, there are currently no Irish or EU standards in force for carbon monoxide.

9.40 The main aim of these standards is to protect human health and the environment.

9.41 The perceived existing levels of air quality, particular, in terms of Particulates PM_{10}, Nitrogen Dioxide, Carbon Monoxide and Sulphur Dioxide concentrations, are well below the Irish Air Quality Standards in the vicinity of the proposed landfill site.

For inspection purposes only.
Consent of copyright owner required for any other use.

Existing Landfill Gas Emissions

9.42 There should be no existing emissions of landfill gas, including methane and carbon dioxide on the site.

Existing Dust Emissions

9.43 Baseline dust monitoring on the landfill site was carried out at one location of the site over 1-month period in August 2003. The result for dust for Meenaboll is below 10mg/m^2/day which is well below the deposition limit of 350 mg/m^2/day according to the EPA guidance.

IMPACT OF AIR EMISSIONS ON THE SURROUNDING ENVIRONMENT

Introduction

9.44 The proposed landfill site will have an approximate area of 4.5 hectares. It will contain 5 phases with an overall lifespan estimated to be 20 years and will have an annual waste capacity of around 24,000 tonnes per annum.

9.45 The proposed site will be a contained site, including a composite lining system and a permanent capping system with a gas collection layer. An active gas extraction system, including active gas extraction wells and flare system, will be installed on the landfill site once the phases are completed.

EPA Export 25-07-2013:16:19:30

9.46 To undertake an air quality impact study, sensitive receptors are to be identified and considered in detail as well as the magnitude of the possible impacts. Sensitive locations are defined as places where members of the public may be regularly exposed to airborne pollutants, including dwellings for long-term impact and site workers for short-term impact. The sensitivity of these receptor points can vary depending on their own characteristics.

9.47 As specified in the site description section of this chapter, the proposed landfill site is located in a rural area therefore no long term sensitive receptors were identified in close proximity of the site.

Landfill Gas Emissions

9.48 The generation of landfill gas emitted from the proposed waste management facility was calculated using GasSim, a computer-modelling package developed by Golder Associates and Land Quality Management on behalf of the Environment Agency. GasSim has been developed as a management tool to provide probabilistic quantitative assessment of the performance of a specific landfill site. The calculations considered the tonnage, the mix (breakdown), composition and moisture content of wastes in the landfill site. The model also takes account of the degradation rates of the different types of waste on a landfill site.

Consent of copyright owner required for any other use.
For inspection purposes only.

9.49 The model is based on degradation following a first-decay equation that calculates the landfill gas generation for up to 200 years. The model takes this output and uses it to calculate landfill gas emissions in terms of bulk and trace gases to the environment after allowing for landfill gas collection, flaring, utilisation (energy recovery) and biological methane oxidation. This is undertaken by using information on the site gas collection system, flare, engine and engineered barriers (cap and liner).

9.50 GasSim is designed to simulate landfills for risk assessments based on the use of Probability Density Functions that allow the model to show the full range of possible results and combinations of different input ranges. The results of air emissions calculated in this model are therefore shown in terms of percentile. The Environment Agency commonly considers the 95% to be a reasonable assessment level in the GasSim Assessment. This percentile will be considered in the results for this impact assessment.

9.51 The production of landfill gas was assessed for the proposed landfill site with the use of different parameter inputs, regarding the infiltration, the landfill site and the waste characteristics.

EPA Export 25-07-2013:16:19:30

9.52 The infiltration is defined as the effective rainfall entering the waste (i.e. rainfall less runoff, evaporation and transpiration). The infiltration rate depends on the proportion of the landfill that is capped and the nature and age of the cap. An infiltration rate of 92 mm/year, as 10% of the effective rainfall, was considered for this study, assuming that the whole landfill site was a fully restored capped area, which is mostly the case during the 70-year simulation period.

9.53 The characteristics of the site were used in the model, including the landfill geometry and the engineering systems.

9.54 Inputs of waste tonnage deposited for each operational year, were also taken into account in the model.

9.55 Table 9.9 summarises the parameters used in the analysis.

Table 9.9 GasSim Parameters for the calculation of Landfill Gas Emissions

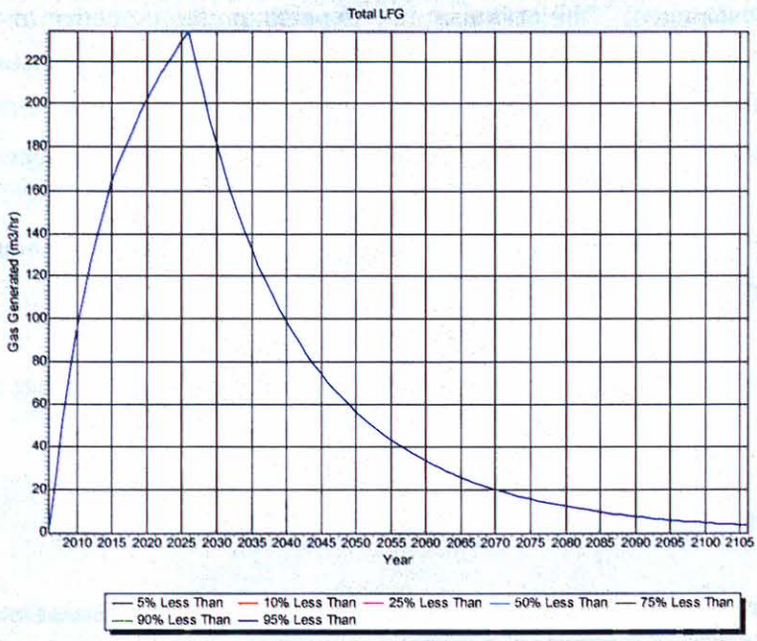
	Proposed Landfill site
Year of Opening	2006
Year of Closure	2026
Operational Period	20 years
Simulation Period	100 years
Infiltration Rate	92 mm/year
Waste Input	24,000 tonnes/year
Waste Composition	71% Domestic 27% Commercial 2% Inert
Site Area	55,200 m^2
Landfill gas composition	% CO_2 = 33.6 % CH_4 = 63.8
Lining System	Composite
Capping System	Single Liner

For inspection purposes only.
Consent of copyright owner required for any other use.

9.56 Graph 9.1 illustrates the landfill gas emissions (m^3/hr) from the proposed landfill site, calculated with the GasSim model. The landfill gas production during the operation of the proposed facility will be low with an estimated landfill gas emission peak of around 230m^3/hr in year 2026.

EPA Export 25-07-2013:16:19:30

Graph 9.1 Production of Landfill Gas for the Proposed Landfill Site



For inspection purposes only.
Consent of copyright owner required for any other use.

9.57 There are no regulations regarding landfill gas emissions from landfills. However, the Environmental Protection Agency (EPA) imposes limits for landfill gas concentrations measured in any building on or adjacent to the facility and are as follows:

Table 9.10 Landfill Gas Concentration at Receptor Points

Methane (CH_4)	Carbon Dioxide (CO_2)
20% LEL (1% v/v)	1.5% v/v

Gas Flare Emissions

9.58 The proposed landfill site will include a gas flare unit as an active gas collection system. The combustion of landfill gas reduces the risk of uncontrolled landfill gas emission and explosion.

9.59 The waste management site will result in an increase in landfill gas emissions, therefore augmenting the formation of gaseous pollutants from the combustion process. However, the flare stack will be designed in order to meet the standards published by the Environmental Protection Agency when referred to Normal Temperature and Pressure (NTP = 0ºC and 1013 mbar) and 3% oxygen and shown in Table 9.11.

EPA Export 25-07-2013:16:19:30

Table 9.11 Emission Limit Values for Landfill Gas Flare Unit

Gas Emitted	Limit Value
Carbon Monoxide	50mg/m^3
Oxides of nitrogen (NOx)	150 mg/m^3
Particulates	130 mg/m^3
TA Luft Organics Class I	20 mg/m^3 (at mass flows > 0.1 kg/hr)
TA Luft Organics Class II	100 mg/m^3 (at mass flows > 2 kg/hr)
TA Luft Organics Class III	150 mg/m^3 (at mass flows > 3 kg/hr)
Hydrogen Chloride	50 mg/m^3 (at mass flows > 0.3 kg/hr)
Hydrogen Fluoride	5 mg/m^3 (at mass flows > 0.05 kg/hr)

Source: EPA, Ballynacarrick Landfill Site, Waste Licence (24-1)

Traffic Fumes Emissions

9.60 The proposed Meenaboll landfill site will be accessed via the regional road R250 between Fintown and Letterkenny.

9.61 With respect to traffic emissions, sensitive locations are generally assumed to be properties within 200 metres of the affected routes.

9.62 It is possible to assess quantitatively traffic fumes emissions using the DMRB (Design Manual for Roads and Bridges) methodology based, in the absence of Irish guidance, on UK Government guidance. This assessment considers those pollutants associated with vehicle motor exhausts which are covered by the Irish Air Quality Standards presented previously in this chapter.

Consent of copyright owner required for any other use.
For inspection purposes only.

9.63 As part of the Traffic Impact Assessment included in this EIS, it was assessed that the overall traffic impact to and from the site will not have a significant impact on the surrounding road network. Therefore, the associated traffic fumes emissions from vehicles exhausts shall be minimal and will not be further assessed in this report.

Lateral Migration

9.64 Although the proposed site will be equipped with an active gas extraction system, a small amount of this gas will be uncollected in the capped area and will result in uncontrolled emissions from the cap and/or lining system. The quantity of emission through both the cap and liner are determined by the permeability and thickness of the most impermeable layer within each construction.

9.65 The calculation of the uncontrolled lateral emissions took into account:

- the liner thickness;

EPA Export 25-07-2013:16:19:30

- the liner hydraulic conductivity; and
- the site dimensions.

9.66 Table 9.12 illustrates the relevant parameters used by the model to assess the lateral migration of Carbon Dioxide and Methane gases. The composite layer has been defined in the model by two layers with specific thickness and hydraulic conductivity. The layers have been defined from top to bottom. Layer 1 shall represent the HDPE membrane and layer 2 represents the bentonite enhance soil (BES).

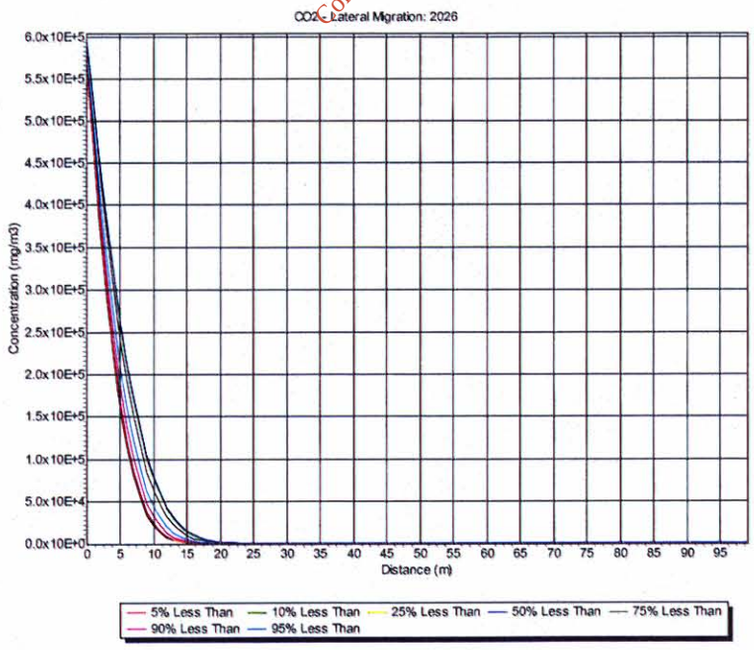
Table 9.12 Lateral Migration Calculation Parameters

Composite Liner	
Layer 1 Thickness	2mm (HDPE Membrane)
Layer 1 Hydraulic Conductivity (m/s)	LogUniform ($1x10^{-12}$,$1x10^{-9}$)
Layer 2 Thickness	0.5m
Layer 2 Hydraulic Conductivity (m/s)	LogUniform ($1x10^{-12}$,$1x10^{-9}$)
Site Dimensions	
Site Area (ha)	5.5

For inspection purposes only.
Consent of copyright owner required for any other use.

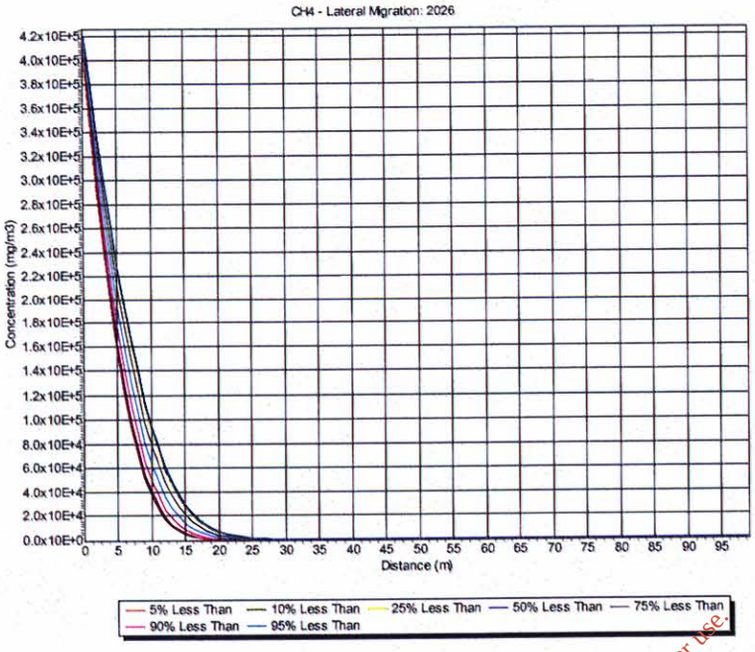
9.67 The simulation was undertaken for the year 2026 which is the year corresponding to the peak emission of landfill gas produced in the landfill area and would correspond to the worst case scenario. Results for carbon dioxide and methane are shown in Graph 9.2 and 9.3.

Graph 9.2 Carbon Dioxide Lateral Migration – Proposed Landfill (2026)



EPA Export 25-07-2013:16:19:30

Graph 9.3 Methane Lateral Migration – Proposed Landfill (2026)



For inspection purposes only.
Consent of copyright owner required for any other use.

9.68 The extent of lateral migration of carbon dioxide and methane caused by the uncontrolled release through the liner is not significant as the landfill gas concentrations decrease rapidly and within 25 metres of the proposed site, there is no methane or carbon dioxide outside limits of detection.

Climate

9.69 The proposed landfill site is not predicted to impact on the microclimate, including local wind flow, temperature, rainfall or solar radiations patterns. However, an important environmental consequence of landfill gas production is the increase made to greenhouse gas emissions in the atmosphere. Carbon dioxide and methane are recognised for their significant contribution to global warming.

9.70 However, the landfill gas control and combustion in Meenaboll landfill site will have the potential to significantly reduce the risk of global warming. Methane is an important greenhouse gas and a major environmental pollutant. Reducing methane emissions is one of the most effective ways of mitigating global warming in the short-term. Each tonne of methane released into the atmosphere has a Global Warming Potential (GWP) of more than 21 tonnes of carbon dioxide. Flaring methane converts the gas to carbon dioxide. While carbon dioxide is also a greenhouse gas, it is less destructive than methane.

EPA Export 25-07-2013:16:19:30

Dust Deposition

9.71 Dust will be generated during all phases of the proposed landfill site. It will occur for example, during the deposition of dry waste containing fine particles, by the movement of vehicles and equipment on the internal roads of the landfill site or during the placing of daily cover.

9.72 The dispersion of dust can be affected by a number of factors including particle size, wind speed, wind direction and rainfall. In general terms, the stronger the wind speed, the larger the particle size that it can carry, and the further dust may be dispersed. Dust emissions require particular control during prolonged dry and windy conditions.

9.73 The greatest potential impact from dust generated is likely to occur when prevailing winds are blowing towards sensitive receptor points. The wind roses from Malin Head demonstrate that the prevailing winds at the site will blow from the south-southwest quadrant.

9.74 Research has shown that large dust particles (>30µm) are commonly the greatest proportion of dust emitted from mineral working activities and will largely deposit within 100m of sources. Intermediate sized particles (10-30µm) are likely to travel up to 250-500m. These coarser fractions of particulate matter are less harmful to human health but could potentially constitute a nuisance.

For inspection purposes only.
Consent of copyright owner required for any other use.

9.75 Considering that the nearest dwelling is more than 2 kilometres away from the proposed waste management facility, the impact of dust emissions will be insignificant, considering the specific dispersion properties of dust particulates described above.

Odour

9.76 The generation of odour can lead to environmental nuisance effects and a deterioration of the quality of life in the vicinity of the landfill site.

9.77 The assessment of odour nuisance is very difficult due to the subjective nature of odours and the varying responses from those affected by them. However, predictions of odour impacts can be assessed by considering various factors such as the location of sensitive receptors in relation to the area of the landfill site where odour emissions are expected, the prevailing meteorological conditions and possible control measures.

9.78 Impact of odour generated by landfilling operations will be more significant when the wind is blowing directly from the tipping face, where fresh waste is being deposited, to the closest receptors. It is estimated, considering the wind roses for Malin Head, that the prevailing winds (west – southwest directions) should blow directly from the proposed development towards the nearest receptor point approximately 30% of the time.

EPA Export 25-07-2013:16:19:30

9.79 However, as the nearest dwelling is more than 2km away from the proposed site, an odour nuisance is not envisaged, even during prevailing winds.

MITIGATION MEASURES

Introduction

9.80 The proposed landfill site is located in an area of low population, therefore reducing any potential nuisance impacts from the site. The local air quality is typical of a rural area, with low background levels of air pollution. Dilution of pollutants occurs due to the southwest prevailing winds from the Atlantic Ocean. The proposed facility will only accept household, commercial, construction and demolition wastes, thereby minimizing any potential toxic or hazardous emissions from the site.

Landfill Gas Emissions

9.81 The proposed waste management facility has been designed as a containment site so it will be engineered to prevent the uncontrolled migration of landfill gas. Landfill gas generated within the waste will be collected and initially vented to the atmosphere being ultimately flared. These measures will contain and control landfill gas within the site. Monitoring boreholes will be provided around the perimeter of the site to assess the efficiency of the gas management and to ensure that gas is not migrating off site. Gas monitoring after closure of the site will continue in line with the landfill gas monitoring regime summarised in Table 9.13 until agreement with the EPA that it is no longer required.

Consent of copyright owner required for any other use.
For inspection purposes only.

Table 9.13 Landfill Gas Monitoring Requirements

Parameter	Monitoring Frequency		Analysis Method [1]/ Technique [2]
	Gas Boreholes/ Vents/Wells	Site Office	
Methane (CH_4) % v/v	Monthly	Weekly	Infrared analyser/flame ionisation detector
Carbon Dioxide (CO_2) % v/v	Monthly	Weekly	Infrared analyser/flame ionisation detector
Oxygen (O_2) % v/v	Monthly	Weekly	Electrochemical cell
Atmospheric Pressure	Monthly	Weekly	Standard
Temperature	Monthly	Weekly	Standard

Notes 1: All monitoring equipment used should be intrinsically safe
2: Or other methods agreed in advance with the Agency

EPA Export 25-07-2013:16:19:30

9.82 **Health and Safety Risks**: Emissions from the landfill site are unlikely to have a detrimental effect on human health, assuming that the site is developed and operated to the required standards. Strict Health & Safety procedures should be implemented on site including no smoking policy to prevent any risks of fire or explosion, staff training regarding the dangers of landfill gas and gas monitoring of site buildings.

Flare Gas Emissions

9.83 In accordance with EPA guidance the plume from a flare, will not be allowed to pass directly to a dwelling or human habitation under prevailing wind conditions.

9.84 Characteristics of the flare stack and the combustion process, such as the temperature of combustion or the height of the stack can moderate the impact on the emissions and dispersions of the flare gas.

9.85 The flare emissions will be operated to the emissions standards outlined in Table 9.13 and will be monitored as outlined below.

For inspection purposes only.
Consent of copyright owner required for any other use.

Table 9.14 Flare Gas Monitoring Requirements

Parameter	Monitoring Frequency	Analysis Method[1]/ Technique[2]
Inlet		
Methane (CH_4) % v/v	Weekly	Infrared analyser/flame ionisation detector
Carbon Dioxide (CO_2) % v/v	Weekly	Infrared analyser/flame ionisation detector
Oxygen (O_2) % v/v	Weekly	Infrared analyser
Outlet		
Volumetric Flow rate	Biannually	Pilot Tube Method
SO2	Biannually	Flue gas analyser
NOx	Biannually	Flue gas analyser
CO	Biannually	Flue gas analyser
Particulates	Annually	Isokinetic/Gravimetric
TA Luft Class I, II, III organics	Annually	Adsorption/Desorption/GC/GCMS[3]
Hydrochloric acid	Annually	Impinger/Ion Chromatography
Hydrogen Fluoride	Annually	Impinger/Ion Chromatography

Notes 1: All monitoring equipment used should be intrinsically safe
2: Or other methods agreed in advance with the Agency
3: Test methods should be capable of detecting acetonitrile, dichloromethane, tetrachloroethylene and vinyl chloride as a minimum.

EPA Export 25-07-2013:16:19:31

Traffic Emissions

9.86 The proposed landfill site will not have any significant impact on the surrounding air quality. In the long-term, vehicle emissions are predicted to decrease over time due to improvements in engine efficiency and stricter enforcement of vehicle emission standards.

Dust Emissions

9.87 Effective dust control measures should be applied on site to limit dust generation and prevent dust disturbance. These will include limiting dust generation by:

- Careful choice of daily cover;
- Damping down materials containing fine particulates in very dry weather;
- Landfilling operations within cells;
- Disposal and immediate burial of dusty wastes; and
- Providing a well-designed site access road.

9.88 Dust monitoring will have to be undertaken at the frequency and methodology outlined by the EPA in the waste licence and summarised in the table below.

Consent of copyright owner required for any other use.
For inspection purposes only.

Table 9.15 Dust monitoring Frequency

Parameter (mg/m2/day)	Monitoring Frequency	Analysis Method/Technique
Dust	Three times a year	Standard Method[1]

Notes 1: Standard method VDI2119 (Measurement of Dustfall, Determination of Dustfall using Bergerhoff Instrument (Standard Method) German Engineering Institute). A modification (not included in the standard) which 2-methoxy ethanol may be employed to eliminate interference due to algae growth in the gauge.

Odour Emissions

9.89 Odour will be controlled by means of site working practices and monitored frequently.

9.90 Odour nuisance from the proposed landfill site should be minimised in the following ways:

- Rapid deposition and covering of malodorous wastes;
- Effective compaction and covering of wastes;
- Installation of the permanent capping system; and
- Flaring of landfill gas.

CONCLUSION

9.91 The Air and Climate Impact Assessment study has demonstrated that the proposed landfill site will not have a significant impact on the existing air quality in the surrounding environment with no significant increase of gas emissions associated with landfill operational activities.

EPA Export 25-07-2013:16:19:31

9.92 The gas emissions, dust deposition and odour nuisance will be minimised by implementation of appropriate mitigation measures during the construction works and the operational phase of the proposed development.

For inspection purposes only.
Consent of copyright owner required for any other use.

EPA Export 25-07-2013:16:19:31

BIBLIOGRAPHY

CEC, (Council of the European Communities), 1999. Council Directive 1999/30/EC of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air. *O.J. L163, 29 June 1999.*

Department of the Environment Transport and the Regions, 2000. The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. Working Together for Clean Air.

Department of Transport, 1999. Design Manual for Roads and Bridges, Volume 11. Environmental Assessment.

DoE (Department of the Environment), 1988. *The Air Pollution Act 1987 Air Quality Standards Regulations S.I. No. 244 of 1987.*

Donegal County Council, 1997. Waste Disposal Licence, Ballynacarrick Landfill Site, Ballintra, Co. Donegal.

EC, (European Commission), 1998. Proposal for a European Parliament and Council Directive relating to limit values for benzene and carbon monoxide in ambient air. COM(1998) 591.

Environmental protection Agency, 1999. Air Quality Monitoring, Annual Report 1999.

Environmental Protection Agency, 2000. Landfill Manuals, Landfill Site Design.

Environmental Protection Agency, 2000. Landfill Manuals, Landfill Monitoring.

Golder Associates (UK) Limited, 2002. GasSim User Manual.

Ruth, Jon H. (1986) Odour Thresholds and Irritation Levels of Several Chemical Substances: A Review. Am. Ind. Hyg. Assoc. J., 47, 142-151)

For inspection purposes only.
Consent of copyright owner required for any other use.

EPA Export 25-07-2013:16:19:31

10.0 FLORA & FAUNA

10.1 This chapter is subdivided into two parts, the first covering habitats, flora and fauna is detailed in paragraphs 10.2 to 10.154, whilst the second part covering farm animal health is detailed in paragraphs 10.155 to 10.181.

FLORA & HABITATS

10.2 The habitats in the site and surrounding area are described and mapped from several field survey visits in September and October 2002, supplemented with further field data collected in 2003. The survey work was carried out with reference to Dúchas guidelines (Lockhart et al, 1993). Habitat classification with related codes (added in brackets in text – refer to Table 10.1) follows the scheme published by the Heritage Council (Fossitt, 2000). Refer to the habitat map presented in Figure 10.1 and plant species list in Table 10.2. Also, a more detailed survey of the in-site plant communities was carried out, using a species cover-abundance method, in series of both transect and randomised quadrants (see Appendix E).

For inspection purposes only.
Consent of copyright owner required for any other use.

Table 10.1 Habitat Classification produced by the Heritage Council (after Fossitt, 2000)

F Freshwater	FL Lakes and Ponds	FL1 Dystrophic lakes FL2 Acid oligotrophic lakes
	FW Watercourses	FW1 Eroding/upland rivers FW4 Drainage ditches
G Grassland and Marsh	GA Improved grassland	GA1 Improved agricultural grassland
		GS3 Dry-humid acid grassland
		GS4 Wet grassland
H Heath and dense bracken	HH Heath	HH3 Wet heath
	HD Dense bracken	HD1 Dense bracken
P Peatlands	PB Bogs	PB2 Upland blanket bog PB4 Cutover bog
	PF Fens and Flushes	PF2 Poor fen and flush PF3 Transition mire and quaking bog
W Woodland and scrub	WD Highly modified/non-native woodland	WD2 Mixed broadleaved/conifer woodland WD4 Conifer plantation
	WS Scrub/transitional woodland	WS1 Scrub WS2 Immature woodland WS5 Recently-felled woodland

EPA Export 25-07-2013:16:19:31

Landuse & Overview of Habitats at Meenaboll

10.3 The habitat in the proposed development site is characterised by conifer plantation forestry, which is highly modified, non-native woodland. Most of the area was clear-felled and replanted with a 2nd rotation within the last ten years. The existing vegetation is transitional and reflects the response of ecological processes to this type of land-use and the changes which have taken place: removal of dense forest canopy, modified drainage patterns, soil disturbance and replanting with sapling conifers, scattered dead-wood, brash and woody litter. The result is a mosaic of semi-natural plant communities, the variability owing to the erratic history of the environment and disorderly soil (edaphic) conditions.

10.4 At its present state of development, the influence of the 2nd rotation conifers is negligible since the trees are small and represent well under 25% average plant cover. For this reason, the habitat type is assigned to the scrub/transitional woodland category, recently-felled woodland (WS5) since, for the time-being, this better reflects the vegetation types present.

10.5 The proposed development site is adjacent to the watershed of two principle river catchments, the River Leannan and the River Finn / River Foyle systems. One of the headwater streams of the Finn, the Sruhanpollandoo, flows through the site where its channel has been modified (canalised) in the course of forestry ground preparation at an earlier stage in the past.

For inspection purposes only.
Consent of copyright owner required for any other use.

10.6 Open moorland habitats lie adjacent to the afforested zone containing the proposed development site. These include upland blanket bog, wet heath, wet grassland and flushes. The vegetation of these habitats was not assessed in great detail since they are removed from the site itself, but a basic survey of the habitats and floristic composition was carried out.

Conifer Plantation (WD4)

10.7 Within and around the site boundaries, the main habitat is conifer plantation which is highly modified, non-native woodland. The forest consists of Sitka Spruce (*Picea sitchensis*) and Lodgepole Pine (*Pinus contorta*) in blocks of varying stand age ranging from immature trees of around 4 to 6 metres high, to high closed canopy forest ready for timber harvest.

10.8 Timber harvesting has been carried out in stages over recent years. Some of the first rotation standing crop of high, closed-canopy forest remains in the proposed development site square B9909, extending south-westward into B9908 and B9808. Some parts, particularly in the latter square, were clear-felled in 2003. Evidently, there are compartments of younger trees (c. 20-30 year old) which are left unfilled, some of which are now isolated in the clear-fell / 2nd rotation areas.

EPA Export 25-07-2013:16:19:31

10.9 The forest of the lower valley slopes, including most of the harvested area, consists of Sitka Spruce (*Picea sitchensis*), while on wetter, boggy land, adjacent to the Shruhanpollandoo stream and on the Brallanmore plateau, the forest contains more Lodgepole Pine (*Pinus contorta*) at closed canopy stage with immature trees of around 4 to 6 metres high, planted circa 1981.

10.10 Due to the dense canopy there is almost zero light penetration, and ground flora appears to be extremely limited, with only a few fern species and sparse cover of mosses including *Hypnum cuppressiforme* noted.

10.11 Some unplanted areas occur within and at the edge of forest blocks, in some cases quite large portions of blanket bog, as in square B9808, as well as forest rides (fire-breaks). A boggy ride traversing east to west in B9808 appears to be subject to increased seepage and is very wet with lawns of a mosaic of bog moss (*Sphagnum* spp). Other rides were similar or variously grassy and rushy.

10.12 Note that the afforested area does not extend to the west side of the Brallanmore ridge-line, contrary to that indicated on the O.S. 1:50,000 map 'Discovery Series' No.6. The forestry barely reaches the 200m contour line on the east side of the ridge. In C9908, forestry occupies most of the area to the east of the public road, however this is not indicated on the Discovery map.

For inspection purposes only.
Consent of copyright owner required for any other use.

Recently-Felled Woodland (WS5)

10.13 Although this category should not include clear-fell restocked with conifers, it is used here because it better reflects the current state of the habitat in much of the 2nd rotation forestry in and adjacent to the proposed development site, particularly in squares B9908, B9909 and C0009. The vegetation is characterised by grasses and sedges, particularly bent, but species composition and cover-abundance vary with wetness, as does the similarity of conditions to primary habitats such as grassland, blanket bog and heath.

10.14 There are patches or bands of vegetation with a high cover of Soft Rush (*Juncus effusus*), reflecting water flux and the modified drainage patterns adjacent to furrow drains, while localised wet boggy patches dominated by Many-Headed Cottongrass (*Eriophorum angustifolium*) are more occasional. For the most part however, Bent grasses (mainly *Agrostis* capillaris, *A. stolonifera*) are widespread and dominant with Red Fescue (*Festuca rubra*), Star Sedge (*Carex echinata*), Ling heather (*Calluna vulgaris*), Tormentil (*Potentilla erecta*), Heath Woodrush (*Luzula multiflora*), featuring as regular companion species. Ling and Purple Moor-grass (*Molinia caerulea*) are also locally dominant in some places.

EPA Export 25-07-2013:16:19:31

10.15 Drier parts are variously heathy or grassy in character. Where the habitat is heath-like, the frequent occurrence of Broad Buckler Fern (*Dryopteris dilatata*) and occasional Male Fern (*Dryopteris filix-mas*), Scaly Male Fern (*Dryopteris affinis*) and Lemon Scented Fern (*Oreopteris limbosperma*) may be owing to the influence of the forest environment. Other heath species included Heath Rush (*Juncus squarrosus*) and Green-ribbed Sedge (*Carex binervis*). Foxglove (*Digitalis purpurea*) was locally frequent and indicative of disturbed conditions associated with forest clearance, as is Figwort (*Scrophularia nodosa*) which was found occasionally.

10.16 The moss *Campylopus introflexus* was also recorded on disturbed peat. Grassy areas, which include the verges of the road and forest tracks, frequently also contain Yorkshire Fog (*Holcus lanatus*), Viviparous Fescue (*Festuca vivipara*), Sweet Vernal Grass (*Anthoxanthum odoratum*), Self Heal (*Prunella vulgaris*), Sheep Sorel (*Rumex acetosella*), Yarrow (*Achillea millefolium*), Eyebright (*Euphrasia* agg.) Common Cat's-ear (*Hypochoeris radicata*), White Clover (*Trifolium repens*), Creeping Buttercup (*Ranunculus repens*), Common Mouse-ear (*Cerastium fontanum*) and occasionally Common Sedge (*Carex nigra*) and Tawny Sedge (*C. hostiana*).

For inspection purposes only.
Consent of copyright owner required for any other use.

10.17 Damper areas regularly support other rush species including Toad Rush (*Juncus bufonious*), Bulbous Rush (*J. bulbosus*), Jointed Rush (*J. articulatus*) and Sharp-flowered Rush (*Juncus acutiflorus*) as well as occasional Common Yellow Sedge (*Carex viridula* subsp. *oedocarpa*), Marsh Willowherb (*Epilobium palustre*), Marsh Bedstraw (*Galium palustre*), Lesser Spearwort (*Ranunculus flammula*) and Marsh Violet (*Viola palustris*) while clumps of the moss *Polytrichum commune* are frequent. Species such as Bog Stitchwort (*Stellaria alsine*), Carnation sedge, (*Carex panicea*), Flea Sedge (*C. pulicaris*) were infrequent.

10.18 Otherwise, in general, moss cover was variable, comprising mainly *Rhytidiadelphus loreus* and *Hypnum cupressiforme*; other woody-heath species including *Thuidium tamariscinum* were occasional. Bog mosses (*Sphagnum* spp.) were not very abundant, confined largely to *Sphagnum capillifolium*, with wet furrows colonised by *S. palustre* and *S. subnitens* in places. Bare, disturbed soil and peat, decaying stumps and wood brash were also frequent elements, accounting for around 10% of ground cover on average. The planted restock of mainly Sitka Spruce (*Picea sitchensis*) accounted for around 12% of plant cover on average.

Upland Blanket Bog (PB2)

10.19 Beyond the limits of the forestry to the east and west of the proposed development site, blanket bog is extensive, particularly on the plateaux of the ridges leading to Binswilly (on the east side) and Brallanmore (on the west side). There is a well defined morphology with extensive hummock – hollow – pool systems.

EPA Export 25-07-2013:16:19:31

10.20 Species diversity is high and the habitat is largely intact and of good quality, except for some localised damage associated with the mobile phone mast and overhead electricity (c. 10kv line) cables. However, peat cutting (mainly 'sausage-machine' extraction) is significant on the southern slope of Meenaboll Hill (square C0008) down as far as the R250 public road. Over-grazing appears also to have had a significant impact on the bog surface and vegetation west of Binswilly (C0110). In the plateau bogs, hummocks topped with the mosses *Racomitrium lanuginosum* and *Sphagnum capillifolium* support a low cover of Ling heather, Cross-leaved Heath (*Erica tetralix*), Single-Headed Cottongrass (*Eriophorum vaginatum*) and Deer Grass (*Trichophorum caespitosum*). Lichen cover was high, with a widespread abundance of *Cladonia portentosa* and *C. arbuscula*.

10.21 The wetter sides of the hummocks frequently support Fir Clubmoss (*Huperzia selago*), and the liverwort (*Pleurozia purpurea*), as well as *Cladonia uncialis* less frequently. Some drier hummocks also had Bell Heather (*Erica cinerea*). Species occurring in the wet hollows included Heath Rush, Carnation Sedge, Star Sedge, Round-leaved Sundew (*Drosera rotundifolia*), with bog mosses *Sphagnum papillosum* and *S. palustre* in very moist conditions. Many-Headed Cottongrass, Deer Grass, locally abundant Bog Asphodel (*Narthecium ossifragum*) and Purple Moor-grass, the latter becoming abundant in places, on flushed slopes. Shallow reticulate pool systems were dominated by Cotton-grasses and *Sphagnum cuspidatum*.

Consent of copyright owner required for any other use.
For inspection purposes only.

10.22 In contrast to the plateau bogs, basin mire on deep peat dominated largely by Deer grass, occurs extensively to the west of the Shruhanpollandoo stream. There are also extensive 'Western Atlantic Bog' pool systems here (dystrophic ponds – FL1), notably in squares B9708, B9709 and B9809. Shallower bog and bog-wet heath mosaic characterised by Purple Moor-grass and Ling Heather occurs widely on the hill slopes throughout and around Lough Muck. Of interest also is a sedge-rich, fen-like bog vegetation in the area between C0010 and C0009, which is fed by base-poor flushes running off the north-westerly slopes of Meenagannive.

Wet Grassland (GS4) with Base-poor Flushes (PF2)

10.23 Wet grassland with flush zones along streams and seepage areas occur across the north-westerly slopes of Meenagannive. The vegetation is clearly characterised by an abundance of Sharp-flowered Rush (*Juncus acutiflorus*) and Soft Rush (*Juncus effuses*) of the vascular species component with other character species including March Violet (*Viola* palustris), Marsh Bedstraw (*Galium palustre*),Lesser Spearwort (*Ranunculus flammula*), Cuckoo Flower (*Cardamine pratensis*) and *Myosotis secunda*.

EPA Export 25-07-2013:16:19:31

Upland Rivers (FW1) and Acid Oligotrophic Lakes (FL2)

10.24 The proposed development site is situated on a coll or saddle which is at the head of two oppositely oriented river valleys, the Owenbeg flowing north-eastwards and the Sruhanpollandoo flowing south-westwards to the Cummirk River. The study area thus falls between two watersheds which are flanked by the Brallanmore and Crockstoller slopes on the west side, and the slopes of Binswilly – Meenaboll Hill on the east side. The site is located within the Cummick catchment. The Cummirk watershed, which includes Lough Muck is a headwater area of the River Finn Catchment, while the Owenbeg watershed is a headwater of the River Leannan.

10.25 Little in the way of aquatic vegetation was seen in the water courses. However, the upper part of the Sruhanpollandoo, which appears to have been channelised during ground preparation for forestry operations, contained some Floating Sweet-grass (*Glyceria X pedicellata*) and Water-starwort (*Callitriche* spp). Much of the stream bed and substrate was coated, in some places heavily, with iron-rich slime deposits, particularly within the forestry area, but this was also noted to a more limited extent in the upper Owenbeg (square C0010) where it appears to have come from flush seepage to the stream. In this latter area, Bog Pondweed (*Potamogeton polygonifolius*) was also recorded.

For inspection purposes only.
Consent of copyright owner required for any other use.

Table 10.2 Vascular Plant Species recorded from habitats in the proposed Development Site

Achillea millefolium	Yarrow
Agrostis canina	Brown Bent Grass
Agrostis capillaris	Common Bent Grass
Agrostis stolonifera	Creeping Bent Grass
Anthoxanthum odoratum	Sweet Vernal Grass
Bellis perennis	Daisy
Blechnum spicant	Hard Fern
Callitriche spp.	Water Starwort
Calluna vulgaris	Ling Heather
Cardamine pratensis	Cuckoo Flower
Carex binervis	Green-Ribbed Sedge
Carex demissa	Common Yellow Sedge
Carex echinata	Star Sedge
Carex nigra	Common Sedge
Carex ovalis	Oval Sedge
Carex panicea	Carnation Sedge
Carex pilulifera	Pill Sedge
Carex pulicaris	Flea Sedge
Carex viridula subsp. *oedocarpa*	Common Yellow Sedge
Cerastium arvense	Field Mouse-ear
Cirsium arvense	Creeping Thistle
Cirsium palustre	Marsh Thistle
Cynosurus cristatus	Crested Dog's tail
Dactylorhiza maculata	Heath Spotted Orchid

EPA Export 25-07-2013:16:19:31

Danthonia decumbens	Heath Grass
Digitalis purpurea	Foxglove
Drosera rotundifolia	Round-leaved Sundew
Dryopteris affinis	Scaly Male Fern
Dryopteris dilatata	Broad Buckler Fern
Epilobium palustre	Marsh Willowherb
Equisetum arvense	Field Horsetail
Erica cinerea	Bell Heather
Erica tetralix	Cross-Leaved Heath
Eriophorum angustifolium	Common Cottongrass
Eriophorum vaginatum	Hare's tail Cottongrass
Euphrasia agg.	Eyebright
Festuca ovina	Sheep's Fescue
Festuca rubra	Red Fescue
Festuca vivipara	Viviparous Fescue
Galium palustre	Marsh Bedstraw
Galium saxatile	Heath Bedstraw
Glyceria fluitans	Floating Sweet-Grass
Glyceria X pedicellata	Floating Sweet-Grass
Holcus lanatus	Yorkshire Fog
Hypochoeris radicata	Common Cat's-ear
Juncus acutiflorus	Sharp-Flowered Rush
Juncus articulatus	Jointed Rush
Juncus bufonious	Toad Rush
Juncus conglomeratus	Compact Rush
Juncus effusus	Soft Rush
Juncus squarrosus	Heath Rush
Lotus corniculatus	Bird's-foot trefoil
Luzula multiflora	Heath Woodrush
Luzula sylvatica	Greater Woodrush
Molinia caerulea	Purple Moor Grass
Myosotis secunda	Creeping Forget-me-not
Nardus stricta	Mat Grass
Narthecium ossifragum	Bog Asphodel
Oreopteris limbosperma	Lemon Scented Fern
Pedicularis palustris	Marsh Lousewort
Pedicularis sylvatica	Lousewort
Pinguicula vulgaris	Common Butterwort
Plantago lanceolata	Ribwort Plantain
Poa annua	Annual Meadow Grass
Polygala serpyllifolia	Milkwort
Polypodium vulgare	Common Polypod
Potamogeton polygonifolius	Bog Pondweed
Potentilla erecta	Tormentil
Prunella vulgaris	Self-heal
Pteridium aquilinum	Bracken
Ranunculus flammula	Lesser Spearwort
Ranunculus repens	Creeping Buttercup
Rumex acetosa	Common Sorrel
Rumex acetosella	Sheep's Sorrel
Sagina procumbens	Procumbent pearlwort
Salix cinerea	Sally (Grey Willow)

For inspection purposes only.
Consent of copyright owner required for any other use.

EPA Export 25-07-2013:16:19:31

Stellaria alsine	Bog Stitchwort
Succisa pratensis	Devils-bit Scabious
Trichophorum caespitosum	Deer Grass
Trifolium pratense	Red Clover
Trifolium repens	White Clover
Ulex europaeus	Gorse
Urtica dioica	Nettle
Vaccinium myrtillus	Bilberry
Viola palustris	Marsh Violet

FAUNA – METHODS

10.26 Field survey work to collect data on the fauna of the existing environment of the site and surrounding habitats was carried out from September 2002 to July 2003. The field surveys were structured to attain information on wintering birds and other fauna, as well as summer breeding birds and other fauna. The survey area (see Figure 10.2) was extended well beyond the proposed development site, to encompass adjacent areas of ecologically important habitat hosting important, sensitive species, which could be considered in the baseline Information and the assessment of impacts.

Consent of copyright owner required for any other use.
For inspection purposes only.

Survey Area

10.27 The fauna survey area, centred on the proposed development site, was delimited according to the character and geography of the local habitats and their suitability for supporting both representative and important species of fauna, particularly birds. Locations are referred to by the name of the area (e.g. townland or hill) or by the 1km square grid reference. Detailed point locations are also given by six-figure grid references and by 10-figure grid references taken with a hand-held GPS. The survey area reached far enough to encompass the outer reaches of designated nature conservation sites located in the environs of the proposed development site. For the Natural Heritage Areas (NHA) & Special Areas of Conservation (SAC), see Figure 10.2. Included in the winter survey area was Lough Muck, an upland oligotrophic lake located 3km to the west of the proposed landfill site. Having data on the current fauna of the lake is of relevance because it could potentially become a loafing site for scavenging gulls in the event of a future landfill operating at Meenaboll.

Winter Season Survey

10.28 The winter survey of birds/other fauna was carried out in three episodes of fieldwork, between late November 2002 to early March 2003, spreading data collection through the winter period so as to take account of dynamic seasonal (biological and physical) factors such as weather conditions, related behaviour patterns, migratory movements and food availability. In all, 17 1km grid squares were visited (Figure 10.2).

EPA Export 25-07-2013:16:19:31

10.29 Fieldwork was conducted alternately using two complimentary methods:

a) A repeated walk-over / transect survey to detect and record species distributed at variable (generally low-) densities in different habitats. This was aimed primarily at inconspicuous ground species such as Red Grouse, Golden plover, Snipe, as well as most passerines / songbirds.

b) A series of fixed-point observations (FPO) from vantage points (VP1, VP2, VP3) to record the presence of species which are more readily detected in flight, or at rest, from a remote viewing point. This includes species such as birds of prey and corvids or gulls, as well as passerines / songbirds recorded incidentally.

Breeding Season Survey

10.30 The survey area covered by the CBS transect method was eight 1km grid squares (see Table 10.5, Figure 10.2). This included the equivalent coverage as one grid square of three outlying squares (C0010, C0110 and C0109 combined, named the COMBI square) carried out so as to arrange the transect routes through most suitable habitat for important species, particularly Golden Plover.

a) In 2003, data was collected during at least one early season survey visit to all squares, with second late season survey visits to selected squares. The core squares of the proposed development site area were also covered by a late-season transect survey in September 2002.

b) The CBS transect survey was supplemented by fixed-point observations over the breeding season from a number of vantage points, continued from the series of observations carried out over the winter period (see Table 10.4).

For inspection purposes only.
Consent of copyright owner required for any other use.

RESULTS

Survey Coverage

10.31 The survey coverage is measurable by observation time per 1km grid square for both survey methods (a & b). Coverage was not equal for all squares and was weighted according to distance from the site and the target species at which the surveys were aimed. Relative coverage of the grid squares of the study area by either method is expressed in Table 10.3.

EPA Export 25-07-2013:16:19:31

Table 10.3 Summary of survey coverage by various methods, expressed as survey time per grid square, in hours totalled over the survey dates

Method	1 km grid Sq	Total Hours
Winter Surveys		
Walk	B9507	1.5
Walk	B9508	1.5
Walk	B9607	2
Walk	B9608	3
Walk	B9609	1
Walk	B9707	2
Walk	B9708	2.5
Walk	B9709	0.5
Walk	B9808	3
Walk	B9809	3
Walk	B9810	0.5
Walk	B9907	3
Walk	B9908	6.5
Walk	B9909	7
Walk	B9910	4.5
Walk	B9911	2
Walk	C0008	6
Walk	C0009	6
Walk	C0010	1.5
Walk	C0109	3
Walk	C0110	2.5
Walk	C1011	0.5
	Sub-Total Hours	**63**
FPO: VP1		4
FPO: VP3		5.5
FPO: VP2		8
	Sub-Total Hours	**17.5**

For inspection purposes only.
Consent of copyright owner required for any other use.

EPA Export 25-07-2013:16:19:31

Table 10.3 Summary of survey coverage by various methods, expressed as survey time per grid square, in hours totalled over the survey dates (Cont'd)

Method	1 km grid Sq	Total Hours
Summer Surveys		
CBS transects	B9808	2
CBS	B9809	2
CBS	B9909	2
CBS	B9910	2
CBS	B9908	4
CBS	C0008	4
CBS	COMBI	4
CBS	C0009	6
	Sub-Total Hours	**26**
FPO: VP1		3.5
FPO: VP2		7
FPO: VP3		1.5
	Sub-Total Hours	**12**
TOTAL HOURS		**118.5**

For inspection purposes only.
Consent of copyright owner required for any other use.

Survey Data

10.32 The field data for winter and breeding surveys have been collated and presented separately in Tables 10.4 and 10.5.

10.33 In the winter survey, it was not possible to accurately collect quantitative data on the relative abundance of each species, nor is it particularly meaningful to express species data in terms of quantities recorded over the winter period since relatively large numbers of some species were recorded in transitory flocks, though infrequently, while other species occurred frequently though often recorded in low numbers, whereby actual numbers are likely to have been under-recorded. The data is therefore collated to indicate the frequency of occurrence of each species in the survey area over the winter months. This is considered to be more representative of the occurrence of each species in the site. The nature of the observations of particular species is elaborated in the species accounts below.

EPA Export 25-07-2013:16:19:31

10.34 The results of the breeding bird survey provide quantitative data on the occurrence and relative abundance of bird species in the breeding season. Some species were clearly not breeding in the square in which recorded (e.g. Swallow), while others could not definitively be located as breeding in a particular grid square (e.g. Raven). Particular interpretations are provided for each species in the accounts below.

BIRD SPECIES ACCOUNTS

10.35 The following bird species accounts provide a brief interpretation of the survey results for each species. The accounts are organised under the main taxonomic/family group headings. The status of each species is included after the title species name, as to whether resident, winter or summer migrant, listed in Annex I of the EU Birds Directive and/or in the BirdWatch Ireland list of 'birds of conservation concern' after Newton *et al*, 1999.

CORVIDS

Hooded Crow (Corvus corone cornix) Resident

10.36 Aside from Raven, Hooded Crow was the most frequently recorded corvid species throughout the winter and summer bird surveys.

For inspection purposes only.
Consent of copyright owner required for any other use.

10.37 Over the winter period, small numbers (i.e. 1-3 birds) were regularly present mainly in the proposed development site squares (B9908, B9909 and C0009) in young 2nd rotation forestry or in closed canopy forest usually near the forest edge. Birds were generally vocal and mobile, moving within these habitat types and between them and moorland habitats also. On the other hand, observations of Hooded Crow in higher moorland habitat in the outlying squares were none or few. A relatively large roving flock of 32 birds was observed on one occasion in square C0008 in late February 2003. These birds had settled on an overhead power line and on the ground underneath. The flock subsequently moved south and westward, circling over the forestry and descending into clearfell on the south side of the regional road.

10.38 The CBS and fixed point survey identified two or possibly three pairs occupying territories in the proposed development site squares B9908, C0009 and B9909 respectively. Compared with the winter distribution, the location of pairs or individuals over the breeding season shows a consistent pattern to suggest that no more than two to three pairs are resident in this area throughout the year. Neighbouring territories are expected in wooded margins and copses further down the Owenbeg river valley in association with hill farms and the sheep range and in forestry and river valleys to the south of the study area.

EPA Export 25-07-2013:16:19:31

10.39 The occurrence of roving flocks outside the breeding season, which may comprise a high proportion of juvenile birds, is a typical occurrence in areas such as this where the species is well established and supported by extensive suitable habitat throughout the region.

Raven (Corvus corax) Resident

10.40 This largest corvid species is typically found in uplands and associated wooded, moorland and farmland habitats. Small numbers (i.e. 1-4 birds) were recorded frequently and widely in both winter and breeding birds surveys. Outside of the breeding season, Raven was most frequently recorded in the proposed development site squares B9908, B9909 and C0009, as well as B9910 and the Lough Muck square B9608. Fewer records were made in neighbouring squares, though Raven was still well represented in most parts and habitats in the area. When observed, birds were generally mobile and vocal, tending to move extensively around the area.

10.41 Raven breeds earlier in the year than most other bird species and the CBS transect survey did not indicate clearly the status of this species. However, taking all records into consideration, particularly activity recorded in January and February, it appears that there may be three or four Raven territories either wholly or partially (note that Raven holds a large territory which may extend beyond the study area) within the study area; one in the centre/north-west part, one the centre/south, possibly one in the east extending further eastward, and one in the Lough Muck area.

For inspection purposes only.
Consent of copyright owner required for any other use.

RAPTORS

Hen Harrier (Circus cyaneus) Resident / Annex I / BWI Red List

10.42 Recorded on two winter survey dates in November 2002 and January 2003. On both occasions, one adult male was observed for a few minutes in low flight, hunting over open moorland and 2nd rotation forest around Meenagannive, within 1km north-east of the proposed development site. Hen Harrier was recorded on a number of occasions in the first half of the breeding season. A 'ring-tail' (i.e. an adult female or an immature first year bird of either sex) was observed in March, April and May. These records indicated repeated presence of a 'ring-tail' in the same area within 500m south of the proposed development site in square B9908. In May, a male was seen performing a sky-dance display in the same area and the male and female were observed together on consecutive days at this time (Lorcan O'Toole pers. comm). The pattern of observed behaviour is indicative of pairing and the establishment of a breeding territory. The habitat, young second rotation forestry, is suitable for a nest-site. Similar nesting habitat is used elsewhere in Ireland.

EPA Export 25-07-2013:16:19:31

10.43 Subsequently, there was no further evidence of Hen Harrier in this area in the nesting period, despite further periods of observation in June and July. It is thought that this may have been a new territory but that pairing occurred too late in the season to result in breeding.

Merlin (Falco columbarius) Resident / Annex I / BWI Amber List

10.44 Merlin, the smallest of our falcons which are thinly distributed across the country, associated mainly with areas of heather moorland were recorded twice over the winter survey period at Meenaboll. In the first and second week of December a female and male respectively were spotted flying low over mature conifers to the north of the mast in sq. C 00 09. Although no signs were encountered suggesting this raptor may breed in the area, forest edges and moorland habitats in the proximity of the site could potentially provide nest sites.

Kestrel (Falco tinnunculus) Resident

10.45 Both male and female Kestrel were recorded regularly in both forested and open moorland habitat near the proposed development site, usually foraging. Records were made in September 2002, through the winter period and in the 2003 breeding season. This would indicate that at least one pair nest in mature forestry, probably to the west or south-west of the proposed development site. A number of pairs may breed in the study area.

For inspection purposes only.
Consent of copyright owner required for any other use.

Buzzard (Buteo buteo) Resident

10.46 Buzzard was seen in the study area on a number of occasions from February to June 2003. In February two birds were observed flying into the forestry area to the north of, the proposed development site. In February and March 2003, one buzzard was seen on a number of visits around the head of the Owenbeg river valley between the forestry and enclosed sheep pastures with scrub woodland. It appeared that this activity concerned a pair associated with an established breeding territory (Lorcan O'Toole, pers. comm) c.2km further down the Owenbeg valley.

10.47 Subsequently, territorial display by a Buzzard was witnessed in square B9808 in late May, where mature forestry abuts with clearfell and young second rotation forestry. This forest edge habitat appears to be a suitable nest site location. Two weeks later in June, a pair of Buzzard was observed in flight, emerging from this area. The birds were being mobbed by two Raven. One of the pair of Buzzard continued to be mobbed ferociously by the two Ravens, observed for more than a half hour period, and was still being mobbed at height while disappearing from view in a north-eastward direction over Binswilly.

10.48 There was therefore a clear indication of a Buzzard breeding territory within 1km to the south-west of the proposed development site. It is unknown if the birds actually breed successfully. There were no indications of birds in the area in late July. Forestry management operations, including clear-felling were noted in the area over the summer period.

EPA Export 25-07-2013:16:19:31

Sparrowhawk (Accipiter nisus) Resident

10.49 This species was occasionally seen over winter, spring and summer months foraging over second rotation forestry and in mature forestry or forest edge. Both male and female were seen on one day flying into mature forest in square B9908 south of the proposed development site. There is certainly one pair, and possibly two to three pairs of Sparrowhawk breeding in forestry habitat within 1km of the proposed development site.

Golden Eagle (*Aquila crysaetos*) Vagrant / Re-introduced Species / Annex I

10.50 A Golden Eagle was seen once soaring to the east of Binswilly on 13 March, 2003. Further registrations were not made in the course of the survey. A re-introduction programme commenced in 2001 at Glenveagh National Park, so that 12 birds released in 2001 and a further 12 birds released in 2002 were indicated as present in Co Donegal or other parts of the country. While these birds were prevalent mostly in the Derryveagh Mts., they are expected to wander broadly about the mountain ranges of the west and north predominantly during their first five years while immature. This has been verified to by radio-telemetry. Information on the reintroduction programme in relation to the proposed development was gained from discussion with the Golden Eagle reintroduction project manager.

For inspection purposes only.
Consent of copyright owner required for any other use.

GROUSE

Red Grouse (Lagopus lagopus hibernicus) Resident / BWI Red List

10.51 Generally seen when flushed from ground cover, this species was recorded on a walk-over survey and on transect counts in both winter and summer periods. It is widely, though sparsely distributed in open moorland, but often quite close to the edge of forestry. Single males were recorded on successive occasions from Meenagannive to Binswilly on the east side, and west of Lough Muck to Brallanmore, on the west side of the study area. A pair was also recorded in square B9907 south of the proposed development site. In addition piles of droppings, indicating presence, were quite frequent in most of the 1km squares of the study area other than in forestry habitats.

WADERS

Golden Plover (Pluvialis apricaria) Resident & winter/passage migrant Annex I / BWI-Amber List

10.52 Although this species winters in Ireland in large numbers, a relatively small resident population breeds mainly on upland habitats such as plateau blanket bog and heath. Afforestation and other landuse conversion coupled with increased disturbance caused by hill-walkers has lead to a decline in this species over recent decades in the Britain and Ireland, with an estimated population of 400 pairs in Ireland (Gibbons 1993), concentrated mainly in the upland regions of the west and north-west.

EPA Export 25-07-2013:16:19:31

10.53 Golden Plover was widely distributed in the study area throughout the winter period, noted regularly at several locations in upland blanket bog and wet heath, 1-3km from the proposed development site. Recorded two at a time for the most part, small flocks also occurred, e.g. 10 birds counted in January on blanket bog west of Binswilly (1km square C0110). Birds frequently occurred from Brallanmore to Lough Muck and further south-west.

10.54 The distribution of breeding territories was found to be not dissimilar to the winter distribution. To the west of the proposed development site, the presence of Golden Plover uttering defensive calls indicated at least one breeding territory in 1km square B9809 and possibly a second in B9909/B9910. It is known from the Upland Bird Survey 2002 (Dúchas / BirdWatch Ireland) that Golden Plover were recorded as breeding in B9709, B9608, B9407, B9406 and B9507. To the east of the proposed development site, three or possibly four breeding territories were located from Meenaboll Hill to Meenagannive and to the west of Binswilly (in four 1km squares). Territories were confirmed, one in each of the 1km squares C0001, C0109 and C0010, while a possible territory was indicated in C0008 by a bird calling in early summer, but further presence in the breeding season was not recorded on subsequent survey visits.

Snipe (Gallinago gallinago) Resident / BWI Amber List

10.55 Snipe was distributed widely though sparsely in winter on moorland and other wet habitat in the study area. Flushes and wet grassland were favoured feeding areas, such as occur west of Meenagannive. Feeding habitat is also widespread in the second rotation forestry, including the proposed development site. Several breeding territories were recorded on transect counts by the presence of calling birds during the breeding season. These were in open moorland habitats indicating an average breeding density of c. 2 pairs per square km.

For inspection purposes only.
Consent of copyright owner required for any other use.

Woodcock (Scolopax rusticola) Resident / BWI Amber List

10.56 Woodcock may be more abundant in winter than summer, due to augmentation by continental migrants. Suitable habitat is afforded by 2nd rotation and closed forest edge adjacent to moorland which is used for feeding. While Woodcock was recorded in winter in B9909 and C0010, breeding was not recorded although the species is likely to be present in the breeding season. It may be under-recorded by the CBS transect method, since it is rarely apparent other than in territorial 'roding' flights at dusk. A species-specific survey method would be required to properly assess its breeding status and abundance.

Passerines

10.57 This group comprises the greater proportion of bird species recorded in the surveys, as well as the ten most abundant breeding species in the area of the proposed development site, which are listed below.

EPA Export 25-07-2013:16:19:32

10.58 The ten most abundant breeding bird species are listed below:

Meadow Pipit (Alauda arvensis) Resident

10.59 Meadow Pipit was the most abundant breeding species across the study area, well represented in both open moorland and young 2nd rotation forestry habitats. Highest densities were recorded in squares where these habitats are the dominant types. It was essentially absent in closed canopy high forest. The species was absent over the winter period, with birds returning from lowlands in March onward.

Chaffinch (Fringella coelebs) Resident

10.60 This common species was among the most abundant in the study area. Territories were closely linked to the availability of mature conifer forest and abundance varied according to the proportion of forestry or alternative woodland cover in each square. Thus the highest density was found in squares where closed high forest was the dominant habitat and lowest in squares lacking in forest or other tree cover. Birds were evident in winter months in forest habitats in B9607, B9908, C0008.

Skylark (Alauda arvensis) Resident / BWI Amber List

10.61 Skylark was the third most abundant breeding species in the CBS transect survey. Highest densities were recorded in squares where open moorland with blanket bog is the dominant habitat. The species was absent over the winter period, with birds returning from lowlands in March onward.

For inspection purposes only.
Consent of copyright owner required for any other use.

Robin (Erithacus rubecula) Resident

10.62 This common species ranked joint-fourth in abundance breeding bird in the CBS transect survey. The density of territories was highest where closed high forest was the dominant habitat. Squares dominated by 2nd rotation forestry supported lower densities. Robin territories were not recorded in open moorland habitats. Birds remained in the study area through the winter period.

Wren (Troglodytes troglodytes) Resident

10.63 Wren was ranked joint-fourth most abundant in the CBS breeding bird survey. Abundance was relatively high in squares with 2nd rotation forestry, but birds were scarce or absent in closed forest and blanket bog and open moorland habitats where deep heather cover or other shrubbery is lacking. Presence of Wren was recorded through the winter period.

EPA Export 25-07-2013:16:19:32

Willow Warbler (Phylloscopus trochilus) Summer Migrant

10.64 This typically scrub woodland species was recorded the fifth most abundant in the CBS survey. Territories were moderately frequent in squares with closed forest or young 2nd rotation forestry, but were largely lacking in squares where open moorland / blanket bog is dominant. This species is a summer migrant, leaving Ireland in September and returning to breed in March and April.

Coal Tit (Parus ater) Resident

10.65 This species ranked joint-sixth most abundant in the CBS. It is at home in conifer forest and occurred at moderate density in afforested habitats in the study area. Territories were most abundant where the dominant habitat was closed forest and elsewhere its occurrence relied on smaller portions of high forest occurring in those squares. Presence of Coal Tit was recorded in this habitat through the winter.

Gold Crest (Regulus regulus) Resident

10.66 This species ranked joint-sixth in abundance in the CBS and its habitat preferences and distribution was similar to that of Coal Tit, with a significantly higher breeding abundance in habitat dominated by closed forest. It was absent from squares where open moorland habitats are the dominant type. Presence of Coal Tit was recorded in forest habitat through the winter.

For inspection purposes only.
Consent of copyright owner required for any other use.

Dunnock (Prunella modularis) Resident

10.67 Dunnock ranked joint-seventh in abundance in the CBS. As it generally prefers habitats such as thick hedges, shrubbery or scrub woodland, this breeding species was not widespread in the survey area. Territories were recorded in suitable pockets of habitat, such as isolated clumps of dense conifer-willow/birch and bramble thickets associated with the 2nd rotation forestry or the edge of closed forest blocks.

Siskin (Carduelis spinus) Resident

10.68 Siskin ranked joint-seventh in abundance in the CBS. Confined here to afforested habitats, this species generally prefers pine and mixed woodland for feeding and breeding. Siskin was located infrequently in closed forest closed to the forest edge and in young 2nd rotation plantation in the proposed development site squares. A number of fledged broods were observed in the late summer period feeding in the scrub and herbage within the 2nd rotation in these squares.

10.69 Passerines occurring in low abundance are listed below.

EPA Export 25-07-2013:16:19:32

Song Thrush (Turdus philomelos) Resident

10.70 Song Thrush was recorded from forest habitats in B9808, B9908, B9909 in the transect survey, indicating two or three breeding territories. Presence was not recorded in the winter survey.

Mistle Thrush (Turdus viscivorus) Resident

10.71 At least two breeding territories were recorded in B9908 and B9910. This species was recorded from a number of forestry squares through the winter.

Treecreeper (Certhia familiaris) Resident

10.72 Treecreeper was only recorded at two locations in conifer forestry, indicating that this species occurs and breeds in low numbers. Treecreepers would tend to prefer mixed woodland with higher species diversity that conifer plantation.

Redpoll (Carduelis flammea) Resident / BWI Amber List

10.73 Redpoll was recorded occasionally during the winter survey in small numbers in the young 2nd rotation and in standing forest of two proposed development site squares. In the breeding season, small numbers were also recorded on the CBS transects in the afforested squares B9808 and B9909 indicating that a low abundance of this species breeds in the area of the site in forestry habitat.

Consent of copyright owner required for any other use.
For inspection purposes only.

Reed Bunting (Emberiza schoeniclus) Resident

10.74 This species was recorded occasionally in small numbers during the latter half of the winter survey, occurring in five squares including the proposed development site squares chiefly in the young 2nd rotation forestry. Abundance in the study area was apparently low in summer. One occupied territory was identified in the breeding bird transect survey in the proposed development site square B9908, where tall herbaceous and scrub vegetation of the 2nd rotation forestry provides suitable habitat for this species.

Stonechat (Saxicola torquatus) Resident / BWI Amber List

10.75 This species was not prevalent over the winter period, though presence was noted in young 2nd rotation forestry in early December. Two to three pairs of Stonechat were recorded in the 2003 breeding season. These were located in the low scrub habitat of the young second rotation forestry, within three proposed development site 1km squares B9808, B9908 and B9909 (Table 10.5). A late season visit indicated that broods of three or more young were successfully raised by at least two pairs.

EPA Export 25-07-2013:16:19:32

Chiffchaff (Phylloscopus collybita) Summer Migrant

10.76 This species was recorded only once, in tall conifer habitat in C0008 / C0009 in late March, at the end of the winter survey. The fact that it was not recorded in the breeding survey may suggest that the bird was singing on arrival when recorded, but did not hold a breeding territory at this location and may have moved elsewhere. This species is a summer migrant, leaving Ireland in September and returning to breed in March and April.

Sedge Warbler (Acrocephalus schoenobaenu) Summer Migrant

10.77 One breeding territory was indicated by a Sedge Warbler singing from a small clump of scrub willow close to the forestry road junction at the north of the 1km square, B9908. This species is a summer migrant, leaving Ireland in September and returning to breed in April.

Grasshopper Warbler (Locustella naevia) Summer Migrant / BWI Amber List

10.78 Males were heard singing at a number of locations in 2nd rotation forestry habitat within three proposed development site squares B9908, B9909 and C0009. Suitable vegetation in the form of damp grassy herbage with low thicket and an abundance of rushes (soft rush, *Juncus effusus*) is extensive, providing suitable breeding habitat to support three occupied territories. This species is a summer migrant, leaving Ireland in September and returning to breed in April.

For inspection purposes only.
Consent of copyright owner required for any other use.

Dipper (Cinclus cinclus hibernicus) Resident

10.79 Dipper was recorded in the breeding season along the stream tributary of the Owenbeg River in the 1km square C0010. It is likely that a number of territories may exist in the upper reaches of the Owenbeg and Shruhanpollandoo rivers although records were not obtained during walks on stretches of river in Spring. Winter records were of a Dipper flushed from a main drain in the 2nd rotation forestry in B9909 and on the Owenbeg River.

Wheatear (Oenanthe oenanthe) Summer Migrant

10.80 One breeding territory was identified by a bird uttering alarm call in the open upland area of heath near the small peak / ridge in B9910. This species is a summer migrant, leaving Ireland in September and returning to breed in March and April.

Whinchat (Saxicola rubetra) Summer Migrant / BWI Amber List

10.81 A brood of Whinchat was recorded in a late breeding season transect survey in 2002 near the road in grid square B9909. However, breeding was not recorded in the 2003 season. This species is a summer migrant, leaving Ireland in September and returning to breed in March and April.

10.82 Non-breeding Passerines:

EPA Export 25-07-2013:16:19:32

Goldfinch (Carduelis carduelis) Resident

10.83 Goldfinch occurred over the winter in small flocks of four to 10 birds, which were seen feeding near the roadside on seeding herbaceous vegetation of the verges and 2nd rotation forestry. It was not recorded during the breeding season.

Snow Bunting (Plectrophenax nivalis)

10.84 This winter migrant was recorded once from squares B9907 / B9908, when a flock of four birds was seen along the gravel road. It is occasionally found across the Donegal uplands and on coastal grasslands.

Crossbill (Loxia curvirostra) Resident

10.85 This species has become an established Irish breeder in recently introduced habitat created by conifer plantation. In the current survey, breeding was not recorded. However, a roaming flock was seen at the high forest edge in B9909 on one occasion in winter, numbering approximately 30 birds.

Blackbird (Turdus merula) Resident

10.86 Though a very common and widespread species, Blackbird was scarcely recorded in the study area. This is possibly due to a lack of suitable feeding habitat for this species. Individuals were noted in the winter survey, but no records were made in the breeding transect survey.

For inspection purposes only.
Consent of copyright owner required for any other use.

Blue Tit (Parus caeruleus) Resident

10.87 Noted from some forestry squares through the winter, Blue Tit was not recorded as breeding.

OTHER BIRD SPECIES

Cuckoo (Cuculus canorus) Summer Migrant / BWI Amber List

10.88 Cuckoo was recorded in the transect survey in May, when male territorial activity was recorded in C0008. This indicates at least one territory of this parasitic species, active in the forested, 2nd rotation and moorland/forest edge habitats in and around this grid square. There are several potential host species present, some in abundance.

Jay (Garrulus glandarius) Resident

10.89 Jay is relatively uncommon in Co Donegal, though widely distributed, frequenting natural or mixed woodlands and moving across much of the conifer forestry which may provide habitat corridors linking established pockets of the population.

EPA Export 25-07-2013:16:19:32

10.90 In the winter survey, Jay was recorded in closed canopy forest in squares particularly in Autumn and early Spring. These were individuals or small groups moving through the canopy, possibly feeding on pine and spruce cones. There were no indications of breeding in the transect survey, but dispersed territories associated with conifer plantations may exist in the area.

Grey Heron (Ardea cinerea) Resident

10.91 Habitat is very limited for this species, which was recorded on just one winter visit in square B9607 near Lough Muck. Some opportunity for feeding is provided by the lake shore, streams and flushes, however Heron is clearly not an abundant or breeding species of this area, or uplands in general.

Swallow (Hirundo rustica) Summer Migrant / BWI Amber List

10.92 Small numbers of Swallow feeding on the wing were recorded during the transect survey, particularly in open moorland areas, west of the forestry. Such birds are likely to be breeding in lower areas such as at farm yards in the neighbouring localities.

House Martin, (Delichon urbica) Summer Migrant

10.93 As for Swallow, just one bird was recorded feeding in flight.

Wood Pigeon (Columba palumbus) Resident

10.94 Wood pigeon was recorded in the afforested areas through the winter and breeding in relatively small numbers.

For inspection purposes only.
Consent of copyright owner required for any other use.

EPA Export 25-07-2013:16:19:32

Table 10.4 Winter Frequency of Occurrence per Square of Bird Species in 17 Grid Squares (From Autumn 2002 to Spring 2003)

Species		1km grid square																	Frequency For Whole Study Area
Common Name	Code	B9607	B9907	B9508	B9608	B9708	B9808	B9908	B9809	B9909	B9910	B9911	C0008	C0009	C0010	C0109	C0110	C0011	
Blackbird	B.	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	3
Blue Tit	BT	0	0	0	0	0	0	1	0	2	1	0	2	1	0	0	0	0	7
Buzzard	BZ	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2
Chaffinch	CH	1	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	5
Chiffchaff	CC	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2
Coal Tit	CT	0	0	0	0	1	1	3	0	2	1	0	0	1	0	0	0	0	9
Crossbill	CR	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Dipper	DI	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Dunnock	D.	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	2
Golden Eagle	EA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Goldcrest	GC	0	0	0	0	0	0	1	0	1	0	0	1	2	0	0	0	0	5
Golden Plover	GP	0	0	1	0	0	0	0	0	0	1	0	0	0	1	1	1	0	5
Goldfinch	GO	0	1	0	0	0	1	3	0	1	0	0	0	0	0	0	0	0	6
Great Tit	GT	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2
Grey Heron	H.	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hen Harrier	HH	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	3
Hooded Crow	HC	1	0	0	0	0	0	7	0	7	0	0	1	7	0	0	1	0	24
Jay	J.	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	2
Kestrel	K.	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	2
Long-tailed Tit	LT	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2
Meadow Pipit	MP	1	0	0	1	1	0	1	0	3	0	0	3	4	0	1	0	0	15
Merlin	ML	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
Mistle Thrush	MT	0	0	0	0	0	1	2	0	0	0	0	0	1	0	0	0	0	4
Pheasant	PH	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Raven	RN	0	1	0	3	1	1	10	1	5	4	2	4	4	0	1	1	0	38
Red Grouse	RG	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0	5
Redpoll	LR	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	2
Reed Bunting	RB	0	0	0	0	1	0	1	0	2	1	0	0	1	0	0	0	0	6
Robin	R.	0	0	0	0	2	1	3	0	2	0	0	2	2	0	0	0	0	12
Siskin	SK	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	3
Skylark	S.	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	4
Snipe	SN	1	0	0	0	1	0	0	0	0	1	0	0	0	0	2	1	0	6
Snow Bunting	SB	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Sparrowhawk	SH	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Stonechat	SC	0	0	0	0	0	1	0	0	2	0	0	1	2	0	0	0	0	6
Tufted Duck	TU	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Woodcock	WK	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	4
Woodpigeon	WP	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	3
Wren	WR	0	0	0	0	1	1	4	0	3	0	0	1	6	0	0	0	0	16
TOTAL NO. OF SPECIES	**6**	**4**	**1**	**6**	**9**	**9**	**45**	**1**	**41**	**10**	**2**	**21**	**43**	**3**	**7**	**5**	**0**		

Consent of copyright owner required for any other use. For inspection purposes only.

EPA Export 25-07-2013:16:19:32

Table 10.5 Bird Species Breeding or Present (X) in the Meenaboll Survey Squares, Indicating Levels of Abundance and Diversity of Species

CODE	BIRD SPECIES	MAIN HABITAT / 1KM GRID SQUARE								MEAN RELATIVE ABUNDANCE
		2F/F B9908	2F/F B9909	2F C0009	F B9808	BB B9809	BB B9910	BB C0008	BB COMBI	
MP	Meadow Pipit	17	13	12	6	5	8	10	13	10.50
CH	Chaffinch	10	3	8	25		6	2		6.75
S.	Skylark	3		2	4	13	13	2	14	6.38
R.	Robin	6	5	5	17		4			4.63
WR	Wren	12	7	13	2			3		4.63
WW	Willow Warbler	6	2	4	5		3			2.50
CT	Coat Tit	3	3	1	8		1			2.00
GC	Goldcrest	2	1	1	12					2.00
D.	Dunnock	3	2		2					0.88
SK	Siskin		1	3	3					0.88
GP	Golden Plover					2		1	3	0.75
HC	Hooded Crow	2	X2	3		X	X			0.63
GH	Grasshopper Warbler	2	1	1						0.50
LR	Redpoll		2		2					0.50
SN	Snipe			2					2	0.50
ST	Song Thrush	1	2		1					0.50
TC	Treecreeper			2	2					0.50
MT	Mistle Thrush	1					2	X		0.38
SC	Stonechat	2	1							0.38
K.	Kestrel	1			1					0.25
RB	Reed Bunting	2								0.25
RG	Red Grouse			1					1	0.25
SH	Sparrowhawk	2	X							0.25
SW	Sedge Warbler	1	1							0.25
WP	Woodpigeon	1			1					0.25
BZ	Buzzard				1			X		0.13
CK	Cuckoo					X		1		0.13
DI	Dipper								1	0.13
HH	Hen Harrier	1	X							0.13
W.	Wheatear						1			0.13
HM	House Martin						X			X
J.	Jay									X
RN	Raven					X	X	X		X
SL	Swallow	X		X		X2		X		X
Total Species Abundance:		**78**	**44**	**58**	**92**	**20**	**38**	**19**	**34**	
Species Number/Diversity:		**21**	**17**	**15**	**16**	**7**	**11**	**10**	**6**	

For inspection purposes only.
Consent of copyright owner required for any other use.

EPA Export 25-07-2013:16:19:32

MAMMALS

Red Deer (Cervus elaphus)

10.95 Red deer occur across the main upland ranges of Co Donegal, from Falcarragh to Pettigo and from Gweebarra to Ballybofey. Today's population originated from the herd established in the former *Glenveagh Deer Forest* from the late 19th century to around 1910. The original herd was based on imported stock from England, Scotland and Co Wicklow. Significant expansion in the range of the population occurred from around 1970, owing to the establishment of conifer plantation forestry, which provides secure cover for the deer. Meenaboll is located in the central part of the deer population's range within a large network of early forestry plantations.

10.96 Red deer are social and tend to occur in matriarchal or family groups. The groups occur in networks, each occupying neighbouring 'home ranges', which usually include lower, sheltered areas with tree or shrub cover and a more open or upland area of summer grazing. Thus, the size of the home range area varies seasonally, expanding into the mountain zone in summer and contracting into valleys, woodland or forestry in winter. Deer use the habitat of the home range according to diurnal patterns of behaviour. Bouts of activity and movement in the range concur with feeding patterns around dawn and dusk and under cover of darkness.

For inspection purposes only.
Consent of copyright owner required for any other use.

10.97 There were clear patterns of the occurrence of established social groups of deer at Meenaboll. The afforested valleys and coll area at the head of the Shruhanpollandoo and Owenbeg watersheds are central to the home range of several social groups. Some of these groups tend to range eastward moving between the 2nd rotation forestry around the proposed development site and the Binswilly – Meenaboll ridge. A group of 17 deer was situated just north of Binswilly peak on one occasion.

10.98 A more extensive open area of mountain-side occurs to the west of the main valleys and proposed development site. Approximately 30 deer, distributed in small groups, were counted in their summer range across eastward slopes of Crockastoller in September 2002. Deer were frequently seen in the Lough Muck area and on the Brallanmore ridge near the forest edge.

EPA Export 25-07-2013:16:19:32

10.99 The distribution and occurrence of deer has been observed throughout the survey visits. Groups and individuals have been seen feeding in all parts of the 2nd rotation forestry and at the edge of closed canopy high forest. This is further indicated by the presence of tracks and droppings throughout the area, and conspicuously on the surface of forestry track roads. A number of well established deer paths were noted linking the higher open areas to both east and west with the forestry of the main valley and proposed development site. Clear evidence of territorial behaviour associated with rutting (when dominant stags hold and defend groups of hinds) was identified by active wallows and trashed shrubbery, one to the north and one to the south-east of the proposed development site.

10.100 Based on the observations made during field visits, it is evident that the study area forms a significant part of the home ranges of an estimated 60 – 100 deer, which is in the order of 10% of the Donegal population.

Red Fox (Vulpes vulpes)

10.101 Although foxes were not seen during the survey, there was widespread evidence of the presence and territorial activity of foxes in the form of trails and fox scats. This was recorded on numerous survey visits in the following grid squares: B9909, B9910, C0009, C0109, B9808, B9809, B9908, C0008, B9707. On one occasion, a strong fox odour was detected along a narrow forest ride where other signs such as small bones (food remains) and fox dung were plentiful. This was indicative of a possible fox earth at B 990 092.

For inspection purposes only.
Consent of copyright owner required for any other use.

Irish Hare (Lepus timidus hibernicus)

10.102 Hares were seen on fieldwork walks and transects on a number of occasions, in open blanket bog and wet heath habitats in grid squares B9607, C0109. Other signs of hare presence was found, such as droppings and a hare 'form' in C0008.

Otter (Lutra lutra)

10.103 Otter was seen on one occasion in the winter survey in Lough Muck near the eastern shore. Evidence of Otter activity was also seen here in the form of foot-prints on the shore sediment and spraints were found on different occasions along the Sruhanloughmuck stream (B9607) and at the side of another small stream in grid square B9707.

Feral Goat

10.104 A group of feral goats was apparently resident in and near the forest area close to the proposed development site over the survey period. Ten goats were feeding in the 2nd rotation forestry of B9908 in September 2002, which is likely to have been a breeding group controlled by a dominant male. Two goats were seen browsing at the edge of tall closed canopy forest in B9910 in December 2002, and others may have been out of sight in the tree cover.

EPA Export 25-07-2013:16:19:32

10.105 No methodological assessment was made of small mammal species. The forest habitats are likely to host the Wood mouse (*Apodemus sylvaticus*) and presence of Pigmy Shrew (*Sorex minutus*) was noted in B9909 in May, when heard in deep grass cover in the 2nd rotation forestry. The ubiquitous Brown Rat (*Ratus norvegicus*) may also occur at times.

10.106 Other mammals were not evident during fieldwork in the study area, although Badger (*Meles meles*) is likely to occur, perhaps lower down the river valleys adjacent to enclosed farmland and pasture. No signs of Pine Marten (*Martes martes*) presence were found.

AMPHIBIANS & REPTILES

Common Frog (Lana temporaria)

10.107 Both mature frogs and small immature individuals were encountered in the study area occurring principally in wet areas within the 2nd rotation forestry, flush vegetation along forest rides, in streamside vegetation and in extensive wet grassland and flush systems. Presence was noted in B9808, B9908, and C0009.

For inspection purposes only.
Consent of copyright owner required for any other use.

Viviparous Lizard (Lacerta vivipara)

10.108 This species was not recorded during surveys, but it is known from upland moorland habitats in the general area.

Invertebrates

10.109 A number of *Odonata* were recorded in peatland habitat and near water bodies. Dragonfly species include, the Common Hawker (*Aeshna juncea*), which was recorded frequently within the 2nd rotation forestry, the Common Darter (*Sympetrum striolatum*), which was abundant in wet boggy places and close to streams in C0010, C0009 and B9808, particularly in late summer 2002. The Four-spotted Chaser (*Libellula quadrimaculata*) was recorded in May 2003, in wet boggy areas in B9808 and B9809. A wet forest ride in B9808, rich in bog mosses, was a habitat where all three species were recorded, and where the Large Red Damselfly (*Phyrrhosoma nymphula*) was also recorded (see under flora, section 10.9).

10.110 Butterfly species included Large White (*Pieris brassicae*), Meadow Brown (*Maniola jurtina*), Peacock (*Inachis io*) and Painted Lady (*Cynthia cardui*). A number of Hoverfly and Bumble bee species were also noted. Moth species, typical of moorland and wood or heath areas were also seen.

EPA Export 25-07-2013:16:19:32

AQUATIC MACROINVERTEBRATES AND BIOLOGICAL ASSESSMENT OF WATER QUALITY

The Owenbeg River

10.111 The Owenbeg River (Sample Site 1) rises on Binswilly and Meenagannive hills to the south of the Glendowan Mountains. It is a headwater of the Leannan system, confluencing with the Bullaba River, a known salmon spawning river, above Gartan Lake. It is a small river, the channel being approximately one metre wide and ten centimetres deep in the survey area, though deeper pools exist. The substrate consisted of semi submerged stones and gravel. The river was fast-flowing with clear and odourless water. Mosses grew on semi-submerged stones. Conifer plantation verged the riverbank on both sides. Grid co-ordinates for Sample Site 1 are B 999 103. The locations of sample sites are indicated in Figure 10.2.

The Sruhanpollandoo and Cummirk River

10.112 The Cummirk River (Sample Site 2) is part of the Foyle catchment and a tributary of the Finn River. It appeared to be ideal salmon spawning water, being rich in gravel beds and deep pools. The Loughs Agency, responsible for the Foyle catchment, states that the Cummirk "*is a river of significant importance in terms of spawning habitat for salmon and sea trout*".

For inspection purposes only.
Consent of copyright owner required for any other use.

10.113 The channel width was approximately three metres. Sample Site 2 was immediately downstream of the confluence with the Sruhanpollandoo (grid co-ordinates are B973 073). Human habitation and agriculture (non-intensive) was evident near its banks.

10.114 The Sruhanpollandoo rises partly on Meenaboll Hill and flows into the Cummirk River. About 200-300m above it's confluence with the Cummirk it is c. 3m broad and fast-flowing with pools up to 1m in depth. It has a peaty-brown colour and moderate in-stream plant growth. A Dipper was observed in this area. Sample Site 3 was located in this area (grid co-ordinates B 97277 07405).

10.115 Just over 1km upstream of Sample Site 3, the Sruhanpollandoo narrows to c. 1m and is up to 1m deep. The substrate here is fine and silty gravel which has an orange colour (characteristic of iron-feeding bacteria). Some peaty clumps have dislodged from the banks and fallen into the stream channel. The colour of the water is clear. The Sruhanpollandoo would appear to be suitable habitat for brown trout (*Salmo trutta*). Sample Site 4 was in this area (B 98097 / 08732).

10.116 About 100m below the site of the proposed development the channel width is c. 15-20cm and the depth is c. 5-30cm. The water is fast flowing over a substrate which is heavily silted and orange coloured. New 2nd rotation and medium-aged forestry surrounds this area and covers the southern bank downstream for about 0.5km. Sample Site 5 is located here (B 99447 / 09397).

EPA Export 25-07-2013:16:19:32

PREAMBLE TO METHODOLOGY

10.117 Biological indices using macro-invertebrates provide a reliable and practical method of assessing water quality. Their one drawback is that they are qualitative and not quantitative.

10.118 The Biotic Score Index (Mc Garrigle et al., 1992) is used in this study. Animals are placed into five broad classes A-E, of which group A is the most sensitive, B is less sensitive, C is relatively tolerant, D tolerant and E comprises of the most tolerant forms.

10.119 Using combinations of the relative abundance of these groups in either eroding or depositing sites, water quality is expressed as a Q value where Q1 is bad and Q5 is excellent quality:

Biotic Index (Q value)	**Water Quality**
5 (diversity high)	Good
4 (diversity slightly reduced)	Fair
4 (diversity significantly reduced)	Doubtful
2 (diversity low)	Poor
1 (diversity very low)	Bad

For inspection purposes only.
Consent of copyright owner required for any other use.

10.120 Four categories of water quality are calculated:

Q Value	**Category of River Quality**
Q5, Q4-5, Q4	Unpolluted
Q3-4	Slightly polluted
Q3, Q2-3	Moderately polluted
Q2, Q1-2, Q1	Seriously polluted

METHODS

10.121 Kick-sampling was employed for a duration of three minutes at each sample site. Macro-invertebrate identification was made on-site and in the laboratory.

EPA Export 25-07-2013:16:19:32

RESULTS

Table 10.6 Sample data from Sample Site 1

Order(o), Family(f), Genus(g), or Species(s).	Abundance
Ephemerellidae(f) [Mayfly larva]	High
Ecdyonurus(f) [Mayfly larva]	Low
Baetis rhodani(s) [Mayfly larva]	High
Leuctra(g) [Stone Fly larva]	Low
Stenophylax(f) [Caddisfly larva]	Low
Polycentropidae(f) [Caddisfly larva]	Low
Limnius(f) [Fly larva]	Low
Arachnida(o) [Water spider]	Low
Oligochaeta(o) [Segmented Worm]	Medium
Roundworm(o)	Low
Chironomidae(f) [Midge larva]	Low
Diptera(o) [Fly larva]	Medium

For inspection purposes only.
Consent of copyright owner required for any other use.

Table 10.7 Irish Biotic Score Index at Sample Site 1

A	B	C	D	E
+	++	+++	-	-

Q4-Q5 Fair to good

Table 10.8 Sample data at Sample Site 2

Order (o), Family (f), Genus (g) or Species (s).	Abundance
Nemoura erratica (s) [Stone Fly larva]	High
Leuctra (g) [Stone Fly larva]	Low
Baetidae (g) [Mayfly larva]	High
Ecdyonurus (g) [Mayfly larva]	Fairly High
Limnius (f) [Fly larva]	Low
Oligochaeta (f) [Segmented Worm]	Fairly High
Roundworm (o)	Low
Hydracarina (o) [Water Mite]	Low
Diptera (o) [Fly larva]	Fairly High

EPA Export 25-07-2013:16:19:32

Table 10.9 Irish Biotic Score Index at Sample Site 2

A	B	C	D	E
+++	++	+++	-	-

Q4-5 Fair to Good

Table 10.10 Sample data at Sample Site 3

Order (o), Family (f), Genus (g) or Species (s).	Abundance
Nemoura erratica (s) [Stone Fly larva]	High
Leuctra (g) [Stone Fly larva]	Low
Nemouridae (g) [Mayfly larva]	Low
*Baeti*dae spp. (g) [Mayfly larva]	Low
Cased *Trichoptera* (o) [Cased caddisfly larva]	Low
Caseless *Trichoptera* (o) [Caseless caddisfly larva]	Fairly High
Oligochaeta (f) [Segmented Worm]	Low
Diptera (o) [Fly larva]	Low
Chironomidae (f) [Non-biting Midge larva]	Medium

For inspection purposes only.
Consent of copyright owner required for any other use.

Table 10.11 Biotic Score Index at Sample Site 3

Class A	Class B	Class C	Class D	Class E
-	++++	++	+	-

Q4. Fair

Table 10.12 Sample data at Sample Site 4

Order (o), Family (f), Genus (g) or Species (s)	Abundance
Nemoura erratica (s) [Stone Fly larva]	Fairly High
Nemurella (g) [Stone Fly larva]	Low
Cased Trichoptera (o) [Cased caddis fly larva]	Low
Oligochaeta (f) [Segmented Worm]	Fairly High
Arachnidae (o) [Water Spider]	Low
Chironomidae (f) [Non-biting Midge larva]	Low
Diptera (o) [Fly larva]	Low

EPA Export 25-07-2013:16:19:32

Table 10.13 Irish Biotic Score Index at Sample Site 4

A	B	C	D	E
-	+++	++	+	-

Q4 Fair

Table 10.14 Sample data at Sample Site 5

Order (o), Family (f), Genus (g) or Species (s)	Abundance
Baetis rhodani (s) [Mayfly larva]	Fairly High (n=6)
Copepoda (o) [Aquatic Crustacean]	Low (n=1)
Polycentropidae (g) [Caddisfly larva]	Low (n=1)
Nemurella (g) [Stone Fly larva]	Low (n=1)
Coleoptera (o) [Beetle larva]	Low (n=1)

Table 10.15 Biotic Score Index at Sample Site 5

Class A	Class B	Class C	Class D	Class E
-	++	++	-	-

Q4. Fair

For inspection purposes only.
Consent of copyright owner required for any other use.

DISCUSSION

10.122 The Owenbeg River water quality was good, though it is possible that physical factors, such as tree shading and acidification have had some effect. Furthermore, the riverbed contains medium sized gravel and stone particles, and does not provide as good a habitat area as finer gravel would. It is several kilometres upstream of an important salmon spawning area on the Leannan river system. It is likely that brown trout (*Salmo trutta*) reside in pools on this river. The stream is well-oxygenated and clear.

10.123 The Cummirk River is of good water quality and substrate. Water-flow is characterised by riffles that provide good habitat for macro-invertebrate fauna. Surrounding vegetation type is predominantly bog-land, with forestry upstream. The river provides ideal habitat for salmon spawning where nursery grounds harbour the developmental stages of animals, and it is important to protect the aquatic environment in which they exist.

EPA Export 25-07-2013:16:19:32

10.124 The Sruhanpollandoo is moderately to heavily silted. It had been recently deforested on the date of survey. It shows signs of iron sulphate deposition. This is likely to arise from forestry drainage in the area. Water quality is fair, due to these effects. The adjacent forestry development has probably had a negative impact on the quality of life in this stream.

10.125 The chemical data from the Sruhanpollandoo (Section 12 and Donegal County Council data for 2001-2002) makes it clear that the stream may be subject to elevated nutrient levels (nitrates, nitrites and phosphates), such as occurs on 21/2/02. Levels of nitrites exceed guideline levels for salmonids tenfold on this date (Freshwater Fish Directive: 78/659/EEC). This may arise from fertiliser application to the surrounding forestry. High nutrient levels cause 'eutrophication' in a water body whereby oxygen is rapidly depleted from the water as the nutrients are biochemically broken down by bacteria, possibly causing the asphyxiation of sensitive species of plants and animals.

10.126 Pollutants of concern, which arise from landfill sites are the heavy metals and nutrients. It is important to protect the aquatic environment from these pollutants and as such the landfill has been designed in accordance with EU standards to protect the environment against pollutants. As detailed in Sections 12 and 13 the landfill is located within the catchment of the Finn/Foyle River system which is a designated salmonid water catchment of regional and national importance.

For inspection purposes only.
Consent of copyright owner required for any other use.

CONCLUSIONS

10.127 The Sruhanpollandoo is subject to episodic nutrient pollution arising from local forestry plantations. The Cummirk River may also be susceptible to this pollution, as the Sruhanpollandoo confluences with it within a few kilometres, though overall the Cummirk and Owenbeg Rivers were found to have fair to good quality status. These rivers are sensitive and contain salmonid spawning grounds.

LEGISLATION

10.128 The Wildlife Act (1976) provides the main legal protection for flora and fauna in Ireland, guarding against intentional harm to individuals or populations of species (e.g. capturing or killing without authorisation). Some amendments to this Act have since been made in line with national policy and relevant EU Directives. The Wildlife (Amendment) Act 2000 provides a legal framework for the designation and protection of proposed Natural Heritage Areas (NHA).

10.129 Two European Directives, the Birds Directive (74/409/EEC) and the Habitats Directive (92/43/EEC) are enacted through the "Conservation of Wild Birds Regulations" (S.I. No 291 of 1985) and the "Natural Habitats Regulations" (S.I. No 94 of 1997).

EPA Export 25-07-2013:16:19:32

10.130 The Birds Directive aims to maintain rare or vulnerable bird species (listed in Annex 1 of the Directive) at a favourable conservation status, by designating internationally important bird sites as Special Protection Areas (SPA). In most cases, this affords conservation of sites which hold at least 1% of a species biogeographic population, or over 20,000 waterfowl. Where the distribution of a species is dispersed or not related to discrete sites, wider countryside measures for conservation are required (Way et al, 1993).

10.131 The Habitats Directive aims to protect and conserve natural habitats of international importance in the E.U. through the designation of "Special Areas of Conservation" (SAC). The 'priority habitats*' are the most threatened and require exacting levels of protection. Site selection and designation is an ongoing process and is subject to review. Additional areas may be designated, while designation of existing areas may be revoked, in accordance with the E.U. Directives and Irish Regulations. Landowners can, on scientific grounds, appeal for or against a designation of their land.

10.132 The Water Standards for Freshwater Fish Directive (78/659/EEC) enacted by the Minister for the Environment in the European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 84 of 1988) sets standards for waters harbouring game or coarse fisheries in respect of the more important physico-chemical parameters of pollution by organic wastes as appropriate to salmonid waters, although these are legally binding only in the case of 'designated' waters.

For inspection purposes only.
Consent of copyright owner required for any other use.

10.133 The Water Framework Directive (2000/60/EC) will instigate a process of protective and sustainable management of river catchments in respect of land-use and the control of adverse effects on water resources. New legislation, in the form of regulations, will be rolled out in 2004 and the coming years to enforce implementation of the directive. Donegal County Council is the authority with leading responsibility for implementation of the directive in Co Donegal.

10.134 The Donegal County Development Plan endorses the protection of the landscape and natural heritage and specifies strict planning control policy in identified sensitive zones.

SITE EVALUATION

10.135 The intrinsic qualities of the site and adjacent environment, with regard to ecological value, are appraised below under a number of headings, following the criteria of (Ratcliffe, 1977).

EPA Export 25-07-2013:16:19:32

Naturalness

10.136 The proposed development site is located within an afforested area and thus contains highly modified habitat relative to its former condition prior to planting. Though subject to a regime of extreme change during the cycle of rotation forestry management, afforested habitats of this type retain semi-natural habitat characteristics of value to a suite of flora and fauna species. Moreover, this location is adjacent to an extensive mountainous area, comprising the Glendowen Mts. and the Derryveagh Mts, which is largely uninhabited and has a high level of naturalness protected variously by National Park, NHA, SAC and SPA status.

Size

10.137 The landfill cells will occupy a relatively small area of 4.5ha and the whole waste disposal facility site is to be approximately 14.5 ha in area. The development will also necessitate upgrading of the public road accessing the site to the standard required for the planned waste delivery traffic. Given the scarcity of any built-development in this area and for some considerable distance in any direction, the size and nature of the proposed development site will represent a notable addition to existing land-use in the context of this locality.

Diversity

10.138 In spite of the fact that the site and adjoining afforested habitats are highly modified, the composition of plant communities and species still bears a strong resemblance to natural upland habitats, especially within the 2nd rotation forestry where the vegetation has recovered to form a semi-natural groundcover containing as yet quite a high diversity of species. Plant species diversity would be expected to decrease again within much of the 2nd rotation plantation as the conifer matures to closed-canopy forest. Diversity of fauna species was also found to be moderately high with 27 out of 34 recorded breeding bird species occurring in the four 1km squares dominated by forestry habitats, while 19 of the total were recorded in the four squares dominated by moorland habitats. A total of 49 species were recorded in both winter and summer bird surveys. Mammal species were also quite diverse with Red Deer, Irish Hare and Otter recorded in the survey area.

Content of copyright owner required for any other use.
For inspection purposes only.

Species Rarity

10.139 No protected, threatened or scarce plant species - as listed in the Irish Red Data Book (Curtis & McGough, 1988) or in relevant legislation - was found in or near the proposed development site. A number of bird species occurring in the survey area in the breeding season, though not rare, have a restricted distribution and are considered vulnerable or in decline mainly due to wide-scale habitat loss. These include Hen Harrier, Red Grouse and Golden Plover. Golden Eagle now occurs in the adjacent montane environment as a result of the re-introduction programme and may become a resident breeding species in the next 5-10 years. Merlin has also been recorded near the proposed development site in winter.

EPA Export 25-07-2013:16:19:33

10.140 There were three resident Annex I species recorded (two holding breeding territories). Two BWI Red-listed species and nine BWI Amber-listed species were recorded in the surveys. Otter and Atlantic Salmon are sensitive to habitat deterioration and pollution. Both species are listed in Annex II of the EU Habitats Directive.

Habitat Rarity

10.141 There are no rare habitat types within the site, although a headwater of the River Finn, a pSAC for Otter and Atlantic Salmon and a Designated Salmonid water, arise within the watershed of the site (Sruhanpollando River). There are areas of both upland and lowland western Atlantic blanket bog, including areas with dystrophic bog pools, in the moorlands around the forestry containing the proposed development site. This is a priority habitat of the EU Habitats Directive.

Representativity

10.142 While the habitat of the afforested area containing the site is semi-natural and intensively managed, it is a relatively good area in terms of the diversity of flora and fauna which afforested habitats may support. The proximity of extensive natural moorland habitats, enhances the value of the afforested area to birds such as Hen Harrier, Merlin, and Raven.

For inspection purposes only.
Consent of copyright owner required for any other use.

10.143 The adjacent habitats surrounding the forestry contain some good examples of western Atlantic Blanket Bog as well as other areas which are of ecological importance but threatened by degradation by disparate causes. The area is evidently of notable importance in terms of the concentration of breeding Golden Plover. The Sruhanpollandoo is a good example of an upland river, though the headwaters and riparian habitat has been affected by afforestation. Combined with other local headwaters, namely L. Muck and Sruhanloughmuck, they are integral elements in the catchment of the River Finn, which is of high ecological value.

Proximity to Sites of Ecological Conservation Importance

10.144 The boundaries of three designated nature conservation sites are in close proximity to the proposed landfill facility; Cloghernagore Bog and Glenveagh National Park pSAC (Site code: 2047) reaches to within 0.5km; the River Finn pSAC (Site code: 2301) reaches to within 3km and Meentygrannagh Bog pSAC to within 2.5km, see Figure 10.2. The first two are large, extensive sites. The SACs are designated for the protection of mainly upland and montane habitats including blanket bog, lakes and rivers. The size and commanding geography of these conservation areas reflects their regional, national and international importance and the relatively pristine qualities of the natural environment. In addition, the River Finn is one of just 22 rivers designated as 'Salmonid Waters' according to the Freshwater Fish Directive.

EPA Export 25-07-2013:16:19:33

Sensitivity to Disturbance and Vulnerability

10.145 The proposed development site and contiguous afforested area has previously undergone ground preparation, drainage, planting and rotation forestry management and may thus be considered a 'brown-field' site. Further disturbance in terms of earth-work / construction would not represent a primary impact on the environment. Sensitive habitat areas are the headwater streams in and adjacent to the proposed landfill facility. These watercourses are exposed to potential impacts during construction and operation if there was a failure to contain polluting substances. It is evident that the upper Sruhanpollandoo has been subject to impacts of afforestation. Other natural habitat of the surrounding environment, comprising mainly of blanket bog, is also sensitive to potential impacts such as changes to local hydrology, drift of air emissions including particulate matter as well as litter contaminants, in the unlikely event of a failure to contain and control emissions emanating from the operation of the proposed development. Some species of fauna, particularly listed bird species of conservation importance are sensitive to potential direct or indirect impacts of the proposed development. The pattern of habitat use by Red Deer in the area is likely be modified to some extent due to the location of the proposed development.

POTENTIAL IMPACTS ON FLORA & FAUNA

For inspection purposes only.
Consent of copyright owner required for any other use.

10.146 The nature of impacts on birds and other fauna that may result from the proposed development, are habitat loss, habitat severance, habitat deterioration, disturbance during the construction phase, disturbance during the operational phase, physical hazards of fencing and netting, and changes to the ecological balance of the area.

10.147 The proposed development site is located within the four 1km squares, B9908, B9909, C0008, and C0009. The loss of habitat will extend to an area of approximately 10 ha of the total 14.9 ha of the development site as a large area of the existing forestry will be retained. The loss of habitat will result in displacement of bird species breeding or wintering in the proposed development site area. There will also be a marginal loss of habitat resulting from upgrading of the public road access to the site.

10.148 Within the four 1km grid squares containing the proposed development site, habitat loss may affect species of conservation importance that are experiencing broad trends of decline often linked to habitat change, as indicated in the BWI Amber list. Among these are Siskin, Skylark, Stonechat, Sedge Warbler and Grasshopper Warbler as well as more common bird species. It is likely that the proposed development will result in a decrease in the number of breeding territories of these species in the relevant four 1km squares. BWI Red listed species include Hen Harrier, also listed in Annex1 of the EU Birds Directive. If breeding Hen Harrier is confirmed at the observed location, the birds may be sensitive to the effects of the proposed development, but mitigation of potential adverse effects is possible.

EPA Export 25-07-2013:16:19:33

10.149 Beyond the immediate area of the proposed development site, there are open moorland habitats supporting important breeding species in relatively high concentrations, notably Golden plover and Red Grouse, as well as Irish Hare. While these species occur outside the main impact zone of the proposed development, they may possibly be exposed and sensitive to combined direct or indirect effects including visual and aural disturbance, and a possible increase in scavenger species such as gulls, corvids and foxes.

10.150 Golden Eagle should become a breeding species in the Glendowen / Derryveagh Mts. area the near future, pending the success of the re-introduction programme. Eagles may be drawn to the landfill site, particularly if scavengers such as gulls and corvids are conspicuous. If there was any significant increase in predator/scavenger species due to the landfill, competition for prey species in the broader area could have an impact on the behaviour of the eagles. However bird control measures including the filling of the waste inside an enclosed litter net have been detailed in Section 7 of the EIS.

DO NOTHING IMPACTS

For inspection purposes only.
Consent of copyright owner required for any other use.

10.151 There are other factors affecting the condition of natural or semi-natural bird habitats in the environment of the survey areas. Over-grazing, erosion, mechanical peat cutting and other localised damage to blanket bog were evident in the open moorland areas particularly to the east and north-east pf the proposed development site. Drainage of afforested areas within the watershed has most likely affected bog hydrology up-slope, causing bog surfaces to dry which can lead to vegetation loss and erosion. These processes are likely to reduce the ecological quality of the habitat and affect its value for birds such as Golden Plover and Snipe. Appropriate management of these areas could arrest and reverse the process of deterioration, so as to stabilise the condition of the habitat.

10.152 The cycle and pattern of forestry management in the area of the proposed development site strongly influences the ecological dynamics of birds and other fauna, such as deer. At its current stage, the mosaic of semi-natural habitats, created by the mix of high closed-canopy and new 2nd rotation forest, provides a range of niches for bird species which are adaptable to these changes. However, the nature of the habitat change over time resulting from forestry management may force fluctuations in the populations of different species.

10.153 If the proposed development were not to proceed, it is quite possible, for the reasons outlined above, that the status of different bird species would change over time in relation to the on-going pattern of habitat change or deterioration in the survey area.

EPA Export 25-07-2013:16:19:33

MITIGATION

10.154 Mitigation of impacts on fauna during the construction phases can be achieved through controls on the seasonal timing of works. Avoidance of significant disturbance during the main breeding period (March – July) is recommended and any activities should be sensitively managed and monitored to mitigate possible adverse effects on important fauna.

10.155 Mitigation of effects during construction on surface watercourses should include clearly specified measures to prevent siltation and pollution of streams and rivers by dirtied surface waters.

10.156 Mitigation of effects during operation should include all possible controls and preventative measures to limit noise, dust and visual pollution (including lighting). The 400kVA diesel generator should be suitably housed and noise-proofed.

10.157 Ecological monitoring should be carried on in respect of birds, other fauna, peatland habitats and flora and aquatic ecology both before, during and after construction in the operational phase. Every opportunity should be made to gather baseline data prior to construction. The possible adverse effects arising from forestry management, sheep farming or other land-use practices in the area should be taken into account in order to differentiate these.

Consent of copyright owner required for any other use.
For inspection purposes only.

HABITAT MANAGEMENT & COMPENSATORY HABITATS

10.158 Given sufficient scope, it is possible that a range of habitat management measures, targeted particularly at the more important and vulnerable bird species recorded in the surveys, could support and conserve these species at a favourable conservation status. This calls for an innovative and broad-based approach to address the issues identified, which extend beyond the construction and operation of the proposed development. The measures to be considered includes the following:

i. Retention of existing tall conifers to screen and shelter the otherwise rather open terrain occupied by 2nd rotation forestry around the proposed development site.

ii. Conversion of selected areas of the recently established 2nd rotation forestry into a mosaic of open grassy, heath or dwarf shrub habitat and patches of scrub woodland. In this context, open areas can be managed by maintaining the existing semi-natural wet grassland and heath. Scrub is best established by creating small mono-typic stands of fast-growing tree species including Birch (*Betula pendula*) and Alder (*Alnus glutinosa*) and Hazel (*Corylus avellana*). It is recommended that this entail both the planting of saplings and extensive broad-casting of locally collected seed on scarified ground.

EPA Export 25-07-2013:16:19:33

Other native species can be planted in a more dispersed planting regime, to include Rowen (*Sorbus aucuparia*), Holly (*Ilex aquifolium*), Willow (*Salix cinerea* and *S. caprea*) and Oak (*Quercus patraea*). Given that conifers are now quite well established in the 2nd rotation plantation, these may be now be used to advantage, selectively thinned while retaining a proportion to provide nursery cover for the mixed planting of broadleaves.

iii. The design details for compensatory habitats and habitat management should be based on an objective approach with respect to nurturing particular target species (e.g. Hen Harrier). The approach may be guided by the concepts of ecological gardening and restoration ecology.

iv. Management measures for blanket bog and bird habitats in the adjacent areas would address the joint problems of drainage, overgrazing and erosion which are causing deterioration in the condition of these habitats. Such measures would help the conservation of breeding species including Golden Plover.

v. There should be implementation of the Forestry and Water Quality Guidelines. This should include a set-back (buffer zone) of at least 20m from natural watercourses in respect of re-planting in the afforested areas adjacent to the Shruhanpollandoo / Cummirk Rivers and the Owenbeg systems, left to recover natural vegetation.

vi. Measures considered necessary to comply with the requirements of the Water Framework Directive in respect of both landfill and forestry management, taking into account the standards of habitat management required to sustain listed Annex-listed fish (i.e. Salmon) at a favourable conservation status.

For inspection purposes only.
Consent of copyright owner required for any other use.

ANIMAL HEALTH

INTRODUCTION

10.159 Sections 10.156 to 10.181 deals with the potential impact that the development may have on farm animal health in the surrounding area.

EXISTING FARMING PRACTICE

10.160 The site is situated in an area of hill bog land and forestry development and, other than the extensive grazing of small numbers of hill sheep, there is no significant farming activity in the area. Landfill sites, by their very nature, contain a number of hazards, which if not adequately contained and controlled could have detrimental effects on animal health. However the lack of significant farming activity and the "extensive" nature of the hill sheep grazing in the immediately surrounding area will, in itself, help mitigate many of the potential animal health hazards associated with landfilling.

EPA Export 25-07-2013:16:19:33

10.161 A hazard in this context is any item, procedure or operation that has the capacity to harm, and a policy of risk management is designed to reduce the level of risk to the lowest attainable level in real life situations.

POTENTIAL CONCERNS FROM LANDFILL SITES RELATED TO ANIMAL HEALTH

10.162 The features of landfill sites, which make them potentially hazardous to animal health, include the following:

- The nature of the material being landfilled, given that it will contain small quantities of animal remains (meat scraps, bones), has the potential to harbour pathogenic organisms.
- The site may attract scavenging birds who may pickup material from the site and carry it off site. This material, deposited on adjacent farmland, may come into contact with livestock. Large numbers of birds may contaminate adjacent farmland with their droppings. These droppings may contain pathogens which may contaminate livestock.
- The site may attract vermin such as rats and mice. The organic food content of the waste may act as a food source. Rats are carriers of a number of livestock diseases and they may also act as mechanical carriers of any pathogens which they come in contact with. Larger wild mammals such as foxes and badgers may also carry pieces of organic material off site.
- The site may attract flies that lay their eggs in the organic content of the waste leading to increased fly populations in the area. Flies may act as mechanical carriers of pathogens such as Salmonella spp.
- Wind borne debris and plastic may be blown on to adjacent farmland where it may be ingested by livestock.
- Dust and air borne pathogens may be blown off site and act as respiratory irritants for animals.
- Noxious weeds (e.g. Ragweed) may grow on the site and seed the surrounding farmland
- The natural breakdown products (gases, leachate) of the material on site may escape off site and contaminate surface water, ground water or surrounding air.

For inspection purposes only.
Consent of copyright owner required for any other use.

MITIGATING MEASURES

10.163 Risks to animal health from landfill sites may be managed and reduced by the application of a Hazard Analysis and Critical Control point approach.

10.164 The operation, having been analysed and the potential hazards identified, can be adjusted to take account of the potential hazards in order to reduce, mitigate or eliminate them.

10.165 The following list enumerates the identified potential hazards and the measures that will be taken to mitigate them.

EPA Export 25-07-2013:16:19:33

The Nature of the Material Being Landfilled

10.166 The site will be for the acceptance of household, commercial, non-hazardous industrial and construction and demolition waste only. Although this may contain physical hazards (e.g. plastic bags, broken glass), chemical hazards (household detergents, cleaners etc.) and biological hazards (household food waste) the nature of the material being accepted is of a low order of risk.

10.167 Random checking procedures will be operated to ensure that material being received at the landfill meets the acceptance criteria.

10.168 Records will be kept of loads of waste entering the site, including details of carrier, type of waste, quantity etc.

Scavenging Birds

10.169 The presence of scavenging birds such as crows and gulls will be continuously monitored. Potential animal health nuisance resulting from the activities of scavenging birds on the landfill site will be controlled and minimised by the following measures:

- The site will be for the acceptance of household, commercial, non- hazardous industrial and construction and demolition waste and therefore will contain no high risk condemned, diseased or high risk biodegradable fraction likely to give rise to contamination of the surrounding farmland.
- The active working faces will be kept as small as possible and all other areas will be covered so as to decrease the potential food supply for scavenging birds. Rapid and effective covering of waste and the consequent decrease in potential food supply is recognised as the most effective means of bird control.
- Daily cover material such as hessian, biodegradable geosynthetic sheeting or soil will be placed on the working faces at the end of each working day.
- The use of an enclosed netting system for control of litter on the site will also be effective in preventing scavenging birds from accessing exposed waste during the working day.
- This will be supplemented by other control measures. If required this will include, visual deterrents, distress calls, physical barriers, birds of prey and the flying of kites over the landfill. These methods will be varied to prevent birds becoming accustomed to a single method and will be reviewed to ensure that effective bird control is being achieved.

For inspection purposes only.
Consent of copyright owner required for any other use.

Vermin and Fly Infestations

10.170 It is recognised that landfill sites have the potential to attract vermin such as rats and flies. Rats are reservoirs for a number of infectious diseases transmissible to humans and animals and in addition may physically transport, on their feet and bodies, disease organisms off site. Flies may also carry disease organisms off site.

EPA Export 25-07-2013:16:19:33

10.171 It is proposed to put in place strict control procedures at the proposed facility in order to control the population of vermin.

10.172 In order to prevent the presence of vermin, a specialist contractor will be employed to inspect the site. The contractor will take the necessary action to eliminate the cause of any evidence of vermin activity discovered or reported. The baiting will be undertaken in a professional manner and every precaution will be taken to avoid non-target species. If rodents or evidence of rodents is seen at any time on site, it will be immediately reported to the contractor who will visit the site as soon as is practicable and take the necessary action to eliminate the rodents.

10.173 The active working face will be kept as small as possible and the face covered on a daily basis to decrease the potential food supply.

10.174 The risk of infestation of dwellings in the surrounding area must be regarded as extremely low as the nearest dwelling is some 2km away, however, in the event of evidence of infestation, the services of the specialist contractor will be made available to the occupier.

For inspection purposes only.
Consent of copyright owner required for any other use.

10.175 In very dry weather, which may give rise to events of fly infestation on the site, insect control will be maintained by controlled spraying of the landfill areas when necessary, with an approved insecticide, in accordance with manufacturers guidelines and relevant regulations. The active working face will be kept as small as possible and the face covered on a daily basis to decrease the potential area available for breeding.

10.176 Ensuring a secure perimeter fence on the site will control larger mammals such as foxes and badgers and control specialists will be employed, if necessary, to ensure that no resident population becomes established on site.

10.177 A record will be kept of all treatments and occurrences, if any, of vermin at the site.

Wind Blown Debris

10.178 Wind blown litter is potentially the most visible contamination of surrounding grassland, hedges and fences and presents a physical hazard when ingested by livestock. The following measures will be employed to control wind blown litter:

- The active working face will be kept as small as possible and all other areas will be covered.
- Daily cover material such as hessian, biodegradable geo-synthetic sheets or soil will be placed on the working face at the end of each working day.

EPA Export 25-07-2013:16:19:33

- Modern wind blow netting systems will be employed at the working face of the landfill and landfilling operations will minimise the possible impact of litter by tipping inside an enclosed litter net which will be located to take account of the prevailing wind direction at the site. In addition to this secondary litter netting will be located at appropriate sections of the perimeter of the site taking account of the wind strength and direction. Details of the litter netting will be provided and recorded in the Environmental Management System. All litter nets will be inspected daily and regularly cleared of litter.
- In the event of failure of the wind blow netting system the proposed fencing around the site will also prevent litter from being blown off site. This fence will be regularly inspected by site operatives and cleaned if required.
- Regular inspection and litter collection will be undertaken at the site and adjoining land if and when necessary. Any litter blown outside the boundaries of the site will be collected if possible during the same day. Any remaining litter at the end of the day will be collected as soon as possible, with notes made in site records of special actions taken to remedy the situation.
- All waste entering the landfill will be in covered vehicles.
- A general clean-up and attendance work will be carried out on a weekly basis by site staff around the entire perimeter of the landfill footprint, on all internal haulage roads and on approach roads. Under normal conditions, all wind blown litter on site will be collected and deposited at the working face by the end of the day. However, if waste has blown outside the site, this will take priority over that contained within. This will not detract from the importance of standards within site and notes will be made in site records of actions taken to resolve problems.

For inspection purposes only.
Consent of copyright owner required for any other use.

Dust

10.179 Landfill sites can present a problem in relation to potential dust emissions. Due to the granular nature of some of the material required for the construction and operation of the landfill and the particulate nature of some dried organic materials found in household waste, wind blown dust and air borne bacteria may be blown off site and impact on the health of livestock in the surrounding area by acting as a respiratory irritant or by direct ingestion. This may be a particular problem during periods of dry windy weather.

- However the measures detailed will mitigate their impact.
- Disposal and immediate burial of dry and dusty wastes
- The use of, and careful choice of, daily cover material to be placed on the working face at the end of each working day.

EPA Export 25-07-2013:16:19:33

- In periods of dry weather, the site and adjoining roads will be inspected on a daily basis for evidence of excessive generation of airborne dust. This inspection will be carried out by Donegal County Council personnel and by the site contractor during the various construction phases, who will also be responsible for taking any remedial action, such as spraying of the access routes and other exposed areas to help reduce dust emissions. In particular the haul route between the clay borrow area and the landfill footprint will be sprayed as required.
- All embankments and soil stockpiles will be vegetated immediately following placement to anchor the soil and reduce the surface area open to the environment. A stockpile of cover material will be made available on site for emergency use.
- The permanent wheelwash on site will ensure that dust emission is not caused from the tyres of vehicles using the landfill site. The wheel-wash at the landfill facility is to be positioned to ensure that waste vehicles leaving the site do not carry excess soil and material.
- A complaints register will also be maintained on-site and should any complaints relating to dust emissions be submitted, then these will be immediately dealt with.

Noxious Weeds

10.180 Weeds such as Ragweed can be toxic to livestock when ingested.

10.181 Weed control will be employed on site and monitored by regular inspection by site staff. A record of these inspections, and any treatments used, will be kept.

Consent of copyright owner required for any other use.
For inspection purposes only.

Gases and Leachate

10.182 The site will be engineered on a containment basis to prevent the uncontrolled migration of leachate and landfill gas. Leachate will be transported off-site for treatment at a suitable wastewater treatment plant.

10.183 Landfill gas generated within the waste will be collected and either vented to the atmosphere or flared.

10.184 A surface water management system will be established in the vicinity of the site to minimise the impacts on water quality and quantity in the adjacent watercourses and on going monitoring of surface water quality at the site will be undertaken.

EPA Export 25-07-2013:16:19:33

CONCLUSION

10.185 The lack of significant farming activity in the area, and the "extensive" nature of hill sheep grazing reduce the likelihood of any individual animal's health being compromised by activities at the landfill to an extremely low level. By identifying potential hazards and implementing management systems as indicated above, the probability of such hazards being expressed will be reduced to a minimum.

For inspection purposes only.
Consent of copyright owner required for any other use.

EPA Export 25-07-2013:16:19:33

BIBLIOGRAPHY

Anon. 2000. *Forestry and Water Quality Guidelines.* Forest Service, Department of the Marine & Natural Resources.

Bibby, C.J., Burgess, N.D., Hill, D.A. and Mustoe, S.H. 2000 *Bird Census Techniques* (Second Edition). Academic Press, London.

Collins, K.D., Gallagher, G., Gardiner, J.J., Hendrick, E. and McAree D. 2000. *Code of Best Forest Practice – Ireland.* Forest Service, Department of the Marine & Natural Resources.

Cramp, S. & Perrins,C. (eds.), 1998. *The Complete Birds of the Western Palearctic on CD-ROM* Oxford University Press.

Croft, P.S. 1986. *Freshwater Invertebrates* Field Studies Council.

Curtis, T.G.F. & Gough, H.N. 1988 *The Red Data Book of Irish Plants.*

Donegal County Council, 2000. *Waste Management Plan.*

Ecoscope, 2000. *Wildlife Management and Habitat Creation on Landfill Sites: A Manual of Best Practice.* Ecoscope Applied Ecologists, Mukker, UK.

Environmenal Protection Agency (EPA), 2001. *Guidelines for the Preparation of Environmental Impact Statements.* EPA, Wexford.

Environmental Protection Agency (EPA), 2000. *Ireland's Environment - A Millenium Report.* EPA, Wexford.

Flanagan, P.J. and Toner, P.F. 1972. *Notes on the chemical and biological analysis of Irish Waters.* Dublin. An Foras Forbartha.

Fossitt, J.A., 2000. *A Guide to Habitats in Ireland.* The Heritage Council, Kilkenny, Ireland.

Gray, N.F. 1999 *Water Technology: An Introduction for Environmental Scientists and Engineers*; Arnold.

Gibbons, D.W., Reid, J.B. and Chapman, R.A., (Eds). 1993. *The New Atlas of Breeding Birds in Britain and Ireland: 1998-1991.* T & AD Poyser. London.

For inspection purposes only.
Consent of copyright owner required for any other use.

EPA Export 25-07-2013:16:19:33

Gilbert, G., Gibbons, D.W. and Evans, J. 1998. *Bird Monitoring Methods*. R.S.P.B., Bedfordshire, England.

Hayden,T. and Harrington, R. 2000. *Exploring Irish Mammals*. Town House, Dublin

Hickie, D. 1997. *Evaluation of Environmental Designations in Ireland* (Second Edition) The Heritage Council, Kilkenny, Ireland.

Lockhart, N. Madden,B. Wolfe-Murphy, S. Wymer, E. Wyse Jackson, M. 1993. *National ASI Survey - Guidelines for Ecologists*. Dúchas, the Heritage Service. Dublin.

Mc Garrigle, M.L., Lucey J. and Clabby, K.C., 1992. *Biological assessment of river water quality in Ireland*. In: Newman, P.J., Piavaux M.A. and Sweeting, R.A., eds, *River Water Quality: Ecological Assessment and Control*. Office for the Official Publications of the European Communities, Luxembourg, pp 371-397.

Newton, S., Donaghy, A., Allen, D. and Gibbons D. 1999. *Birds of Conservation Concern in Ireland*. Irish Birds **6**, 333-344

Ratcliffe, D. (1977). *A Nature Conservation Review* 1. Cambridge University Press

Way, L.S., Grice, P., Mac Kay, A., Galbraith,C.A., Stroud,D.A., Pienkowski, M.W. 1993. *Ireland's Internationally Important Bird Sites*. Joint Nature Conservation Committee (UK).

Woods, C.S. 1974. *Freshwater Life in Ireland* Irish University Press.

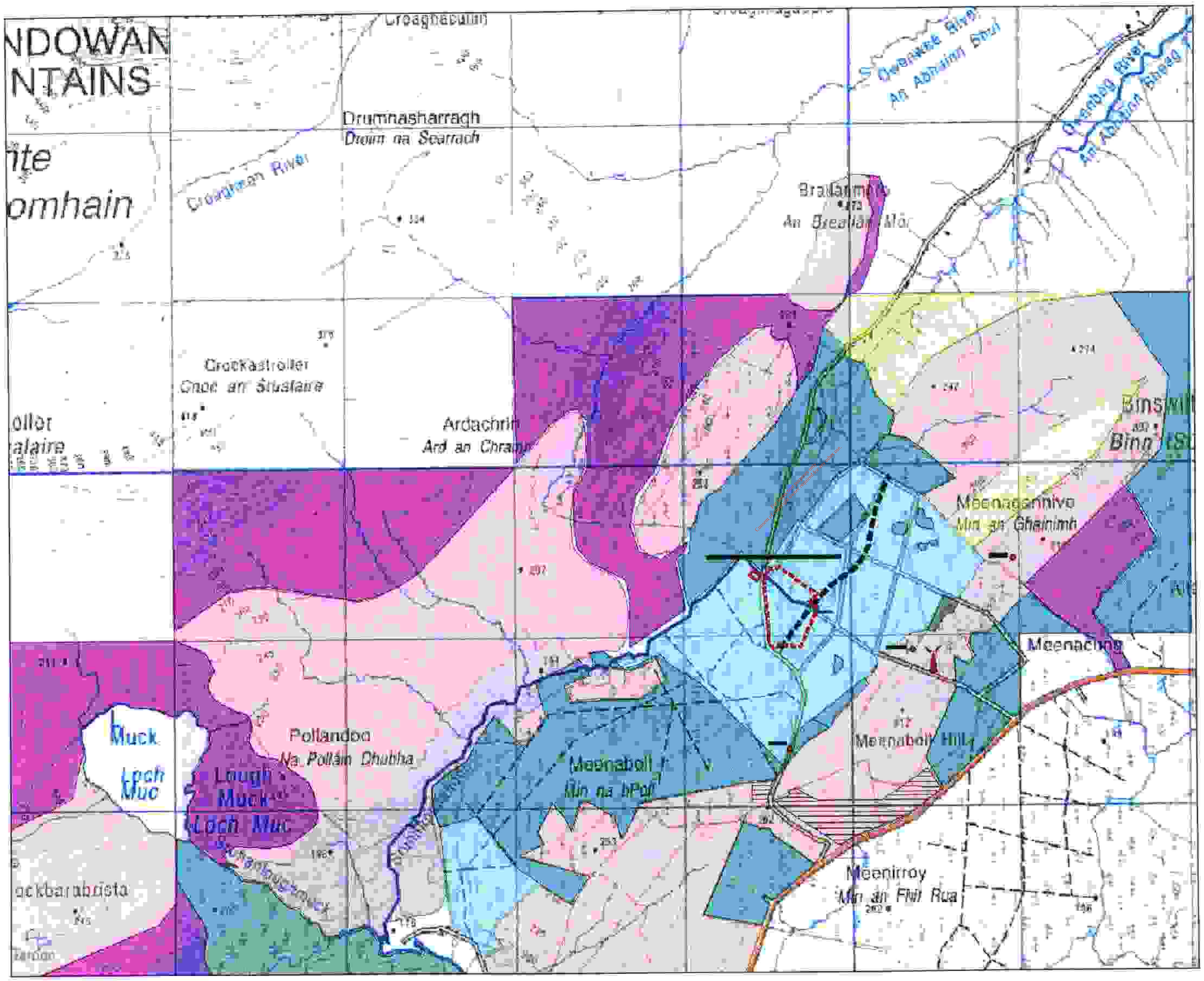
For inspection purposes only.
Consent of copyright owner required for any other use.

EPA Export 25-07-2013:16:19:33

FIGURES

For inspection purposes only.
Consent of copyright owner required for any other use.

EPA Export 25-07-2013:16:19:33



KEY

- HEATH
- BLANKET BOG
- 2nd ROTATION FOREST
- HIGH FOREST
- PEAT CUTTING
- WET GRASSLAND/FLUSH VEGETATION
- BOUNDARY OF PROPOSED DEVELOPMENT
- WATERCOURSE
- COILLTE SERVICE TRACK

SCALE: 1:25,000

KIRK McCLURE MORTON
CONSULTING ENGINEERS

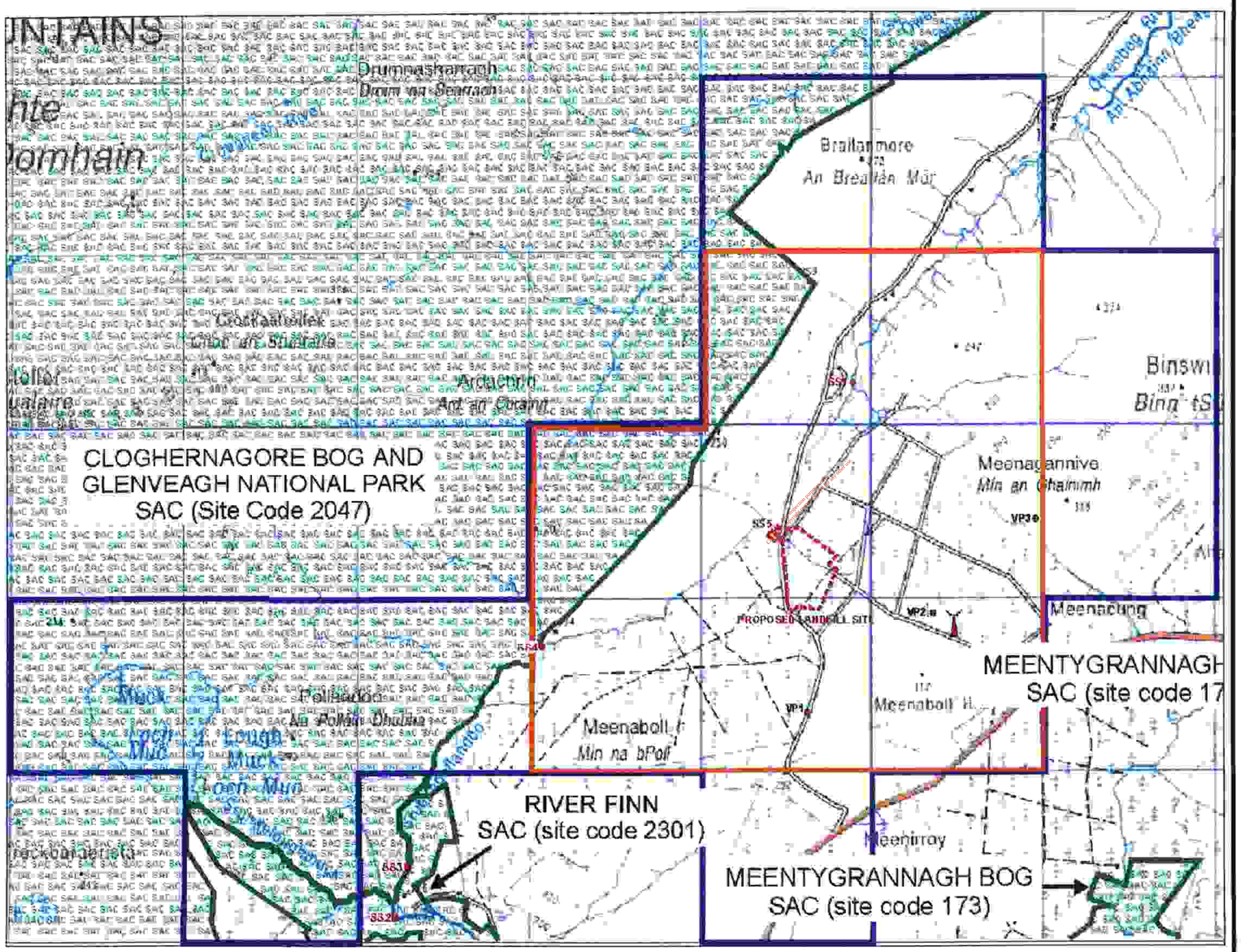
Comhairle Chontae Dhún na nGall
Donegal County Council

PROJECT
MEENABOLL LANDFILL PROJECT

TITLE
HABITATS OF STUDY AREA

FIGURE
10.1

EPA Export 25-07-2013:16:19:13



KEY

- WINTER SEASON BIRD SURVEY AREA
- BREEDING SEASON BIRD SURVEY AREA
- SS1 VANTAGE POINTS FOR BIRD SURVEY
- VP1 AQUATIC ECOLOGY SAMPLE SITES
- BOUNDARY OF PROPOSED DEVELOPMENT

SCALE: 1:25.000

KIRK McCLURE MORTON
CONSULTING ENGINEERS

Comhairle Chontae Dhún na nGall
Donegal County Council

PROJECT
MEENABOLL LANDFILL PROJECT

TITLE
ECOLOGICAL SURVEY AREA

FIGURE
10.2