



# **Ballynacarrick Landfill Site**

## **Closure, Restoration and Aftercare Management Plan**

**BY**

**DONEGAL COUNTY COUNCIL**

**TO**

**ENVIRONMENTAL PROTECTION AGENCY**





**DONEGAL COUNTY COUNCIL**  
**BALLYNACARRICK LANDFILL SITE**  
**CLOSURE, RESTORATION AND**  
**AFTERCARE MANAGEMENT PLAN**  
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## 1.0 INTRODUCTION

This closure, restoration and aftercare management plan (CRAMP) has been prepared for Ballynacarrick Landfill Site in order for Donegal County Council to comply with Condition 10.8 and 10.9 of their Waste Licence, W0024-04.

### 10.8 Closure, Restoration & Aftercare Management Plan (CRAMP):

*10.8.1* The licensee shall maintain a fully detailed and costed plan for the closure, restoration and long-term aftercare of the site or part thereof.

*10.8.2* The plan shall be reviewed annually and proposed amendments thereto notified to the Agency for agreement as part of the AER. No amendments may be implemented without the prior agreement of the Agency.

### 10.9 The CRAMP shall include as a minimum, the following:-

*10.9.1* A scope statement for the plan.

*10.9.2* The criteria, including those specified in this licence, which define the successful closure & restoration of the facility or part thereof, and which ensures minimum impact to the environment.

*10.9.3* A programme to achieve the stated criteria

*10.9.4* Where relevant, a test programme to demonstrate the successful implementation of the plan.

*10.9.5* Details of the long-term supervision, monitoring, control, maintenance and reporting requirements for the restored facility,

*10.9.6* Details of the costings for the plan and the financial provisions to underwrite those costs.

10.10 A final validation report to include a certificate of completion for the CRAMP, for all or part of the site as necessary; shall be submitted to the Agency within three months of execution of the plan. The licensee shall carry out such tests, investigations or submit certification, as requested by the Agency, to confirm that there is no continuing risk to the environment.

This CRAMP also takes due regard of the EPA Guidance on Environmental Liability Risk Assessment, Residuals Management Plans and Financial Provision Document (2006).

In accordance with the guidance there are two types of closure;

- Clean Closure - upon cessation of operations and subsequent decommissioning at the facility, there are no remaining environmental liabilities.
- Non-Clean Closure – upon cessation of operations and subsequent decommissioning - there are remaining liabilities, which require a restoration and aftercare management plan.

## 1.1 FACILITY AND LICENCE DETAILS

Ballynacarrick Landfill Site has been in operation since 1980. In 2000 Donegal County Council submitted an application to the Environmental Protection Agency for the continued operation of the landfill site, as required by the Waste Management (Licensing) Regulations 1997.

On the 7<sup>th</sup> of December 2000 the Environmental Protection Agency (EPA) granted the Council a Waste Licence (registration number W0024-01) for the facility, in accordance with the Third and Fourth Schedule of the Waste Management Act, 1996.

In November 2003 the Council submitted a waste licence application to the EPA and a planning application to An Bord Pleanála for an extension of 3.5 hectares to the landfill site. A waste licence W0024-02 was granted to Donegal County Council on the 10<sup>th</sup> December 2004 and planning permission was granted by An Bord Pleanála on the 15<sup>th</sup> July 2004.

A waste licence review was undertaken in November 2007 to increase the annual tonnage accepted at the facility from 24,000 tonnes to 35,000 tonnes per year and to raise the final contours to increase the capacity of the site. This (waste licence W0024-03) was approved in November 2008.

The Agency commenced a review of the waste licence in 2009 in accordance with Section 46(2)(b) of the Waste Management Acts, 1996 to 2008. The review was in relation to the following:

- Need to give effect to Articles 5 and 6 of Council Directive 1999/31/EC on the landfill of waste (the Landfill Directive) regarding the treatment of waste prior to landfill and diversion of biodegradable municipal waste from landfill.
- Need to give effect to article 49(5) of the Waste Management (Licensing) Regulations 2004 which states that waste that has not been subject to treatment shall not be accepted or disposed of in a landfill facility. Article 52(5) of the Waste Management (Licensing) Regulations 2004, as amended, requires the EPA to review a waste licence in order that a landfill will operate in compliance with the relevant requirements of the Landfill Directive.
- Need to further the general Best Available Techniques (BAT) obligation to reduce the overall environmental impact of landfill.
- The EPA will also (a) determine whether new conditions on odour prevention and control should be proposed, (b) amend, replace or delete a number of other conditions where this is appropriate and (c) propose new conditions where these are deemed necessary.

Licence W0024-04 was issued on 24<sup>th</sup> March 2010.



## 1.2 FACILITY CLOSURE SCENARIOS COVERED IN THE PLAN

The scope of this report is to outline to the Agency, for their agreement, the intended closure, restoration and aftercare management proposals for Ballynacarrick Landfill, Co. Donegal. It is intended that this report meets the requirements of Condition 10.8, 10.9 and 10.10 of Waste Licence W0024-04.

## 2.0 SITE EVALUATION

### 2.1 FACILITY DESCRIPTION AND HISTORY

The site is located at Ballynacarrick, Ballintra, Co Donegal as shown on Drawing No. IBR0132/100 - Site Location, and occupies an area of approximately 9 hectares; this consists of 5.5 hectares of historic landfill and 3.5 hectares extension. The facility is located in a rural setting and surrounding land use is of a purely agricultural nature. The site is located in a low lying position in an area of marginal hill land and is bounded on all boundaries by a chain link fence. The site lies 3km southeast of Ballintra and 7 km south of Laghey. The site layout is shown on Drawing No. IBR0132/101A - Site Layout.

In accordance with the waste licence only those wastes types and quantities listed in Schedule A shall be recovered or disposed of at the facility unless prior agreement from the Agency has been obtained. The maximum annual tonnage of individual waste categories for acceptance to the site is listed in Schedule A of the Waste Licence as shown in Table 2.1

**Table 2.1 Waste Categories and Quantities**

WASTE TYPE <sup>1</sup>	MAXIMUM QUANTITY (Tonnes per Annum) <sup>2 3</sup>
Residual Non Hazardous Household Commercial and Industrial Waste. <sup>4</sup>	<b>34,950</b>
Residual Non Hazardous Construction and Demolition waste.	
Composting of Biodegradable waste (<1000m <sup>3</sup> capacity).	
Household Hazardous Waste deposited at the Civic Waste Facility for off-site recovery or disposal <sup>5</sup>	<b>&lt;50 t per annum</b>
<b>TOTAL</b>	<b>35,000</b>

An Environmental Impact Statement was prepared for Ballynacarrick Landfill Site in November 2003. This accompanied waste licence applications W0024-02. A Waste Licence Review Application was undertaken in 2008 resulting in Waste Licence W0024-03 which was granted in November 2008.

<sup>1</sup> Any proposals to accept other compatible waste streams must be agreed in advance by the Agency and the total amount of waste must be within that specified

<sup>2</sup> Construction & demolition or Inert or compost waste imported to the site for use in the construction/closure are not included in these limitations. A detailed statement (with mass balance) of waste used in construction should be included as part of the AER.

<sup>3</sup> Quantities of waste types may be altered, subject to the agreement of the Agency, provided the total quantity for disposal does not exceed 35,000 tonnes per annum.

<sup>4</sup> Includes non-hazardous WEEE deposited at the Civic Waste Facility for off-site disposal/recovery.

<sup>5</sup> Includes hazardous WEEE deposited at the Civic Waste Facility for off-site disposal/recovery.

For the purpose of this CRAMP the landfill has been divided into three distinct areas; Area 1 2 and 3. These areas are described in the sections below and estimations are given on when the areas are predicted to 'close'. Drawing No IBR0132/102A - Landfill Areas, illustrates the site layout and the distinct areas.

### **2.1.1 Area 1**

Area 1 is located to the east of the site and consists of the original site at Ballynacarrick which was developed to operate under dilute and disperse principles and as such no containment was provided except in area of Cell 4.

Cell 4 (Mc Williams Cell) of the existing landfill site has been developed on an engineered containment basis. The composite lining system installed in Cell 4 comprises a 500mm deep layer of Bentonite Enhanced Soil (BES) with a specified hydraulic conductivity of less than  $1 \times 10^{-10}$  m/s overlain with a 2mm layer of High Density Polyethylene (HDPE) on the floor and lower slopes, and a Geosynthetic Clay Liner (GCL) on the upper slopes of the north and east banks. A protective geotextile was laid above the HDPE geomembrane. The geotextile was directly overlain by the leachate drainage blanket on the floor and a geonet on the embankment. Filling in Area 1 commenced in 1980s and was completed in 2004.

A final cap has been installed in Area 1 under two separate contracts and comprises of the following:

- *Geonet Gas Drainage Layer*  
7mm thick, drainage core with a minimum discharge capacity  $\leq 1.5$ l/m/s under a confining stress of 50Kpa and a hydraulic gradient of 1. The geonet consists of a three dimensional drainage system consisting of a drainage core and two layers of geosynthetic filter fibre. The drainage core is manufactured from HDPE and the geosynthetic filter layers are needle-punched nonwoven polypropylene geotextiles. All layers are bonded together to provide a high shear strength.
- *GCL Barrier Layer*  
The GCL has a permeability (kv valve) of  $5 \times 10^{-11}$  m/s.
- *Geonet surface water drainage layer*  
As per the gas drainage layer
- *Soil Layer*  
17,000m<sup>2</sup> has 300mm of subsoil with 700mm deep layer of peat placed on top to make the soil cover a total depth of 1m.  
27,500m<sup>2</sup> has 850mm of subsoil with 150mm deep layer of soil/peat placed on top to make the soil cover a total depth of 1m.

An area of approximately 4,500 m<sup>2</sup> remains to be capped as shown on Drawing No. IBR0132/103A.

This area is a non-clean closure status (as defined in the EPA Guidance Document, referred in Section 1.1 above).

### **2.1.2 Area 2**

Area 2 is the additional landfilling area licenced under W0024-02 located to the west of Area 1. This area consists of two phases containing 6 cells.

Phase 1 of the extension has also been developed on an engineered containment basis. The composite lining system on the base comprises of a 500mm thick layer of BES (permeability of less than  $1 \times 10^{-10}$  m/s) installed on the top of the groundwater drainage blanket (300mm crushed stone) and a separation geotextile ( $120\text{g/m}^2$ ). The liner is a 2mm thick high density polyethylene (HDPE) geomembrane which is protected by a  $1500\text{g/m}^2$  geotextile. A 500mm deep blanket of 16/32 mm sized rounded gravel acts as a drainage blanket for the efficient removal of leachate. Phase 2 Basal Liner has been engineered as per Phase 1, however a Low Density Polyethylene / Very Flexible Polyethylene (LLDPE/VFPE) liner was used to form part of the side slope lining on the waste bank on the eastern slope of phase 2. A geosynthetic clay liner (GCL) is placed on top of a 500mm of clay along this slope to achieve the required permeability.

The groundwater drainage layer allows groundwater to drain freely westwards through a 225mm perforated pipework which connects to the 500mm concrete surface water drainage pipework.

Filling commenced in this area in 2005. Area 2 will remain open until mid 2012. After this period Area 2 will progress to a non-clean closure status.

### **2.1.3 Area 3**

Area 3 contains all infrastructural support for the site including:

- the main entrance to the site,
- bottle banks,
- administration building with weighbridge,
- Toilet block with treatment system,
- landfill gas management compound,
- leachate treatment plant,
- a contractors entrance,
- waste inspection and quarantine areas.

This area will remain active until filling in Area 2 is complete and for a substantial period after that to allow for leachate and landfill gas treatment management.

## 2.2 FACILITY COMPLIANCE STATUS

There were no complaints received by the Environment Section of Donegal County Council during 2008-2009.

### 2.2.1 Area 1

Area 1 generally complies with the conditions laid down by the current licence. In the years 2008-2009 there have been 9 No. reported incidents associated with Area 1. These relate to exceedances in groundwater and surface water quality and exceedances in carbon dioxide levels in piezometers. These are summarised below.

**Table 2.2 Summary of Incidents Reported During 2008-2009 Area 1**

Date of Incident	Report to EPA
<b>2008</b>	
24 <sup>th</sup> January	On-going emissions exceedance report.
22 <sup>nd</sup> April	On-going emissions exceedance report.
27 <sup>th</sup> June	On-going emissions exceedance report.
17 <sup>th</sup> September	On-going emissions exceedance report.
<b>2009</b>	
5 <sup>th</sup> January	On-going quarterly reporting of emissions exceedances.
17 <sup>th</sup> April	On-going quarterly reporting of emissions exceedances.
3 <sup>rd</sup> July	On-going quarterly reporting of emissions exceedances.
2 <sup>nd</sup> September	Leachate pump no 7 failed and high level alarm activated.
8 <sup>th</sup> September	On-going quarterly reporting of emissions exceedances.

### 2.2.2 Area 2

Area 2 generally complies with the conditions laid down by the current licence. In the years 2008-2009 there have been 9 No. reported incidents as mentioned above. However these exceedances are associated with the unlined areas of the site and not with engineered Area 2.

### 2.2.3 Area 3

Area 3 generally complies with the conditions laid down by the current licence. In the year 2009 there were a number of incidents associated with Area 3 as shown in Table 2.3. These relate to downtime of landfill gas flare. These are summarised below.

**Table 2.3 Summary of Incidents Reported During 2008-2009**

Date of Incident	Report to EPA
<b>2008</b>	
18 <sup>th</sup> January	Flare down for 12 hours due to power cut and alarm failure.
24 <sup>th</sup> January	Flare down for 1 hour due to high oxygen.
29 <sup>th</sup> January	Flare down for less than 1 hour due to high oxygen.
6 <sup>th</sup> February	Flare down for 6 hours due to high oxygen.
12 <sup>th</sup> March	Flare down for 8 hours in storm conditions due to high oxygen.
11 <sup>th</sup> September	Flare down for 14 hours due to power interruption, thermocouple and alarm failure.
4 <sup>th</sup> October	Flare down for 45 hours due to thermocouple failure.
23 <sup>rd</sup> & 25 <sup>th</sup> October	Flare down for 14 hours and 85 hours respectively due to high temperature (thermocouple failure) & alarm failure.
10 <sup>th</sup> November	Flare down for 15 hours due to power disruption and alarm failure.
22 <sup>nd</sup> November	Flare down for 39 hours due to storm conditions and alarm failure.
<b>2009</b>	
6 <sup>th</sup> -7 <sup>th</sup> January	Flare down for a total of 22.5 hours due to extremely low temperatures causing frozen condensate.
27 <sup>th</sup> January	Flare extinguished on low methane, down for 8 hours.
7 <sup>th</sup> February	Flare extinguished on high oxygen, down for 2 hours.
6 <sup>th</sup> March	Flare extinguished due to ESB power cut, down for 2 hours.
22 <sup>nd</sup> April	Flare extinguished due to pump failure in knock-out pot, down for 2 days.
6 <sup>th</sup> June	Flare extinguished due to ESB power cut, down for 12 hours.
2 <sup>nd</sup> September	Leachate pump no 7 failed and high level alarm activated.
9 <sup>th</sup> September	Flare extinguished due to pipeline damage, down for 6 hours.
12 <sup>th</sup> September	Flare extinguished on low methane, down for 2 days.
4 <sup>th</sup> December	Unable to restart flare after power outage due to faulty igniter, down for 3 days.
24 <sup>th</sup> – 29 <sup>th</sup> December	Flare frozen, down intermittently for 5 days.

### 2.3 FACILITY PROCESSES AND ACTIVITIES

For the purpose of Article 48(1) of the Waste Management (Licensing) Regulations, 2004 (SI No. 395 of 2004), this facility is classed as a landfill for non-hazardous waste.

The licensed disposal activities, in accordance with the Third Schedule of the Waste Management Act, 1996 to 2008 are restricted to those listed as follows:

- **Class 5 Specially engineered landfill, including placement into lined discrete cells which are capped and isolated from one another and the environment: (Principal Activity)**
- **Class 6 Biological treatment not referred to elsewhere in this Schedule which results in final compounds or mixtures which are disposed of by means of any activity referred to in paragraphs 1. to 10. of this Schedule:**
- **Class 13 Storage prior to submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where the waste concerned is produced:**

Licensed waste recovery activities, in accordance with the Fourth Schedule of the Waste Management Act, 1996 to 2008 are restricted to those listed as follows:

- **Class 2 Recycling or reclamation of organic substances, which are not used as solvents (including composting and other biological transformation processes).**
- **Class 3 Recycling or reclamation of metals and metal compounds:**
- **Class 4 Recycling or reclamation of other inorganic materials:**
- **Class 13 Storage of waste intended for submission to any activity referred to in proceeding paragraph of this schedule, other than temporary storage, pending collection, on the premises where such waste is produced.**

### 2.4 INVENTORY OF SITE BUILDINGS, PLANT, RAW MATERIALS AND WASTES

Drawing No. IBR0132/104A illustrates the landfill gas boreholes and landfill gas collection system within Area 1, Area 2 and Area 3. Drawing No. IBR0132/105A illustrates the leachate management system and Drawing No. IBR0132/106A illustrates the monitoring points within Area 1, Area 2 and Area 3.

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### 3.0 POLLUTION CONTROL SYSTEMS

The following sub-sections outline the pollution control systems that will be managed and maintained throughout the restoration and aftercare phase in accordance with Conditions of Waste Licence W0024-04. These controls shall be maintained on-site until the EPA approves of their decommissioning.

#### 3.1 CAPPING

Two phases of capping have been installed at Ballynacarrick Landfill to date, as described in greater detail in Section 2.1.1.

#### 3.2 LEACHATE MANAGEMENT

The leachate generated at Ballynacarrick Landfill is collected from each cell and unengineered parts of the site and pumped to a leachate tank. Four leachate abstraction towers with pumps were installed in the unengineered parts of the site.

Leachate is pumped from each cell and unengineered parts of the site to the small leachate tank via a 90mm OD HDPE pumping main. Leachate is then transferred into the second larger tank by means of an end suction pump over a two hour period on a 24hr cycle, where it receives treatment. The leachate treatment entails aeration for a further 14 hours and the decanting of the leachate following a 2 hour settlement period. There is then a 6 hour window for the operator to withdraw leachate via the floating decant system into tankers for disposal.

The installation includes an AQUA DECANT AD 80-5 which slides along vertical guiding bars that are fixed to the top rim of the tank. An AQUA TURBO direct drive floating surface aerator, 45kW AER-AS 4500-24 is positioned in the centre of the tank with 3 mooring cables and a single power cable fixed to one of the mooring cables. The mooring anchors are fitted on the top rim of the tank.

The main factors associated with leachate generation are precipitation, surface runoff and evapotranspiration. The capping and re-vegetation of the landfill area will prevent the ingress of surface water and therefore reduce the volume of leachate generated. The leachate treatment and monitoring programme will continue into the aftercare phase to confirm the effects of the aforementioned remediation works. Drawing No. IBR0132/105A illustrates the leachate infrastructure.



### 3.3 LANDFILL GAS MANAGEMENT

A landfill gas management system has been progressively installed at Ballynacarrick as part of the previous restoration phases and as an ongoing measure to avoid passive gas venting. A 500m<sup>3</sup>/hr enclosed landfill gas flare and SCADA System has been installed at the facility. This is located in an enclosed compound adjacent to the site office.

Vertical landfill gas extraction wells have been installed. The gas wells were drilled to 75% of the waste depth and comprise of a 400 mm diameter drilled boreholes fitted with a 160mm OD slotted High Density Polyethylene (HDPE) well casing backfilled with pea gravel. The well heads are based around a 63mm diameter black HDPE 90° bend. The well head fits inside the well casing and remains both parallel and concentric with the well casing. A flex-seal coupling is fitted externally to provide a gas tight seal and prevent the ingress of debris. The well heads are connecting to gas wells constructed from 160mm 10bar rated pipe. The well head contains a gas sampling point and leachate dipping point. Drawing No. IBR0132/104A illustrates a well head. Some of the well heads allow for the movement of the gas in relation to the waste in both horizontal and vertical direction with a flexible 63mm hose connection. Self dewatering well heads have been installed where fall is back towards the gas extraction well.

Horizontal landfill gas extraction pipework consisting of a 90mm perforated HDPE pipe, surrounded by 16-32mm clean stone, has been installed at 15-20m centres and 3-4 meter vertical intervals within the waste infilled in Phase II only. This is connected to 90mm solid pipework which has been laid up the side slope to the 250mm landfill gas main. Control of flow from the horizontal extraction pipework and gas monitoring is undertaken at the 250mm landfill gas main. This horizontal landfill gas extraction pipework will remain connected to the active landfill gas extraction system.

A horizontal gas extraction pipework system will be installed at the top of the side slope to minimise gas emanating from the leachate collection layer in Phases 1 and 2. This system will be constructed 1m below the level of the existing waste. This extraction pipework will consist of a 90mm perforated HDPE pipe installed on 400mm deep crushed rock bedding in a trench 600mm wide and backfilled with crushed rock. The maximum length of the horizontal gas extraction pipework perpendicular to the edge of the cell will be 50m. This pipe will be connected to an adjacent manifold and ultimately to the existing gas extraction system.

A black HDPE gas main has been constructed with a 250mm Nominal Bore (NB) and joined using electrofusion or fully automatic butt-welding techniques. The gas main has been installed from the flare compound on the landfill site. Black HDPE spurs (90 mm NB) from the landfill gas wells are connected to the gas main using manifolds. Pipes are laid to a fall in the direction of landfill gas flow, where possible.

There are currently nine manifold chambers installed to access and control the gas wells on the site. Gas wells are connected to central collection points or manifold via 90mm OD HDPE pipework. The pipes belonging to each are joined to the manifold by a butterfly or safi valve, which can be adjusted to control the pressure and flow. A Tefen gas sampling point is provided immediately upstream of each of the control valves to monitor the landfill gas composition from each well. While some manifolds are joined to the main gas main through the use of 90° bends and a T-junction, there are a number of 'in-line' manifolds. The manifolds are used to reduce the number of control points on a landfill site.

Manifolds consist of a HDPE chamber with a lockable lid. The lid overlaps the chamber to seal against water ingress. The lids are also spring loaded to allow for lifting and locking in an open position by one person, thus facilitate balancing of the field at the chamber. The manifold chambers are based around a galvanised steel support frame with outer walls either fabricated or constructed from HDPE.

A landfill gas trench consisting of slotted pipework and 100mm diameter vent pipes has been constructed along the boundary of the north eastern corner of the site. This is connected to the active landfill gas extraction system.

The gas management system has been extended into Phase 1 and 2 and will be completed during final capping of the site. Drawing No. IBR0132/104A illustrates the landfill gas extraction system.

### **3.4 SURFACE WATER MANAGEMENT**

Surface water from the east of the site passes via a 500mm HDPE and concrete pipeline along the southern and western boundary at a discharge point to an existing stream at the North West of the site.

Surface water pipework to the Northern Boundary consists of a 225mm corrugated twinwalled HDPE pipe, also discharging at the North West of the site. This collects surface water from the north of the site and also delivers surface water collected from the cap into the surface water management system.

Surface water collected from the capped areas via a 225mm corrugated twinwalled HDPE pipe along the southern boundary discharges into the 500mm HDPE and concrete pipeline.

The concrete roads and carpark at the site have a sufficient drainage layout to ensure that water is shed to drainage gulleys which flows through an oil interceptor prior to discharge to an area to the east of the site. Drawing No. IBR0132/107A illustrates the surface water management system.

## 4.0 CLOSURE CONSIDERATIONS

This section details the plant, buildings, equipment and other materials which require consideration as part of the closure process. Non Clean Closure with active aftercare leading eventually to Clean Closure is envisaged for the site.

Closure considerations are outlined under two main headings:

- Underground Decommissioning
- Surface Decommissioning

## 4.1 CLEAN OR NO CLEAN CLOSURE DECLARATION

Successful 'clean closure' requires that there are no remaining environmental liabilities existing at the site. In practice, for a facility such as a landfill, monitoring will be required for at least a 30-year period. Therefore all landfilling areas will be subject to non-clean closure and an aftercare management plan will have to be maintained as part of this report and its revisions.

## 4.2 PLANT OR EQUIPMENT DECONTAMINATION REQUIREMENT

All plant equipment will remain on site if needed. Any plant that is to be decommissioned will be decontaminated using the Best Available Technology (BAT). Equipment associated with the waste inspection area, leachate treatment system and the gas flare will be maintained on-site in the aftercare period until the EPA approves of their decommissioning.

### **4.1.1 Building Demolition**

Demolition debris will be segregated into steelwork, masonry and other materials for efficient recycling or disposal.

### **4.1.2 Removal of Infrastructure & Services**

All drainage and associated services no longer required which are located outside of the filled waste areas will be removed. Decontamination to be carried out as previously outlined if necessary.

## 4.3 PLANT DISPOSAL OR RECOVERY

Working plant will be assessed for its value for being used elsewhere. All other plant will be removed and disposed of or recovered where possible.

**4.4 WASTE DISPOSAL OR RECOVERY**

Waste arising will be assessed and sent for reuse or recovery where possible. All other waste will be removed for disposal.

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## 5.0 CRITERIA FOR SUCESSFUL CLOSURE

### 5.1 ADDRESSING OF SITE ENVIRONMENTAL LIABILITIES AT CLOSURE

#### ***5.1.1 Criteria for Successful Closure***

As per the guidance document it should be outlined what type of closure is expected:

- Clean Closure - upon cessation of operations and subsequent decommissioning at the facility, there are no remaining environmental liabilities.
- Non-Clean Closure – upon cessation of operations and subsequent decommissioning - there are remaining liabilities, which require a restoration and aftercare management plan.

Successful 'clean closure' requires that there are no remaining environmental liabilities existing at the site. In the case of Category 3 facilities, due to the nature of the operation (i.e. landfill) a process of extensive restoration and aftercare may be required. It is expected that during this period there would be once-off restoration/remediation works and long term monitoring and management.

In practice, for a facility such as a landfill, monitoring will be required for at least a 30-year period. Therefore all landfilling areas will be subject to non-clean closure and an aftercare management plan will have to be maintained as part of this report and its revisions.

For non clean closure, a Restoration and Aftercare Management Plan (RAMP) will be required in order to address this aspect. The content of this RAMP is outlined in Section 3.4 of the EPA Guidance on Environmental Liability Risk Assessment, Residuals Management Plans and Financial Provision Document (2006).

**Table 5.1 Criteria for Successful Non Clean Closure for Areas 1 2 & 3**

Criteria	Action
Monitoring parameters are settling to normal levels for a continuous period of 2 years.	Monitoring frequency can be reduced, however monitoring must continue for these parameters.
Leachate concentrations no longer cause a hazard to the aquatic environment for a continuous period of 2 years.	Proposals should be looked at to discharge untreated 'leachate' directly to surface water. The leachate tanks and treatment plant could be decommissioned.
Amounts of landfill gas produced are no longer sufficient to operate a 100m <sup>3</sup> /hr flare for a continuous period of 2 years.	Decommission gas flare and remove from site. Landfill gas will be continually monitored.
Landfill Settlement has reduced to non-detectable levels over a 2 year period.	Annual surveys are no longer required.
Gas Flare Decommissioned.	Once gas production has ceased in the landfill, the gas flare can be decommissioned, decontaminated and taken off site. The area of the gas compound can then be returned to the natural environment.
Leachate treatment plant decommissioned.	The treatment plant will be decommissioned, decontaminated and taken off site. The area of the treatment plant can then be returned to the natural environment.

### **5.1.2 Monitoring Programme**

Monitoring will continue for the parameters identified in Schedule C of the Waste Licence W0024-04. If monitoring identifies possible environmental pollution, action will be taken to rectify this. After parameters settle to normal levels associated with surface water, groundwater, leachate and landfill gas, monitoring will be reduced in frequency.

### **5.1.3 Identification of On Site Environmental Liabilities at Closure**

When 'non clean-closure' is being applied an environmental liabilities risk assessment will be carried out in order to assess any outstanding risks which may lead to a potential environmental hazard occurring. The scope of this risk assessment will cover all risks including those to: surface water, groundwater, atmosphere, land and human health.

The ELRA shall be reviewed as necessary to reflect any significant change on site, and in any case every three years following initial agreement.

**5.1.4 Non Clean Closure Declaration**

Areas 1 (unlined except in area of Engineered Cell 4), Area 2 (Engineered Phase 1 and 2) and Area 3 (infrastructural area) will be subject to 'non-clean' closure and a restoration and aftercare plan will have to be maintained.

## 6.0 RESTORATION AND AFTERCARE MANAGEMENT PLAN

Permanent capping of part of the site has already been undertaken in Area 1 of the landfill site. The majority of the original and unlined part of the site has been capped. Following the completion of infilling and allowing time for settlement, the remaining phases will be capped and progressively restored. Drawing No. IBR0132/103A Areas to be Capped illustrates these phases.

Further permanent capping of part of the extension Phase 1 and part of Phase 2 (Areas 2) will commence in 2010 with the remaining area being capped when the site has reached capacity. Drawing No. IBR0132/108A Phased Restoration illustrates the areas to be capped under these two contracts.

## 6.1 RESTORATION PROPOSALS

Current standards and waste management practice recognise the potential environmental risks associated with landfill sites. The main potential environmental hazards are;

- Leachate migration off site resulting in contamination of ground water and surface water;
- Landfill gas migration off site to vulnerable receptors such as residential houses;
- Landfill gas (which comprises 'greenhouse' gases) emissions to atmosphere

Through the proper restoration of Ballynacarrick Landfill Site, Donegal County Council aims to minimise future potential risks due to environmental emissions from the site.

In order to minimise future potential environmental risks the restoration of the remainder of the site will comprise of a number of stages:

1. Minimal reprofiling or doming of the site - to increase surface runoff and reduce infiltration into the landfill, therefore reducing the amount of leachate generated.
2. Capping of the site – to prevent infiltration of precipitation and surface water into the landfill mass therefore reducing the potential for leachate generation and migration of landfill gas. The capping will also provide a suitable growing medium for restoration planting.
3. Surface Water Management System – to control surface water generated on the restored landfill so that it does not erode the landfill capping or ingress into the waste.
4. Leachate Treatment System – to control and treat the leachate generated within the waste body prior to discharge to Waste Water Treatment Works.
5. Landfill Gas Extraction System – to control landfill gas generated from the waste and to prevent off site migration.



6. Environmental Monitoring – to ensure that the restoration measures from the site are effective.

### **6.2.1 Profiling**

The site will be graded to the proposed final waste contour level. The grading of the site will not only facilitate surface water runoff but will also allow for ongoing settlement of the waste without the risk of undue ponding of water.

Following the reprofiling of the landfill the surface will lie at a gradient of between 1 (vertical):10 (horizontal) and 1:25 and the side slopes 1:3.

### **6.2.2 Capping System**

As part of the restoration and aftercare of this landfill, Areas 1 and 2 will be capped as per waste licence requirements. The proposed capping system will comprise of the layers as set out in Table 6.1. Drawing No. IBR0132/109A provides a diagrammatic representation of the proposed capping layer formulation (see Appendix A).

#### Material Requirements

The area of the landfill to be capped extends to approximately 37,000 m<sup>2</sup> as shown on Drawing No. IBR0132/108A. This will be capped in two phases. The initial contract will cover an area of approximately 17,000 m<sup>2</sup> whilst the remainder of the site (approximately 20,000 m<sup>2</sup>) will be capped within one year of operations ceasing on site.

The approximate material requirements for the capping system are as follows:

- 5,550 m<sup>3</sup> of topsoil soil.
- 31,450 m<sup>3</sup> of subsoil.
- 37,000 m<sup>2</sup> of geosynthetic surface water drainage layer.
- 37,000 m<sup>2</sup> of geosynthetic clay liner.
- 37,000 m<sup>2</sup> of geosynthetic gas drainage layer.

**Table 6.1 Capping System**

Layer	Thickness (mm)	Properties	Purpose
Topsoil	150		To provide a growing medium, to control surface water erosion of the capping layers and provide a satisfactory visual appearance to the site.
Subsoil	850		To provide a layer of protection against damage to the GCL layer. To provide a growing medium for shrub growth.
Drainage Layer (GEONET)		Hydraulic conductivity of equivalent to 500mm deep layer of stone at $k_v \geq 1 \times 10^{-4} \text{m/s}$	To remove and transport the surface water to an appropriate discharge point.
Geosynthetic Clay Liner		Permeability of less than $1 \times 10^{-9} \text{m/s}$ .	To provide a low permeable barrier to prevent infiltration of water into the landfill mass as required in the Licence conditions.
Geosynthetic Gas Collection Layer (GEONET)		Hydraulic conductivity of equivalent to 500mm deep layer of stone at $k_v \geq 1 \times 10^{-4} \text{m/s}$	To control and facilitate the lateral movement of landfill gas which is generated within the Landfill mass to gas vents.
Regulating Layer	<300		To provide a temporary cover of the waste prior to the permanent capping layer being installed.
<b>WASTE</b>			

Timescales

The permanent capping of the remainder of the site will be undertaken as detailed in Table 6.2.

**Table 6.2 Programme for Permanent Capping**

Area	Permanent Cap
Partial Phase 1 & Cell 2A	2010
Remainder area of the site	2013

### **6.2.3 Surface Water**

A surface water drainage layer (geonet) will be installed beneath the subsoil layer and above the barrier layer. The purpose of this layer is listed below:

- Minimise the head of water on the underlying barrier layer, which reduces the percolation of water through the capping system.
- Provides drainage of the overlying soil layers
- Increases slope stability by reducing pore water pressure in the overlying soil material.

Surface water run-off from the capped landfill is and will be collected in the existing perimeter drain surrounding the site and in a surface water collection system. The existing and proposed surface water collection system is shown on Drawing No. IBR0135/107A. The quality of this water will be monitored regularly in accordance with the requirements set out in the Waste Licence.

### **6.2.4 Leachate Management**

The management of leachate at the site will be achieved through limiting leachate generation, by the profiling and capping of the landfill and collection via the existing leachate collection system is shown on Drawing No. IBR0135/105A. The existing leachate monitoring boreholes will continue to be monitored to determine the changes in the quality and level of leachate within the landfill as a result of the capping works.

### **6.2.5 Leachate Generation**

A Water Balance calculation indicates that annual leachate production at the site will reduce to approximately 9,000 m<sup>3</sup> after all restoration work has been completed.

### **6.2.6 Landfill Gas Management**

The existing landfill gas extraction system is shown on Drawing No. IBR0132/104A Landfill Gas Management System. This system will be extended through the installation of horizontal and vertical landfill gas extraction wells which will be connected to the existing landfill gas extraction system.

The flare and associated works will be operated on a continuous basis. Any adjustments to the operational parameters of the flare will be made in accordance with manufacturer's operational instructions. No adjustment shall be made which will result in the flare failure to achieve the emissions limits or operational parameters as set out in the Waste licence and EPA Landfill Operational manual. Maintenance and servicing of the flare will be carried out on the flare in accordance with the manufacturer's instructions.

The flare is equipped with automatic controls to ensure that the flare is operated in a controlled and safe manner.

### **6.2.7 Landscaping**

Landscaping proposals were described in full in Section 15.0 of the Environmental Impact Statement (EIS), previously undertaken in 2003, and are summarised below.

It is not proposed to carry out major areas of landscaping on the landfill site itself. This is consistent with good landfill practice, as root systems from trees and shrubs, etc, may compromise the integrity of the capping system (i.e. the GCL). However, it is recognised that the restoration of the site would benefit from the planting of hedgerows and trees both in terms of creating a visually acceptable landscape in the long term and help where possible to screen operations by advance works.

It is therefore proposed to carry out the landscaping works as previously proposed in the EIS. Perimeter planting has been undertaken prior to the commencement of landfilling operations in Phases 1 and 2. A perimeter berm has been constructed along the eastern and southern boundary of the site. The perimeter berm along the western and southern boundary of Phase 1 has been planted with Ash (*Fraxinus excelsior*), hawthorn (*Crataegus monogyna*), Alder (*Alnus Glutinosa*), Holly (*Ilex Aquifolium*), Elder (*Sambucus Nigra*), Hazel (*Corylus Avallana*), Willow (*Salix Caprea and cinera*), Birch (*Beyula Pubsescens*) and Sorbus (*sorbus Acuparia*).

## **6.2 PROPOSED AFTERUSE OF THE SITE**

The proposed end use of Area 1 is grassland. It is intended to restore the landfill to its natural habitat and landscape so that it fits in with the landscape of the surrounding area.

### **6.2.1 Area 1**

Donegal County Council will implement the aftercare plan, as detailed in Section 8.0 of the Environmental Impact Statement previously undertaken in 2003 as stated below, on Area 1 which is fully restored.

Donegal County Council will assume responsibility for the aftercare management of the site. The Council will ensure that a suitable level of staffing is maintained to allow this process to continue as required.

Each restored cell will be subject to an initial aftercare period. During this period an annual inspection will take place.

The following aftercare issues are likely to be considered depending upon site conditions:

- The need for a programme of soil analysis to determine requirements for liming and fertilising during the year;
- Need for ripping or other treatment of the soils to improve drainage;
- Areas where reseeded is necessary and any changes to the rate of seed application or seed mix;

- Modifications to the mowing or grazing regime.

The restored area has already been seeded with grass specially mixed to take into account local grass species. Landscaping and screen planting has been implemented around the site boundaries.

#### Final Profile

The final restoration contours have been prepared to show the final profile of Area 1, 2 and 3 in accordance with Condition 10.2 of Waste Licence. Further filling in Area 2 is required to reach these contours as shown on IBR0132/110 Final Contours.

#### **6.2.2 Area 2**

The proposed end use of Area 2 is grassland. As stated in Section 6.2 Donegal County Council will implement the aftercare plan, as detailed in Section 8.0 of the Environmental Impact Statement previously undertaken in 2003 as stated below, on Area 1 which is fully restored and will carry this through to Area 2 once final restoration of this area is complete (due to be completed in 2010 and 2013).

#### Final Profile

The final restoration contours has been prepared to show the final profile of Area 1, 2 and 3 in accordance with Condition 10.2 of Waste Licence. Further filling in Area 2 is required to reach these contours as shown on IBR0132/110 Final Contours.

#### **6.2.3 Area 3**

Area 3 contains all infrastructural support for the site including:

- the main entrance to the site,
- bottle bank,
- administration building with weighbridge,
- Toilet block with treatment system,
- landfill gas management compound,
- leachate treatment plant,
- a contractors entrance.
- monitoring infrastructure(boreholes)
- waste inspection and quarantine areas.

This area will remain active until filling in Area 2 is complete and for a substantial period thereafter until the waste has stabilised. In accordance with the EU Directive on Landfill of Waste (99/31/EC) and the EPA Landfill Manuals, the landfill will be remediated on the basis of the EPA licence.

The pollution control systems of Area 3, as described in Section 3, will be also be operated and maintained until the waste has stabilised. If maintenance or remedial works are required on any of the pollution control systems after full restoration has occurred, the following measures will be implemented to ensure minimal impact:

- All operations will be supervised to minimise damage to the restored land. Work shall progress only when soil conditions are suitable.
- A minimal practical working area and suitable access will be used to reduce disturbance.
- Machinery and plant that will cause minimum soil compaction will be used.
- Construction records of all underground systems will be kept for reference to prevent damage during works on-site. Once pollution control systems are exhausted, redundant equipment and ancillary structures shall be removed.

#### Final Profile

Area 3 will remain as an administration area for the landfill until such time as it can be proved that the landfill is causing no impact on the environment through monitoring.

### **6.3 AFTERCARE MANAGEMENT**

#### **6.3.1 Aftercare Monitoring**

Landfilled wastes will continue to settle over a protracted period due to physical compaction and biological degradation. It is, therefore necessary to estimate the amount of settlement that will occur if proposed final levels are to be achieved. Experience has shown that a settlement allowance of 15% of the overall depth should be allowed. Slopes on the restoration profile vary between 1 in 3 and 1 in 8 and as such can accommodate differential settlement within the cap without compromising the ability of the cap to shed surface water.

All post closure monitoring will be in accordance with the requirements of the Environmental Protection Agency's Manual on Landfill Monitoring. The minimum requirements for aftercare monitoring are shown in Table 6. The location of the aftercare monitoring points are shown in Drawing No. IBR0132/106A Monitoring Points.

**Table 6.3 Proposed Aftercare Monitoring Programme**

Parameter	Frequency	Determinand
Surface water	Six Monthly will depend on water body and flow rate. Annually	NH <sub>4</sub> -N, BOD, COD, Cl, DO, EC, pH, TSS, Temp Cd, Cr, Cu, Fe, Pb, Mg, Mn, Hg, K, SO <sub>4</sub> , Alk, PO <sub>4</sub> , TON, Zn
Groundwater	Quarterly (may be reduced to 6-monthly if there is evidence of stable conditions). Annually (may be reduced to bi annually if there is evidence of stable conditions).	Visual, Groundwater level, NH <sub>4</sub> -N, Cl, EC, pH, Temp, Fe, TON.  Cd, Cr, Cu, Cn, Pb, Mg, Mn, Ni, Hg, K, SO <sub>4</sub> , Alk, PO <sub>4</sub> , TON, Zn, Phenols, List I & II substances.
Landfill gases	Six Monthly	CH <sub>4</sub> , CO <sub>2</sub> , O <sub>2</sub> , AP
Leachate levels	Monthly (reduce to quarterly if stable conditions prevail)	Leachate level
Leachate Volume and Composition	Six Monthly  Annually (may be reduced to bi annually if there is evidence of stable conditions).	Visual, Level, NH <sub>4</sub> -N, BOD, COD, Cl, EC, pH, Temp, TON Cd, Cr, Cu, Fe, Pb, Mg, Mn, Hg, Ni, SO <sub>4</sub> Tot. Phos, TON, Zn.
Meteorological Data	Monthly	Precipitation, Temp, Wind, Evaporation, Humidity, Atmospheric Pressure
Other parameters	Annually	Settlement

**6.3.2 Aftercare of Infrastructure**

During the aftercare period the maintenance of the gas management system shall include:

- Regular monitoring of boreholes and balancing of landfill gas wells,
- Monitoring of the flare stack for combustion efficiency and emissions.

Performance and gas yield will identify areas where maintenance works are required. Any remedial work required to wells and pipework shall be carried out in a manner with minimal impact on the proposed afteruse.

Leachate monitoring will include regular checks of the leachate monitoring points and pumping system. Any remedial works or modifications to the leachate system, including collection, treatment and monitoring systems, shall be carried out with minimal impact on the afteruse.

The current SCADA System installed at the site for leachate and landfill gas management will be maintained with a call out system via text message should problems arise. The SCADA system will be accessible from a Donegal County Council Office.

In the event that maintenance to the capping system is required, it will be ensured that the repaired cap is properly sealed to prevent the ingress of water and the various layers re-laid. The effectiveness of the drainage system will be monitored and any remedial works to the drainage layer or surface water collection system will be carried out where required. If required, the site operator will employ soil specialists to undertake soil maintenance checks to assess the physical and chemical status of the soils.

All drainage ditches and outfalls carrying run-off from the site will be regularly checked to ensure effective surface water flows are being maintained. Any depressions created through settlement will be re-profiled to ensure surface water runoff.

A surface water management plan will be implemented as part of the final capping to prevent the ingress of water.

### **6.3.3 Vegetation**

The long-term aftercare of the site will require vegetation management. This will require fencing, cutting, fertilising and replanting in areas where vegetation may not be flourishing. Personnel with appropriate landscape experience will undertake such maintenance work.

### **6.3.4 Decommissioning**

It is envisaged that the site building, leachate treatment plant and gas flare stack will all be retained on site post closure. Ultimately it will be possible to remove the building, leachate treatment plant and gas flare stack. The weighbridge, wheelwash and waste inspection area will be removed after completion of the final phase of restoration on the infilled area. The perimeter security fencing will be removed and replaced with post and wire fencing except for areas involved in the ongoing aftercare management of the site.

All controls shall be maintained on-site until the EPA approves of their decommissioning. Once leachate abstraction and landfill gas extraction is no longer required, decommissioning and removing of redundant structures shall take place. All work in relation to leachate and landfill management shall be carried out in an environmentally safe manner and shall not adversely impact the afteruse or users of the restored site.



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## 7.0 CLOSURE PLAN COSTING

### 7.1 FINANCIAL PROVISIONS

Donegal County Council is a Local Authority and is committed to provide for the proper management, development and restoration of the Ballynacarrick Landfill Site.

### 7.2 COST OF RESTORATION PROPOSALS

The predicted costs for the restoration and aftercare of each area of the landfill are supplied below. These costs are based on previous amounts paid and tendered for similar works at Ballynacarrick. Both short and long-term “known” environmental liabilities exist at the landfill. The short-term liabilities are those which are expected to arise within the next 2 - 4 years and include the capping of remaining Area 1, Area 2 and the extension of the gas extraction system.

The long-term “known” environmental liabilities are those that will occur between 4 and 30 years from now. Whilst it is known that environmental liabilities at the landfill are likely to extend beyond 30 years, the assessment of the environmental liabilities has been limited to a 30-year period in accordance with Article 10 of the Council Directive 1999/31/EC of 26 April 1999 on the Landfill of Waste. Long-term liabilities which apply include the maintenance of the leachate treatment plant, the SCADA pumping system, the gas utilisation system, as well as general maintenance and management of the landfill in the aftercare phase. Table 7.1 and 7.2 contains the “known” liabilities for restoration costs for each area of the site and Table 7.4 and 7.5 contain the costs for aftercare.

**Table 7.1 Known Liabilities and Associated Cost – Area 1 and Area 2**

Environmental Liability	Description	Cost Estimate <sup>6</sup>
Extend capping system	Based on area of 37,500 m <sup>2</sup> <ul style="list-style-type: none"> <li>▪ Preliminaries</li> <li>▪ Demolition and Site Clearance</li> <li>▪ Site Preparation</li> <li>▪ Earthworks – Regrading</li> <li>▪ Geosynthetic Liners</li> <li>▪ Subsoil and topsoil</li> <li>▪ Haul Roads</li> </ul>	€894,000.00
Extend gas abstraction system	<ul style="list-style-type: none"> <li>▪ Extraction Wells</li> <li>▪ Manifold</li> <li>▪ Pipework</li> </ul>	€162,000.00
Extend leachate abstraction system	<ul style="list-style-type: none"> <li>▪ Pipework</li> <li>▪ Ancillaries</li> </ul>	€10,000.00
Extend surface water management system	<ul style="list-style-type: none"> <li>▪ Manhole</li> <li>▪ Pipework</li> <li>▪ Ancillaries</li> </ul>	€103,000.00
<b>Total</b>		<b>€1,209,000.00</b>
	Consultancy services	€200,000.00
<b>Overall Total</b>		<b>€1,409,000.00</b>

**Table 7.2 Known Liabilities and Associated Cost – Area 3**

Environmental Liability	Cost Estimate
Decommission infrastructure at gas compound	€10,000.00
Decommission leachate treatment plant	€10,000.00
Decommission office building and toilets	€7,000.00
Demolish inspection /quarantine area	€5,000.00
Remove weighbridge / wheelwash	€12,000.00
<b>Total</b>	<b>€44,000.00</b>

<sup>6</sup> All cost estimates based on previous tenders received.

## 7.3 COST OF AFTERCARE MANAGEMENT PROPOSALS

Table 7.3 Cost of Aftercare Management Proposals – Area 1 &amp; 2 and 3

Environmental Liability	Description	Cost Estimate
General Management and maintenance of site during aftercare phase (30 yrs )	€ 50,000 per annum.	€ 1,500,000
Management and maintenance of leachate treatment plant and pumping system during aftercare phase (30 yrs)	€ 180,000 per annum.	€ 5,400,000
Management and maintenance of Gas Management System during aftercare phase (30 yrs)	€ 20,000 per annum.	€ 6,000,000
<b>Total for 30 year period after closure</b>		<b>€ 7,500,000</b>

**8.0 CLOSURE PLAN UPDATE, REVIEW, IMPLEMENTATION AND VALIDATION****8.1 PROPOSED FREQUENCY OF MONITORING**

The plan shall be reviewed annually and proposed amendments thereto notified to the Agency for agreement as part of the AER in accordance with Condition 10.8.2 of the licence. No amendments will be implemented without the prior agreement of the Agency.

**8.2 PROPOSED SCOPE OF REVIEW**

Due to the nature of the operation (landfill – Category 3 facility) a process of restoration and aftercare will be required including on-going restoration/remediation works, management and long term monitoring. The scope of this report is to describe the facility and to outline the closure, restoration and aftercare proposals in relation to the criteria required, management issues and costs. All revisions to this report will update any new proposals in relation to closure, restoration and aftercare management and associated costs and logistics.

The review will check if restoration proposals, that were scheduled, were carried out. If scheduled proposals for restoration and aftercare were not carried out, the review of this report assesses if proposals need to be changed and formulate a new programme for carrying out proposals.

**8.3 IMPLEMENTATION**

The closure of the site is currently projected for 2012-2013 depending on annual tonnage received. The permanent capping of the remainder of the site will be undertaken as detailed in Table 8.1. The EPA will be given 3 months notice of closure date.

**Table 8.1 Programme for Permanent Capping**

Area	Permanent Cap
Partial Phase 1 & Cell 2A	2010
Remaining area of the site	2013

**8.4 VALIDATION**

Upon Closure of the facility a closure validation audit will be carried out by an independent consultant. The closure validation audit may be carried out for each distinct area separately and then a final audit will be carried out upon closure of the entire site.

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## 9.0 CONCLUSION

This Closure Restoration and Aftercare Management Plan for Ballynacarrick Landfill, Co. Donegal has been prepared in compliance with Condition 10.8 of Waste Licence W0024-04, takes guidance from the EPA Landfill Manual 'Landfill Restoration and Aftercare' (1999) and the EPA Guidance on Environmental Liability Risk Assessment, Residuals Management Plans and Financial Provision Document (2006). This CRAMP meets the requirements of the EU Council Directive (1999/31/EC) on the Landfill of Waste.

This Plan is a working document that will be held on site at Ballynacarrick Landfill.



## **APPENDIX A**

### **DRAWINGS**