



Waste Licence Application Form

EPA Ref. N^o:

(Office use only)

This document does not purport to be and should not be considered a legal interpretation of the provisions and requirements of the Waste Management Acts 1996 to 2003.

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WASTE Application Form

Environmental Protection Agency
Application for a Waste Licence

WASTE MANAGEMENT ACTS 1996 to 2003

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INTRODUCTION

A valid application must contain the information prescribed in the Waste Management (Licensing) Regulations 2004 (SI No. 395 of 2004). **The applicant is strongly advised to read the *Application Guidance Notes for Waste Licensing*, available from the EPA.**

The applicant must conform to the format set out in the guidance notes for applications. Each page of the completed application form must be numbered, e.g. *page 5 of 45*, etc. Also duplicated pages from the application form should be uniquely numbered, e.g. page 5(i) of 45, etc. **The basic information should for the most part be supplied in the spaces given in application form** and any supporting documentation should be supplied as attachments, as specified. Consistent measurement units must be used throughout.

The applicant should note that the application form has been structured so that it requires information to be presented in an order of progressive detail.

When it is found necessary, additional information may be provided on supplementary attachments which should be clearly cross referenced with the relevant sections in the main document.

While all sections in the application form may not be relevant to the activity concerned, the applicant should look carefully through all aspects of the form and provide the required information, in the greatest possible detail.

All maps/drawings/plans must be no larger than A3 size and scaled appropriately such that they are clearly legible. In exceptional circumstances, where A3 is considered inadequate, a larger size may be requested by the Agency.

Information supplied in this application, including supporting documentation will be put on public display and open to inspection by any person. Should the applicant consider information to be confidential, this information should be submitted in a separate enclosure bearing the legend “ In the event that this information is deemed not to be held as confidential, it must be returned to”. In the event that information is considered to be of a confidential nature, then the nature of this information, and the reasons why it is considered confidential (with reference to the “ Access to Information on the Environment” Regulations) should be stated in the Application Form, where relevant.

It should be noted that it will not be possible to process or determine the application until the required documents have been provided in sufficient detail and to a satisfactory standard.

CHECKLIST

Articles 12 and 13 of the Waste Management (Licensing) Regulations, 2004 (S.I. No. 395 of 2004) set out the information which must, in all cases, accompany a waste licence application. In order to ensure that the application fully complies with the legal requirements of Articles 12 and 13 of the 2004 Regulations, all applicants should **complete** the following.

In each case, refer to the attachment number(s) of your application which contain(s) the information requested in the appropriate sub-article.

Article 12(1) In the case of an application for a waste licence, the application shall -

- (a) give the name, address and, where applicable, any telephone number and telefax of the applicant (and, if different, the operator of the facility concerned), the address to which correspondence relating to the application should be sent and, if the applicant or operator is a body corporate, the address of its registered office or principal office,

LOCATION	B.1	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

- (b) give the name of the planning authority in whose functional area the relevant activity is or will be carried on,

LOCATION	B.3	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

- (c) in the case of a discharge of any trade effluent or other matter (other than domestic sewage or storm water) to a sewer of a sanitary authority, give the name of the sanitary authority in which the sewer is vested or by which it is controlled,

LOCATION	Not Applicable	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

- (d) give the location or postal address (including where appropriate, the name of the townland or townlands) and the National Grid reference of the facility or premises to which the application relates,

LOCATION	B.2	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

- (e) describe the nature of the facility or premises concerned, including the proposed capacity of the facility or premises, and in the case of application in respect of a landfill of waste, the requirements specified in Annex 1 of the Landfill Directive,

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LOCATION	A.1.1	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

(f) specify the class or classes of activity concerned, in accordance with the Third and Fourth Schedules of the Act, and in the case of an application in respect of the landfill of waste, specify the class of landfill in accordance with Article 4 of the Landfill Directive,

LOCATION	B.7	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

(g) specify, by reference to the relevant European Waste Catalogue codes as presented by Commission Decision 2000/532/EC of 3 May 2000, the quantity and nature of the waste or wastes which will be treated, recovered or disposed of,

LOCATION	B.7	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

(h) specify the raw and ancillary materials, substances, preparations, fuels and energy which will be utilised in or produced by the activity,

LOCATION	G.1	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

(i) describe the plant, methods, processes, ancillary processes, abatement, recovery and treatment systems and operating procedures for the activity,

LOCATION	D.1.d & D.2	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

(j) provide information for the purpose of enabling the Agency to make a determination in relation to the matters specified in paragraphs (a) to (g) of section 40(4) of the Act,

LOCATION	L	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

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- (k) give particulars of the source, location, nature, composition, quantity, level and rate of emissions arising from the activity and, where relevant, the period or periods during which such emissions are made or are to be made,

LOCATION	E	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

- (l) give details, and an assessment of the effects, of any existing or proposed emissions on the environment, including any environmental medium other than those into which the emissions are, or are to be made, and of proposed measures to prevent or eliminate or, where that is not practicable, to limit or abate such emissions,

LOCATION	I	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

- (m) identify monitoring and sampling points and indicate proposed arrangements for the monitoring of emissions and the environmental consequences of any such emissions,

LOCATION	F	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

- (n) describe any proposed arrangements for the prevention, minimisation and recovery of waste arising from the activity concerned,

LOCATION	C.2	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

- (o) describe any proposed arrangements for the off-site treatment or disposal of solid or liquid wastes,

LOCATION	A.1.9	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

- (p) describe the existing or proposed measures, including emergency procedures, to prevent unauthorised or unexpected emissions and minimise the impact on the environment of any such emission,

LOCATION	J	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

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(q) describe the proposed measures for the closure, restoration, remediation or aftercare of the facility concerned, after the cessation of the activity in question,

LOCATION	K.1	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

(r) in the case of an application in respect of the landfilling of waste, give particulars of –

(i) such financial provision as is proposed to be made by the applicant, having regard to the provisions of Articles (7)(i) and (8)(a)(iv) of the Landfill Directive and section 53(1) of the Act, and

LOCATION	Not Applicable	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

(ii) such charges as are proposed or made, having regard to the requirements of section 53A of the Act,

LOCATION	Not Applicable	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

(s) state whether the activity is for the purposes of an establishment to which the European Communities (Control of Major Accident Hazards involving Dangerous Substances) Regulations, 2000 (S.I. No. 476 of 2000) apply,

LOCATION	B.8	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

(t) in the case of an activity which gives rise or could give rise to an emission into an aquifer containing the List I and II substances specified in the Annex to Council Directive 80/68/EEC of 17 December 1979, describe the existing or proposed arrangements necessary to give effect to Articles 3,4,5,6,7,8,9 and 10 of the aforementioned Council Directive,

LOCATION	Not Applicable	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

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(u) include a non-technical summary of information provided in relation to the matters specified in paragraphs (a) to (t) of this sub-article,

LOCATION	A.1	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

Article 12(4) Without prejudice to Article 13(1) and (2), an application for a licence shall be accompanied by -

(a) a copy of the relevant page of the newspaper(s) in which the notice in accordance with article 6 has been published,

LOCATION	B.6	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

(b) a copy of the text of the notice or notices erected or fixed in accordance with article 7,

LOCATION	B.6	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

(c) where appropriate, a copy of the notice given to a local planning under article 9,

LOCATION	B.6	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

(d) a copy of such plans (appropriately scaled and no larger than A3 size), including a site plan or plans and location map or maps, and such other particulars, reports and supporting documentation as are necessary to identify and describe, as appropriate -
 (i) the position of the notice in accordance with article 7,

LOCATION	B.2	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

(ii) the point or points from which emissions are made or are to be made, and

LOCATION	E	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

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(iii) the point or points at which monitoring and sampling are undertaken or are to be undertaken,

LOCATION	F	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

(e) such fee as is appropriate having regard to the provisions of articles 40 and 41.

INCLUDED Y/N	Y	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

Article 12(5)(a) & (b) An application shall comprise 1 signed original of the application and 2 copies in hardcopy format plus 2 copies of all files in electronic searchable PDF format on CD-Rom.

HARDCOPIES PROVIDED Y/N	Y	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

CD OF PDF FILES PROVIDED? Y/N	Y	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

Article 13 Where a development requires an Environmental Impact Assessment to be carried out, 1 signed original and 2 copies in hardcopy format of the environmental impact statement plus 16 copies in electronic searchable PDF format on CD-ROM should accompany this application.

EIA REQUIRED ? Y/N	N	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>
3 HARD COPIES OF EIS INCLUDED ? Y/N	N	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>
16 CD versions of EIS, as PDF files, PROVIDED? Y/N	N	
CHECKED	Applicant <input checked="" type="checkbox"/>	Official <input type="checkbox"/>

PROCEDURES

It is recommended that pre-application consultations with the Agency are undertaken before a formal submission of the waste licence application.

The procedure for making and processing of applications for waste licences, and for the processing of reviews of such licences, appear in the Waste Management (Licensing) Regulations 2004 (S.I. No. 395 of 2004) and are summarised below. The application fees that shall accompany an application are listed in the Second Schedule to the Regulations.

Prior to submitting an application the applicant must publish in a local newspaper, and erect on site, a notice of intention to apply. An applicant, other than a local authority in whose functional area the development is located, must also notify the Local Planning Authority, in writing, of their intention to apply.

An application for a licence must be submitted on the appropriate form (available from the Agency) with the correct fee, and should contain relevant supporting documentation as attachments. The application should be based on responses to the form, supporting written text and the appropriate use of tables and drawings. Where point source emissions occur, a system of unique reference numbers should be used to denote each emission point. These should be simple, logical, and traceable throughout the application.

The application form is divided into a number of sections of related information. The purpose of these divisions being to facilitate both the applicant and the Agency in the provision of the information and its assessment. Attachments should be clearly numbered, titled and paginated and must contain the required information as set out in the application form. Additional attachments may be included to supply any further information supporting the application. Any references made should be supported by a bibliography.

All questions should be answered. No waste management facility is exactly the same and hence each application will require different information. It is therefore possible that some of the sections of this application form may not be relevant to the activity concerned. **Where information is requested in the application form, which is not relevant to the application, the words “not applicable” should be clearly written on the form. The abbreviation “N/A” should not be used.**

Additional information may need to be submitted beyond that which is explicitly requested on this form. Any references made should be supported by a bibliography. The Agency may request further information if it considers that its provision is material to the assessment of the application. Advice should be sought from the Agency where there is doubt about the type of information required or the level of detail.

Information supplied in this application, including supporting documentation will be put on public display and be open to inspection by any person. **Should the applicant**

consider information to be confidential, then the nature of this information, and the reasons why it is considered confidential should be clearly stated in an attachment to the Application Form. This information should be submitted in a separate enclosure bearing the legend “In the event that this information is deemed not to be held as confidential, it must be returned to (representative of the applicant)”.

Applicants should be aware that a contravention of the conditions of a waste licence is an offence under Section 39 of the Waste Management Acts 1996 to 2003.

The provision of information in an application for a waste licence which is false or misleading is an offence under Section 45 of the Waste Management Acts 1996 to 2003.

Note: Drawings. The following guidelines are included to assist applicants:

- *All drawings submitted should be titled and dated.*
- *They should have a **unique reference number** and should be signed by a clearly identifiable person.*
- *They should indicate a scale and the **direction of north**.*
- *All drawings should, generally, be to a scale of between 1:20 to 1:500, depending upon the degree of detail needed to be shown and the size of the facility. Drawings delineating the boundary can be to a smaller scale of between 1:1000 to 1:10560, but must clearly and accurately present the required level of detail. Drawings showing the site location can be to a scale of between 1:50 000 to 1:126 720. All drawings should, however, be A3 or less and of an appropriate scale such that they are clearly legible. Provide legends on all drawings and maps as appropriate.*

The provision of information in an application for a waste licence, which is false or misleading, is an offence under s45 of the Acts.

SECTION A NON-TECHNICAL SUMMARY

A Non-Technical Summary is to be submitted. The summary should include information on those aspects outlined in the Guidance Note and must comply with the requirements of Article 12 (1) (u) of the Waste Management (Licensing) Regulations, S.I. 395 of 2004.

The Non-Technical Summary should form **Attachment A.1**.

Attachment A.1 – Non-Technical Summary**A.1.1 Background & Nature of the Facility**

Dungarvan Landfill is located in Ballynamuck Middle Co. Waterford approximately 2km north west of Dungarvan, off the N25 road on the Southern Bank of the Colligan River. The landfill site is located on a meander of the Colligan River, immediately to the west of Ballyneety Bridge. Adjacent to the site the Colligan River becomes tidal, with an extensive area of mudflats located further to the east of Ballyneety Bridge extending into Dungarvan Harbour. Dungarvan Harbour itself is designated as a Special Protection area (SPA) which extends from Helvic Head to Ballyneety Bridge. A National Heritage Area (NHA) covers most of the bay and touches the western boundary of the landfill site.

The topography of the area is a gentle south facing slope and is bounded by a low ridge running east-west to the north of the Waterford-Cappoquin Road. The general character of the landscape is one of good quality agriculture with a relatively high level of visual amenity. Land use in the vicinity of the site is primarily agricultural pastureland with some isolated patches of cropland. There is urbanisation in the form of ribbon development on the county roads around the site. There is also an “angler’s path” running along the boundary of the site adjacent to the river on which there is a public right of way.

The site contains the following:

- A closed landfill
- A compost facility
- A Waste Transfer Station
- A Civic Amenity Area

Landfill

The site itself consists of a landfill that has ceased accepting waste since 2003. The landfill covers an area of approximately 6.5 hectares. It is thought that filling on the site commenced in the late 1960’s. Ownership of the landfill was passed to Waterford County Council in 1985. The landfill is an unlined landfill i.e. it does not contain any engineered liner material underneath the waste. It does however contain a thick layer of low permeable clay which would prevent a significant amount of leachate ingress into the groundwater.

The landfill site has recently been capped completely and now progresses to non-clean closure status as defined in the Agency’s ELRA, Residuals Management and Financial Provision Guidance Document. In accordance with Waste Licence W32-02 and in accordance with the Closure, Restoration and Aftercare Management Plan (CRAMP) issued to the Agency, it is intended to develop a series of Integrated Constructed Wetlands (ICW) at the site to treat the leachate and provide a public local amenity area.

While the primary objective of the constructed wetlands is for leachate treatment, the development and conservation of wildlife habitats is compatible as an afteruse. The layout, structure and composition of the wetlands will be entirely compatible with the surrounding ecology and will greatly increase the restored landfill’s visual and wildlife amenity. Wetlands are important as habitats for invertebrates, marginal and



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aquatic vegetation, amphibians, fish and a range of breeding and wintering wildfowl as an area for nesting and feeding. The restored site will play an important role as a wildlife corridor in the area.

Capping works were completed in mid 2008. The final capping system generally comprises of a gas collection layer, LLDPE liner, drainage layer, subsoil layer and topsoil layer as follows:

- 150-300mm layer of topsoil; underlain by
- Subsoil such that thickness of topsoil and subsoil is at least 1m thick; underlain by
- A surface water geocomposite layer; underlain by
- 1mm LLDPE liner (a low permeability geomembrane material).
- Geocomposite gas collection layer.

The capping layers will provide protection from the ingress of rain into the site and thus minimise leachate generation. In addition to the capping detail as required by the licence it is proposed that wetland ponds be constructed for the purpose of treating leachate. The drainage geocomposite layer is placed on the side slopes only as the constructed wetlands will effectively control surface water drainage; in addition the depth of subsoil/topsoil will be decreased from 1m to 0.3m in areas where the ponds are located. Approximately 5,500m² of the side slopes on the Southern side of Dungarvan landfill were capped in 2002 using a GCL as the low permeability layer. Geogrid was also placed on the side slopes as required for slope stability. The drainage geocomposite layer is placed on the side slopes only as the constructed wetlands effectively control surface water drainage on the flat areas. Leachate extraction wells are located strategically across the site in order to maximise collection efficiency. Furthermore, rainwater will assist in the dilution of leachate within the constructed wetlands. The surface water drainage from the side slopes will run-off towards the surface water carrier drain, which runs along the northern boundary.

The landfill gases generated within the landfill body itself will be collected by the landfill gas management system and flared off.

Compost Facility

The compost facility on site currently only accepts green waste in the form of bushes, trees, grass etc. A mobile shredder is brought onto site once a month at a minimum or whenever a sufficient amount of green waste is to be shredded. Two enclosed in-vessel units are currently on site for 14 day maturation of the compost material however because only green waste is now being composted these are no longer required. When the material is shredded, it is placed in a curing bunker where it is allowed to decompose with the aid of aeration slots and a biofilter.

Waste Transfer Station

The waste transfer station is licensed to accept 10,000 tonnes per annum. The building is 10m x 35m in size and is fully enclosed. An air handling unit of three overhead pipes is connected to three extractor fans to ventilate the building.

All waste accepted is unloaded within the transfer building itself. All waste remains in the building for a maximum of 48 hours prior to being loaded and transported to either Powerstown Landfill in County Carlow or the composting facilities at Veolia in Waterford City or Milltown Composting, Fethard, Co. Tipperary. The facility is washed down and cleaned after compostable material is transferred. This is collected on a three week cycle together with municipal waste and dry recyclables.

Civic Amenity Area

The civic amenity area is open to the public and subject to a pricing structure depending on the amount of waste or type of vehicle or size of trailer. The facility accepts waste from 9.00am to 17.00pm Monday to

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Friday and 9.00am to 1.00pm on Saturday. All waste coming into the civic amenity area is inspected by staff prior to disposal. The civic amenity area accepts the following waste;

- Glass
- Paper & Cardboard
- Newspapers/magazines
- Plastics
- Garden Waste
- Construction & Demolition waste
- Wood
- Waste cooking oils
- Batteries
- Oil Filters
- Waste paint
- Mixed residual waste
- Bulky waste (furniture, mattresses etc.)
- WEEE
- Mixed dry recyclables including tetra-pak
- Textiles
- Scrap metal
- Aluminium & tin cans

A.1.2 Classes of Activities

Dungarvan Landfill is currently licensed to carry out activities under Classes 4 and 13 in accordance with the Third Schedule of the Waste Management Acts 1996 to 2005.

Under this waste license review Waterford County Council are applying to carry out activities under the following classes in accordance with the Third Schedule of the Waste Management Acts 1996 to 2005:

- Class 4. Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons.
- Class 11. Blending or mixture prior to submission to any activity referred to in 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.

Class 4 activities relates to the storage of leachate within the six wetland ponds that are currently being constructed as part of the capping works.

Class 11 activities relates to the mixture of water with the abstracted leachate. This is necessary to dilute the leachate before it is pumped into the wetland system.

Class 13 relates to the storage of waste in the waste transfer station prior to this waste being transferred to either composting facilities for recovery or Powerstown Landfill for disposal.

Dungarvan Landfill is currently licensed to carry out activities under Classes 2, 3, 4, 9, 11 and 13 in accordance with the Fourth Schedule of the Waste Management Acts 1996 to 2005.

Under this waste license review Waterford County Council are applying to continue carrying out activities under the above classes as per Waste License 032-02.

The principal activity at the site is Class 13 of the Third Schedule as detailed above.

A.1.3 Quantity and Nature of Waste Handled

The main types of waste handled at the facility are household (mixed residual waste and mixed dry recyclables), green waste and construction & demolition waste and commercial waste. The quantities and nature of waste that the facility is currently licensed to accept are shown in the table below.

WASTE TYPE	TONNES PER ANNUM
Municipal Waste	10,000
Hazardous Municipal Waste (including WEEE)	400
Inert C & D	20,000 over the lifetime of the facility
Garden Waste	1,120
Total	11,520

A.1.4 Raw and Ancillary Materials

The main raw material used on site is water for cleaning the hard standing areas namely the civic amenity area, the compost facility and the waste transfer station. Diesel is used to run the shredder however this is not permanently on site. Electricity is used in the site lighting, weighbridge, and in the office and garage buildings.

A.1.5 Site Operating Procedures

Waste is delivered to the site mainly by Waterford County Council (WCC) and Dungarvan Urban District Council refuse collection trucks. This waste is domestic household waste. All trucks must pass over the weighbridge prior to admission to the waste transfer station where it is unloaded within the building itself. This mitigates odour, noise and dust emissions to the atmosphere. The waste is then inspected and is transported off site to either composting facilities for recovery or Powerstown landfill in County Carlow for disposal within 48 hours.

All waste accepted by the compost facility (green waste only) and civic amenity area is inspected prior to admission. In the past the facility accepted domestic waste and to facilitate in the composting of this material, two enclosed in-vessel units were commissioned to allow a 14 day maturation period. Because the facility only accepts green waste at present, odour is no longer an issue hence it is not in use. Every month or sooner if required, a mobile shredder is brought to site to shred the green waste into chips. This is then transferred to one of the concrete curing bunkers of that contain aeration slots and biofilters that facilitate decomposition and odour control. The civic amenity area is open to the public free of charge. Waste is inspected by staff prior to admission and if the material is accepted, the public are directed to the required container(s).

A.1.6 Nature & Impacts of Emissions at the facility

Emissions to Air

The potential emissions to air that arise from the operation of the facility are noise, dust and odour. The majority of these emissions result from waste coming into and leaving the transfer station. These emissions are mitigated by ensuring that all incoming waste is unloaded within the building itself thus

reducing the emissions to the atmosphere. In addition, all biodegradable waste coming into the facility is removed within 48 hours.

Dust levels at the facility established during monitoring undertaken indicate that dust generation at the facility are significantly below the EPA recommended level of 350mg/m²/day.

The main source of odour nuisance is potentially generated from the compost facility. Because the compost facility no longer accepts kitchen waste, odour nuisance at the facility is minimal.

Emissions to Groundwater

As mentioned previously, the landfill body itself is unlined resulting in the threat of leachate ingress into the groundwater. Although this is a potential issue, a thick layer of low permeability clay exists underneath the landfill which reduces the potential for leachate migration. In addition to this the fully engineered landfill cap that is being constructed in accordance with Waste Licence 032-2 will prevent the ingress of moisture into the waste body of the landfill, thus mitigating against future leachate generation. Because the landfill is now closed and recently capped, the amount of leachate generated on an annual basis will deplete over time.

Emissions to Surface Water

Surface water generated from the slopes of the landfill will be collected via a series of stone filled carrier drains that will discharge into the River Colligan.

Surface water from the civic amenity area is collected and passed through a petrol interceptor before being discharged to the Colligan River.

Wastewater from the composting area and the waste transfer station will be directed to the leachate treatment system.

Noise Emissions

The primary source of noise emissions coming from the facility relate to activities concerning the waste transfer station. These emissions are minimised by carrying out all loading and unloading of vehicles within the main building. Another source of noise emissions would be the auger that shreds the green waste, however due to the fact that this runs approximately once a month, it is perceived that this is not an issue.

A.1.7 Provision of Information related to Section 40(4) of the Waste Management Act

Compliance with Emission Standards

Waterford County Council will operate the facility so as to comply with all emission standards and limits set out by the Environmental Protection Agency in the Waste Licence.

Avoidance of Environmental Pollution

The facility is designed and operated to ensure that the operation of the facility will not cause environmental pollution; some of the design features and operational practices that ensure this are outlined below:

Avoidance of Emissions to Air

- All waste related to the waste transfer station is transferred in enclosed or covered vehicles.
- All waste-handling is restricted to inside the waste transfer station.
- All waste disposed of at the waste transfer station is removed off site within 48 hours of delivery.
- Water-spraying of hardstanding areas is carried out in periods of dry weather.

- Only green waste is accepted at the compost facility.

Avoidance of Emissions to Water

- The civic amenity area, the waste transfer station and the compost facility are paved allowing collection of all surface water generated.
- All surface water from the civic amenity area is passed through a petrol/oil interceptor before being discharged to the Colligan River.
- Wastewater from the composting area and waste transfer station will be directed to the leachate treatment system.

Avoidance of Other Environmental Nuisances

- The site is cleaned regularly to prevent wind blown litter.
- Municipal waste collected by WCC is stored within the main waste building and is not exposed.
- A vermin control plan was developed by a pest-control specialist and is being implemented and the site is regularly inspected.
- Regular monitoring of agreed parameters as set out in the existing Waste Licence will ensure that environmental controls are monitored for performance.

Best Available Technology (BAT)

Waterford County Council adheres to BAT principles to avoid any environmental pollution and prevent and mitigate any nuisance emissions from the facility.

Fit and Proper Person

Mr. David Regan has responsibility for the day to day operations at the site. Mr. Regan is currently undertaking the FAS Waste Management Certificate.

No employee of the applicant, Waterford County Council, has been convicted of an offence under the Waste Management Act 1996.

Technical Competence & Site Management

Waterford County Council is required as a local Authority to follow instructions set out by the EPA and has extensive experience in waste management. Waterford County Council has also extensive experience and in operating licensed facilities and will operate the facility in strict accordance with the Waste Licence. The table and organisational chart in Attachment C.1 sets out the staff structure for the management of the facility.

Financial Provision

Waterford County Council, as a Local Authority, are fully aware of their responsibilities to make financial provision in respect to the operation of a waste recovery facility as set out in Section 53 of the Act.

A.1.8 Monitoring and Sampling Arrangements

It is proposed to continue the monitoring programme as set out by the EPA for the facility in the previous Waste Licence W32-02.

A.1.9 Off-site Treatment of Waste

All outgoing waste from the Waste Transfer Station is sent to either composting facilities or Powerstown Landfill in County Carlow (Waste Licence W0025-02). All waste from the civic amenity area is sent to appropriate waste recovery facilities. Mixed dry recyclables are sent to the Materials Recovery Facility at Shandon, Dungarvan which is nearby and is also owned by the Applicant. All vehicles involved in the transportation of these wastes are fully enclosed and are in possession of the appropriate collection permits.

It is not proposed to treat any liquid waste, i.e. leachate from the landfill off-site.

A.1.10 Emergency Procedures

A set of emergency procedures have been developed for the facility to implement appropriate measures to prevent environmental pollution in the event of any emergency situation. Under these emergency procedures specific staff members have designated responsibilities. Events that would constitute an emergency would include:

- Spills
- General fire/Explosion
- Internal/External Flooding
- Malicious Damage
- Other Unforeseen Emergencies

A.1.11 Closure, Restoration & Aftercare of the Site

It is envisaged that the site (with the exception of the landfill) will operate in the long-term. A Closure, Restoration and Aftercare Management Plan (CRAMP) has been submitted to the Agency and was drawn up in accordance with Waste Licence W0032-02. The facility will continue to be monitored in the aftercare period until it is fully decommissioned and until there is no potential for emissions to the environment.

SECTION B GENERAL***B.1 Applicant's Details*****Name*:** Waterford County Council**Address:** Civic Offices,
Dungarvan
Co. Waterford**Tel:** 058 - 22000**Fax:** 058 - 42911**e-mail:** environmentinfo@waterfordcoco.ie

* This should be the name of the applicant which is current on the date this Waste Licence Application is lodged with the Agency. It should be the name of the legal entity (which can be a limited company or a sole trader). A trading/business name is not acceptable.

Name and Address for Correspondence

Only application documentation submitted by the applicant and by the nominated person will be deemed to have come from the applicant.

Name: Jimmy Mansfield**Address:** Senior Executive Engineer
Environment Section
Civic Offices,
Dungarvan, Co. Waterford**Tel:** 058 - 22000**Fax:** 058 - 42911**e-mail:** environmentinfo@waterfordcoco.ie***Address of registered or principal office of Body Corporate (if applicable)*****Address:** Waterford County CouncilCivic Offices,
Dungarvan
Co. Waterford**Tel:** 058 - 22000**Fax:** 058 - 42911**e-mail:** environmentinfo@waterfordcoco.ie

If the applicant is a body corporate, the following information must be attached as **Attachment B1**:

- a Certified Copy of the Certificate of Incorporation or Memorandum and Article of Association;
- the Company's Registration Number from the Companies Registry Office; and
- a list of the Company Directors.



WASTE Application Form

State the interest of the applicant in the land which is subject to the application. The applicant is (please check):

Landowner	<input checked="" type="checkbox"/>
Lessee	<input checked="" type="checkbox"/>
Prospective Purchaser	<input type="checkbox"/>
Other (please specify)	

Name and address of all occupiers of the land on which the Activity is situated (if different from applicant named above).

Name: _____

Address: _____

Tel: _____

Fax: _____

e-mail: _____

Name and address of the current* owner(s) and lessees of the land, buildings and ancillary plant on which the activity is or will be situated (if different from applicant named above). An appropriately scaled drawing(≤A3) showing the above details should be included in Attachment B1.

Name: Dungarvan Town Council ^{note 1}

Address: Town Hall

Dungarvan

Co. Waterford

Tel: 058-41111

Fax: _____

e-mail: _____

*Current at the time the application is submitted
Note 1 – Dungarvan Town Council is owner of the landfill apart from a small area adjacent to the River Colligan required for sideslopes which is leased from a local landowner. Waterford County Council are in full possession of the site and all access is via the main entrance to the landfill site.

Name: Thomas Burke

Address: Ballyneely

Dungarvan,

Co. Waterford.


Tel: _____


Fax: _____

e-mail: _____

Attachment B.1
Site Ownership Map (DG0500)

LEGEND

 Extent of Waterford County Council Land Ownership

 Extent of Land Leased by Waterford County Council



NOTES

1. This drawing is the property of RPS. It is a confidential document and must not be copied, used, or its content divulged without prior written consent.
2. All Levels refer to Ordnance Survey Datum, Malin Head.
3. DO NOT SCALE; use figured dimensions only, if in doubt ask.

No.	Date	Drawn By	Amendment / Issue	App
F01	Dec.08	RH, EB	Final Issue	EB
D01	Apr.08	RH, BOK	Draft Issue	Mg

Client



WATERFORD COUNTY COUNCIL
Comhairle Chontae Phort Láirge
Civic Offices, Dungarvan, Co. Waterford
Phone: 058 22000 Fax: 058 42911

Drawn By: RH
Checked By: BOK
Approved By: MS
Date: April 2008



West Pier Business Campus
Dun Laoghaire Co. Dublin

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Email: Ireland@rpsgroup.com

Project: **DUNGARVAN LANDFILL WASTE LICENCE APPLICATION**

Drawing Status: Final
Scale / Sheet Size: 1:1000 @ A1, 1:2000 @ A3

Drawing Number: **MDR0350/DG0500**

Rev: **F01**

Title: **LAND OWNERSHIP MAP**

B.2 Location of Activity

Name: Dungarvan Waste Disposal Site,
Address*: Ballynamuck Middle,
 Dungarvan,
 Co. Waterford
Tel: 058-43358
Fax:
e-mail:

* Include any townland

National Grid Reference (8 digit 4E,4N)	224,698E 094,569N
--	----------------------

Location maps ($\leq A3$), appropriately scaled, with legible grid references should be enclosed in **Attachment B.2**. The site boundary must be outlined on the map in colour.

Attachment B.2

Attachment B.2 contains:

- Location Map, Site Layout, Site Boundary & Location of Site Notice (Dg0501)

B.3 Planning Authority

Give the name of the planning authority in whose functional area the activity is or will be carried out.

Name: Waterford County Council,
Address: Civic Offices,
 Dungarvan,
 Co. Waterford
Tel: 058 - 22000
Fax:

Has the Planning Authority received written notification from the applicant of the application to The Environmental Protection Agency for a Waste Licence under Article 9 of the Waste Management (Licensing) Regulations?

Planning Authority notified	Yes <input type="checkbox"/>
	No <input checked="" type="checkbox"/>

Planning Permission relating to this application:-

<i>has been obtained</i>	<input type="checkbox"/>
<i>is being processed</i>	<input type="checkbox"/>
<i>is not yet applied for</i>	<input type="checkbox"/>
<i>is not required</i>	<input checked="" type="checkbox"/>

Local Authority Planning File Reference N^o:	
---	--



WASTE Application Form

Attachment B.3 should contain the most recent planning permission, including a copy of all conditions, and the required copies of any EIS should also be enclosed. For existing activities, Attachment B.3 should also contain copies of the most recent waste licence and any permits in force at the time of submission. Where planning permission is not required for the development, provide reasons, relevant correspondence, etc.

Attachment B.3

The Applicant (Waterford County Council) is applying to the Agency for the review of an existing Licence hence the above paragraph is not applicable.

Appendix 4 contains:

- Copy of Waste Licence 32-2 - the most recent Waste Licence for the facility

The site is an existing site managed by Waterford Co. Council and owned by Dungarvan Urban District Council and was in operation prior to the Local Government (Planning and Development) Regulations, 1994, and as such is not subject to planning permission approval.

B.4 Sanitary Authority

In the case of a discharge of any trade effluent or other matter (other than domestic sewage or storm water) to a sewer of a sanitary authority or other body, give the name of the sanitary authority in which the sewer is vested or by which it is controlled and the waste water treatment plant (if any) to which the sewer discharges.

Name: Not Applicable

Address:

Tel:

Fax:

The applicant must enclose, as Attachment B.4, a copy of any effluent discharge licence and/or agreement between the applicant and the body with responsibility for the sewer.

B.5 Other Authorities

The applicant should tick the appropriate box below to identify whether the activity is located within the Shannon Free Airport Development Company (SFADCo.) area.

Within SFADCo. Area Yes No

The applicant should indicate the Health Board Region where the activity is or will be located.

Name: South Eastern Health Board

Address: Head Office, Kilkenny

Tel: 056 - 20400

Fax:

DUNGARVAN LANDFILL LOCATION PLAN

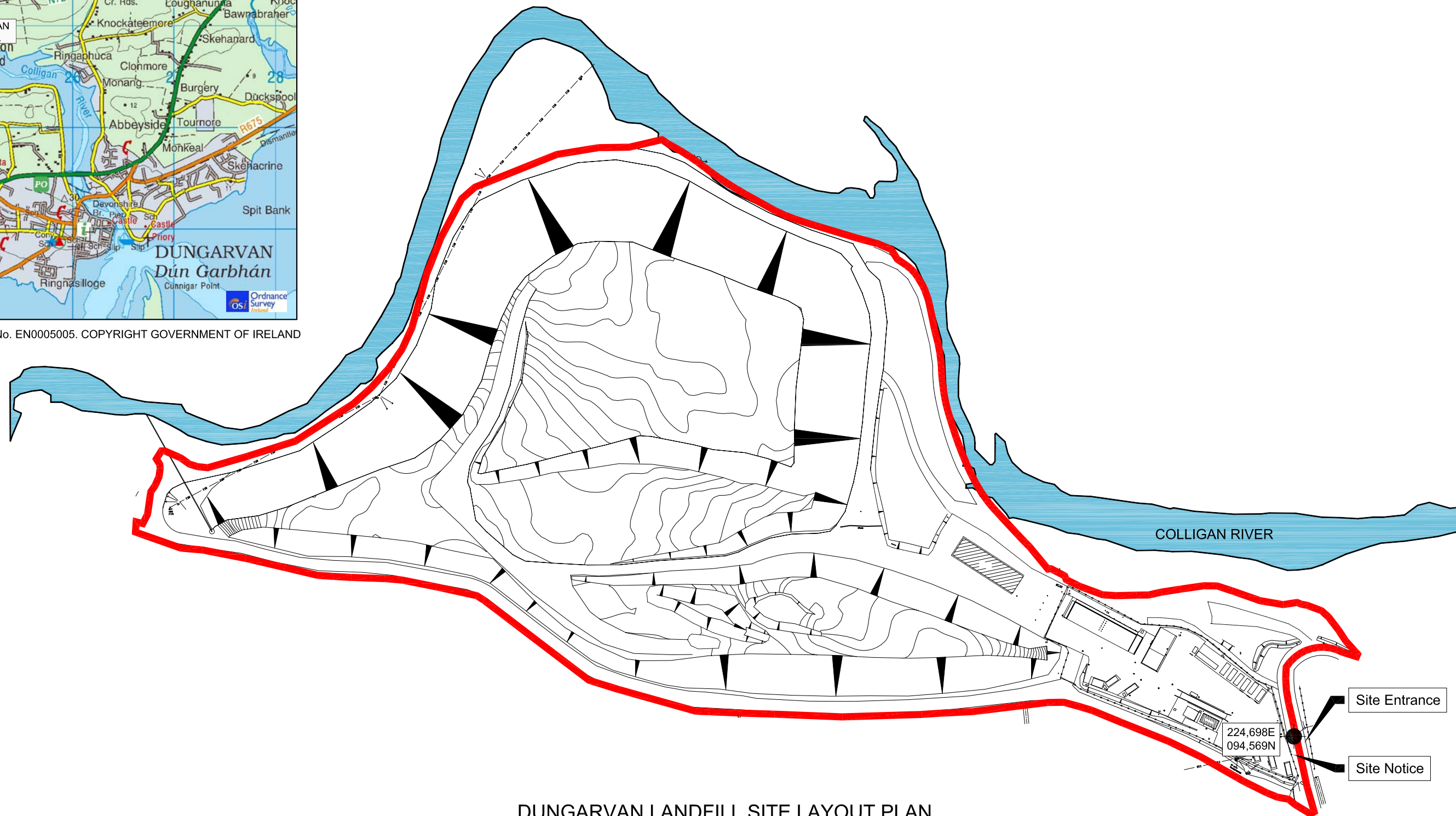
Scale 1:40,000 @ A3



ORDNANCE SURVEY LICENCE No. EN0005005. COPYRIGHT GOVERNMENT OF IRELAND

LEGEND

Site Boundary



DUNGARVAN LANDFILL SITE LAYOUT PLAN

Scale 1:2000 @ A3

NOTES

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2. All Levels refer to Ordnance Survey Datum, Malin Head.
3. DO NOT SCALE. Use figured dimensions only, if in doubt ask.

No.	Date	Drawn By	Amendment / Issue	App
F01	Dec '08	RH	Final Issue	EB
A01	Aug '08	BO'K	Issue for Approval	PM

Client

WATERFORD COUNTY COUNCIL
 Comhairle Chontae Phort Láirge
 Civic Offices, Dungarvan, Co. Waterford
 Phone: 058 22000 Fax: 058 42911

Drawn By: RH
 Checked By: BO'K
 Approved By: MS
 Date: April 2008

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 E: Ireland@rpsgroup.com

Project: **DUNGARVAN LANDFILL WASTE LICENCE APPLICATION**

Drawing Status: Final
 Scale / Sheet Size: NTS @ A1 As shown @ A3

Drawing Number: **MDR0350/DG0501**
 Rev: **F01**

Title: **SITE LOCATION, SITE LAYOUT & LOCATION OF SITE NOTICE**

B.6 Notices and Advertisements

Articles 6 and 7 of the Waste Management (Licensing) Regulations 2004 requires all applicants to advertise the application in a newspaper and by way of a site notice. See *Guidance Note*.

Attachment B.6 should contain a copy of the site notice and an appropriately scaled drawing ($\leq A3$) showing its location on site. **The original application must include the complete newspaper in which the advertisement was placed.** The relevant page of the newspaper containing the advertisement should be included with the original and three copies of the application.

Attachment B.6:

Attachment B.6 contains:

- Copy of site notice erected
- Copy of newspaper notice

Site Plan & Location of Notice (Dg0501) is located in attachment B.2.

B.7 Type of Waste Activity, Tonnages & Fees

B.7.1 Specify the class or classes of activity in Table B.7.1, in accordance with the Third Schedule or Fourth Schedule to the Waste Management Acts 1996 to 2003, to which the application relates (check the relevant box(es) and mark the principal activity with a ‘P’).

Attachment B.7 should identify the principal activity and include a brief technical description of each of the other activities specified. **There can only be one principal activity.**

TABLE B.7.1 THIRD AND FOURTH SCHEDULES OF THE WASTE MANAGEMENT ACTS 1996 TO 2003

Waste Management Acts 1996 to 2003			
THIRD SCHEDULE Waste Disposal Activities	Y/N	FOURTH SCHEDULE Waste Recovery Activities	Y/N
1. Deposit on, in or under land (including landfill).	N	1. Solvent reclamation or regeneration.	N
2. Land treatment, including biodegradation of liquid or sludge discards in soils.	N	2. Recycling or reclamation of organic substances which are not used as solvents (including composting and other biological processes).	Y
3. Deep injection of the soil, including injection of pumpable discards into wells, salt domes or naturally occurring repositories.	N	3. Recycling or reclamation of metals and metal compounds.	Y
4. Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons.	Y	4. Recycling or reclamation of other inorganic materials.	Y
5. Specially engineered landfill, including placement into lined discrete cells which are capped and isolated from one another and the environment.	N	5. Regeneration of acids or bases.	N
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 5 or paragraphs 7 to 10 of this Schedule.	N	6. Recovery of components used for pollution abatement.	N
7. Physico-chemical 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 5 or paragraphs 8 to 10 of this Schedule (including evaporation, drying and calcination).	N	7. Recovery of components from catalysts.	N
8. Incineration on land or at sea.	N	8. Oil re-refining or other re-uses of oil.	N
9. Permanent storage, including emplacement of containers in a mine.	N	9. Use of any waste principally as a fuel or other means to generate energy.	Y
10. Release of waste into a water body (including a seabed insertion).	N	10. The treatment of any waste on land with a consequential benefit for an agricultural activity or ecological system.	N
11. Blending or mixture prior to submission to any activity referred to in a preceding paragraph of this Schedule.	Y	11. Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule.	Y
12. Repackaging prior to submission to any activity referred to in a preceding paragraph of this Schedule.	N	12. Exchange of waste for submission to any activity referred to in a preceding paragraph of this Schedule.	N
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.	P	13. Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced.	Y

The Landfill ceased accepting municipal waste in 2004 and is currently undergoing restoration and aftercare works as per the Closure, Restoration & Aftercare Management Plan (CRAMP) Report as submitted to the EPA.

Attachment B.7

Waterford County Council wish to apply to carry out activities under the following classes as per the Third Schedule of the Waste Management Acts 1996 to 2005:

- Class 4. Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons.
- Class 11. Blending or mixture prior to submission to any activity referred to in 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.

Class 4 activities relates to the storage of leachate within the six wetland ponds and associated leachate tanks that are currently being constructed as part of the capping works.

Class 11 activities relate to the mixture of water with the abstracted leachate. This is necessary to dilute the leachate before it is pumped into the wetland system.

Class 13 relates to the storage of waste in the waste transfer station prior to this waste being transferred to either composting facility for recovery or Powerstown Landfill for disposal.

Waterford County Council are applying to carry out activities under the following classes as per the Fourth Schedule of the Waste Management Acts 1996 to 2005:

- **Class 2.** Recycling or reclamation of organic substances which are not used as solvents (including composting and other biological processes).
- **Class 3.** Recycling or reclamation of metals and metal compounds.
- **Class 4.** Recycling or reclamation of other inorganic materials.
- **Class 9.** Use of any waste principally as a fuel or other means to generate energy.
- **Class 11.** Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule.
- **Class 13.** Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced.

Class 2 relates to the composting of green waste that is accepted on site. Green waste is shredded and left to mature on a curing slab for approximately two months. Class 2 also refers to the acceptance of cardboard, newspapers and magazines from the public for recycling.

Class 3 relates to the acceptance of metal waste including aluminum and in cans from the general public. This metal waste is stored on site before being transferred off site for recycling. This class also refers to the acceptance of electronic goods on site.

Class 4 relates to the acceptance of wastes for recycling such as glass, plastics, textiles, batteries etc. for storage on site before being transferred off site for recycling. This class also refers to the acceptance of electronic goods on site.

Class 9 refers to the potential use of landfill gas extracted from the site for utilization.

Class 11 refers to the use of C&D waste such as clay which is accepted at the site. This material is used in the restoration of the main landfill site and for landscaping around the civic amenity as required.

Class 13 refers to the storage of all recyclable materials accepted on site prior to transfer off site for recycling.

TABLE B.7.2 MAXIMUM ANNUAL TONNAGE

The maximum annual tonnage of waste to be handled at the site should be indicated and the year to which the quantity relates indicated.

Maximum Annual Tonnage (tpa)	10,200*
Year	2012 onwards

*See tables H.1 (a), (b) and (c) for breakdown.

B.7.3 FEES

State each class of activity for which a fee is being submitted as per Part I of the Second Schedule of the Waste Management (Licensing) Regulations 2004, S.I. No. 395 of 2004. Note: two fees are required if disposal and recovery are to occur.

Waste Activity	Fee (in €)
Disposal of Waste (appropriate disposal activity 1.4)	€ 6,000
Recovery of Waste (4)	€ 5,000
Total	€ 11,000

TABLE B.7.4 (FOR A LANDFILL APPLICATION)

STATE WHICH OF THE FOLLOWING IS RELEVANT TO THE CURRENT APPLICATION.

(a) landfill for hazardous waste	<input type="checkbox"/>
(b) landfill for non-hazardous waste	<input checked="" type="checkbox"/> *
(c) landfill for inert waste	<input type="checkbox"/>

*Closed and fully capped site. No landfill activities are proposed to take place.

B.8 SEVESO II DIRECTIVE

State whether the activity is for the purposes of an establishment to which the European Communities (Control of Major Accident Hazards involving Dangerous substances) Regulations, 2000 (S.I. No. 476 of 2000), apply.



WASTE Application Form

Regulations Apply	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
--------------------------	------------------------------	--

If yes, **Attachment B.8** should include the relevant details. Supporting information, as well as copies of any Hazardous Operation Studies (HAZOP) carried out for the site, should also be included in the attachment.



SECTION C MANAGEMENT OF THE FACILITY

Advice on completing this section is provided in the *Guidance Note*.

C.1 Technical Competence and Site Management

This information should form **Attachment C 1**.

Details of the applicant’s experience and qualifications, along with that of other relevant employees, should be summarised as shown below. Statements of duties, responsibilities, experience and qualifications should be submitted for each position named below. Additional information, including the management structure and an organisational chart, should be included in **Attachment C 1**.

Attachment C.1

Name	Position	Duties and Responsibilities	Experience /Qualifications
Gabriel Hynes	Senior Engineer	Overall responsibility for the all activities in relation to Dungarvan Landfill and civic amenity centre.	Degree in Civil Engineering
Jimmy Mansfield	Senior Executive Engineer	Engineer in the Environmental Section of Waterford Coco with responsibility for the civic amenity centre and landfill.	Engineer with Waterford Coco for 31 years
Dave Regan	Civic Amenity Manager	Responsible for civic amenity centre and monitoring at the landfill.	Currently taking the FAS Waste Management Course, Diploma in Civil Engineering.
Bill O Keeffe	Caretaker	Caretaker - Day to Day supervision and management of activities on site: operation of weighbridge, collection of tickets and maintenance of on-site records.	Caretaker at the landfill since 1995.

Waterford County Council Management Structure

County Manager

Mr Ray O' Dwyer



Director of Services Environment & Planning

Mr. Denis M^cCarthy



Senior Engineer

Mr. Gabriel Hynes



Senior Executive Engineer

Mr. Jimmy Mansfield



Executive Scientific Officer

Mr. Paul Carroll

Executive Engineer

Mr. David Campion



Civic Amenity Manager

Mr. Dave Regan



Caretaker

Mr. Bill O Keeffe



3 – Site Operatives

C.2 Environmental Management System

Attachment C 2 should contain the Environmental Management System (EMS) details required.

Attachment C.2

An EMS was submitted to the Agency in accordance with previous Waste Licence Review.

C.3 Hours of Operation

Attachment C 3 should contain details of hours of operation for the waste facility, civic waste facilities and other facilities.

- (a) Proposed hours of operation.
- (b) Proposed hours of waste acceptance/handling.
- (c) Proposed hours of any construction and development works at the facility and timeframes (required for landfill facilities).
- (d) Any other relevant hours of operation expected.

Attachment C.3

Hours of Operation

The facility operates from 8.30am to 6.00pm Monday to Friday and 8.30am to 14.00 on Saturday.

Hours of Waste Acceptance

The facility accepts waste from the 9.00am to 5.00pm Monday to Friday and 9.00am to 1.00pm on Saturday.

C.4 Conditioning Plan

Address as **Attachment C 4**, in the case of a LANDFILL Application, and only for the review of a Landfill Waste Licence.

Attachment C.4 Conditioning Plan

A conditioning plan was included in the original waste license application in 1998. Below is an outline of the ongoing and proposed works that will further improve the environmental performance of the site.

The site is fully capped and now progresses to a non-clean closure status as defined in the Agency's ELRA, Residuals Management and Financial Provision Guidance Document. The landfill side slopes and a small area of the flat surface will be grassed thus improving the surface stability and visual impact. Grass is a suitable crop for landfill restoration as it is tolerant of poor soil conditions, provides all year round soil cover and promotes the development of soil structure. Suitable grass seeds will be based upon the type of grass in the surrounding area. Suitable grass seeds for poor soil conditions that would be experienced in landfill restoration conditions would include ryegrasses, meadow fescues, timothy and clover. Choice

of grass seeds also depends on consultation with the Agency Manual on Restoration and Aftercare.

The key objectives for the facility are:

- To develop the Integrated Constructed Wetlands and return the landfill body to its natural environment with a view to create a local amenity area in accordance with the Closure, Restoration and Aftercare Management Plan (CRAMP) submitted to the Agency in accordance with Waste Licence W0032-02.
- Abstract and treat the leachate currently stored within the landfill body by means of the Integrated Constructed Wetlands.
- Reduce the amount of leachate generated from the waste body by completing the engineered capping system as detailed in Waste Licence W32-02 by preventing the ingress of moisture.
- Control the gas that is generated within the landfill body by extracting and flaring it via the gas flare.
- Install, commission and operated a gas flare at the site.
- Divert the waste water from the compost facility, green waste reception area and the waste transfer station to the leachate treatment system.
- Improve the general operation and management of the civic amenity area, the compost facility and the transfer station.

A copy of the Conditioning Plan submitted is included in Appendix E.

Leachate Treatment

It is intended to develop a series of Integrated Constructed Wetlands (ICW) at the site to treat the leachate and provide a public local amenity area. When the ICW's are commissioned, the leachate will be passed through the ponds to break down the leachate concentrations. Once the leachate has met the requirements stipulated in the waste licence, the treated leachate will discharge into the River Colligan. While the primary objective of the constructed wetlands is for leachate treatment, the development and conservation of wildlife habitats is compatible as an afteruse. The layout, structure and composition of the wetlands will be entirely compatible with the surrounding ecology and will greatly increase the restored landfill's visual and wildlife amenity. Wetlands are important as habitats for invertebrates, marginal and aquatic vegetation, amphibians, fish and a range of breeding and wintering wildfowl as an area for nesting and feeding. The restored site will play an important role as a wildlife corridor in the area.

The treatment process is described in the steps below.

1. Leachate is extracted from the 9 combined wells and pumped to the leachate-balancing tank (Tank 1).
2. Once a certain level has been reached in Tank 1, inflow is stopped and the concentration of the leachate (from the 9 different wells) is analysed to determine the concentration of NH_4 . The maximum concentration of the diluted leachate to enter the wetland cells is 100mg/l NH_4 .
3. Based on the concentration analysis of the leachate in Tank 1, if required, the feed source pump will pump water from the Colligan River to dilute the

leachate sample to the required NH₄ concentration in the Dilution Tank (Tank 2). If the sample shows that the concentration is less than 100mg/l NH₄; the leachate can be pumped directly to wetland pond 1 from Tank 1, otherwise it will be pumped to Tank 2 for dilution.

4. Further analysis is undertaken in Tank 2 to ensure that the required dilution has been achieved. If this has been achieved then the diluted leachate will be pumped to wetland pond 1.
5. The diluted leachate flows sequentially through each of the six ponds.
6. Flow from the last wetland pond will discharge to a treated leachate tank. The concentration of the treated effluent is continuously monitored to determine the concentration of NH₄.
7. If the treated effluent achieves the discharge limit values, it can be discharged to the river Colligan. If the sample is above the discharge limit values the sample is redirected to the balancing tank or wetland pond 1.
8. The treated effluent may also be used to dilute the leachate abstracted prior to pumping to wetland pond 1.
9. There is to be a shut off level in Tank 3 which when reached will shut off the abstraction pumps and the gate valve on the inlet to the tank, until this level drops again. The treated leachate is allowed to continue to drain from the ponds and a freeboard will be created to accommodate this.

A full description of the treatment process is contained in the document “Response to EPA Request for Information on Leachate Treatment” contained in Appendix A.

Gas Management

The capping system referred to in **Attachment A.1.1** contains a gas collection layer. This material prevents gas generated from the landfill body being emitted to the atmosphere. A series of gas wellheads strategically placed around the landfill will collect the generated gas. This gas will then be extracted through a series of HDPE pipes which will then transport the gas to the flare unit.

Surface Water Management

A series of carrier drains has been installed 1m above the anchor trench around the landfill itself. These collect all surface water from the slopes of the landfill. The surface water will be carried via the carrier drains to a discharge point where the surface water will pass through an interceptor which will remove the silt prior to discharge. The surface water from the compost facility, the transfer station and the green waste acceptance area will be diverted into the leachate treatment system while the surface water from the civic amenity area is passed through an interceptor prior to discharge into the River Colligan.

General

As the landfill body itself is now in its restoration and aftercare period, the civic amenity area, the compost facility and the transfer station are the only sources of waste acceptances at the facility. Over time the leachate levels and gas emissions will reduce within the landfill but despite this, monitoring and control of emissions will continue to be implemented within the facility.

SECTION D INFRASTRUCTURE & OPERATION

D.1 Infrastructure

Complete the following table detailing the site infrastructure. **Attachment D 1** should contain the appropriate documentation. Information provided should follow the sequence, and use the headings, established in Table D.1. Additional advice on completing this section is provided in the application *Guidance Note*.

Table D.1. Infrastructure		y/n	Comments
D.1.a	Site security arrangements including gates and fencing	Y	See Attachment D1
D.1.b	Designs for site roads	Y	See Attachment D1
D.1.c	Design of hardstanding areas	Y	See Attachment D1
D.1.d	Plant	Y	See Attachment D1
D.1.e	Wheel-wash	N	Not Applicable
D.1.f	Laboratory facilities	N	Not Applicable
D.1.g	Design and location of fuel storage areas	N	Not Applicable
D.1.h	Waste quarantine areas	N	Not Applicable
D.1.i	Waste inspection areas	Y	See Attachment D1
D.1.j	Traffic control	Y	See Attachment D1
D.1.k	Sewerage and surface water drainage infrastructure	Y	See Attachment D1
D.1.l	All other services	Y	See Attachment D1
D.1.n	Plant sheds, garages and equipment compound	Y	See Attachment D1
D.1.n	Site accommodation	Y	See Attachment D1
D.1.o	A fire control system, including water supply	Y	See Attachment D1
D.1.p	Civic amenity facilities	Y	See Attachment D1
D.1.q	Any other waste recovery infrastructure	N	Not Applicable
D.1.r	Composting infrastructure	Y	See Attachment D1
D.1.s	Construction and Demolition waste infrastructure	N	Not Applicable
D.1.t	Incineration infrastructure (if applicable). Provide information to fulfil Article 4 (2) & (3) of the Incineration of Waste Directive	N	Not Applicable
D.1.u	Any other infrastructure	N	Not Applicable

Attachment D.1**D.1.a Site Security arrangements including gates and fencing**

The site is accessible from the public road to the eastern end of the site. The entrance is guarded by a gate which is locked during closing hours. The civic amenity area which is located at the eastern end (i.e. at the site entrance – see DG0502) is secured with a palisade fencing while the landfill contains chainlink and stockproof fencing.

Although security fencing does not surround the whole of the site, the River Colligan provides a natural divide on the north face and the south side of the site is protected by a natural hedgerow, separating it from the adjacent farmland. It is not possible to secure the whole of the site as a public *right of way* exists for fishermen through the landfill. Therefore, two small pedestrian entrances must remain open at the extreme west of the site and also adjacent to the main site gate.

A security alarm is installed in the site office. Investigations were undertaken in the past to ascertain the identity of persons fly tipping outside the site entrance and this operation proved very successful.

D.1.b Design of Site Roads

The site is situated off a third class road to the south of the A72 and approximately 1 km off the R672. The entrance into the facility is 7m wide which opens directly onto the civic amenity area. The access road to the administration building is bituminous and is incorporated into the hardstanding area of the civic amenity area. Access roads to the landfill area for aftercare maintenance will be hardcore only and will be unbound.

D.1.c Design of Hardstanding Areas

The majority of the hardstanding area around the civic amenity area consists of a bituminous pavement. The pavement at the compost facility and at the skips consists of a reinforced concrete pavement. Concrete footpaths also exist around the Administration Building and a concrete hardstanding area exists which is primarily used for washing down site plant and equipment.

D.1.d Plant

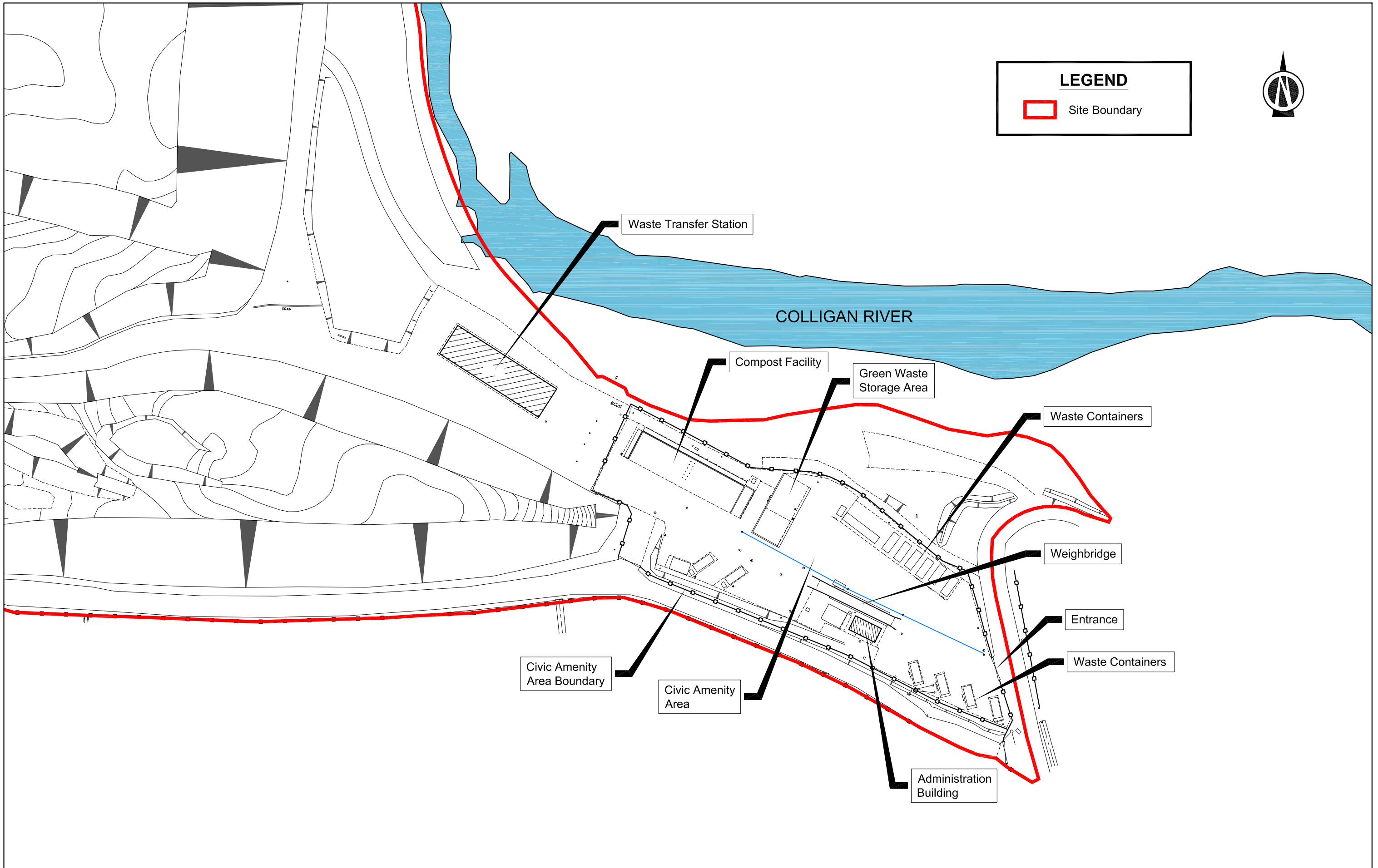
A weighbridge exists at the administration building. This is used for waste activities relating to the waste transfer station.

D.1.e Wheelwash

Not Applicable.

D.1.f Laboratory Facilities

There are no laboratory facilities on site. The EPA monitor the surface water both upstream and downstream of the landfill at least 5 times a year. These results are analysed at the EPA Regional Inspectorate Laboratories located in Kilkenny.



LEGEND

Site Boundary



Waste Transfer Station

COLLIGAN RIVER

Compost Facility

Green Waste Storage Area

Waste Containers

Weighbridge

Entrance

Waste Containers

Civic Amenity Area Boundary

Civic Amenity Area

Administration Building

NOTES

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2. All Levels refer to Ordnance Survey Datum, Malin Head.
3. DO NOT SCALE, use figured dimensions only, if in doubt ask.

No.	Date	By	App	Amendment / Issue
F01	Dec '08	RH, EB	EB	Final Issue
A01	Aug '08	RH, BOK	PM	Issue for Approval

Client



WATERFORD COUNTY COUNCIL
Comhairle Chiontae Phort Láirge
Civic Offices, Dungarvan, Co. Waterford
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Drawn By: RH
Checked By: BOK
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Date: April 2008

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Project: **DUNGARVAN LANDFILL WASTE LICENCE APPLICATION**

Drawing Status: Final
Scale / Sheet Size: NTS @ A1
1:2000 @ A3

Drawing Number: **MDR0350/DG0502**
Rev: **F01**

Title: **LAYOUT OF CIVIC AMENITY AREA**



WASTE Application Form

Laboratory facilities are available for use by Waterford Co. Council in Kilmeadan (located approximately 23 miles away) if required in the future.

D.1.g Design and location of fuel storage areas

There are no fuel storage areas on site.

D.1.h Waste Quarantine Areas

Not Applicable.

D.1.i Waste Inspection Area

All incoming material into the civic amenity area is inspected by staff prior to acceptance.

D.1.j Traffic Control

DG0502 shows the layout of the Civic Amenity Area. The drawing shows the layout of the containers and indicates ample space for site visitors to park while unloading. Patrons are instructed where to park after inspection of waste. The layout of the containers allows sufficient space for vehicles to deliver or collect waste with ease.

D.1.k Sewerage and surface water drainage infrastructure

The surface water run-off from the landfill side slopes will be collected by the surface water carrier drains at the bottom of the slopes and discharged into the River Colligan (see DG0504). All drainage infrastructure is regularly checked to ensure effective surface water flows are being maintained.

All surface water from the civic amenity area is collected via a series of gullies grills and pipes. This run off is diverted to an existing oil interceptor prior to discharge to the River Colligan. Surface water from the composting area, waste transfer station and the green waste reception area will be collected and diverted to the on site leachate treatment system.

There is a toilet and small domestic sized septic tank. The toilet is located in the site office. The septic tank is located near the Civic Amenity area. An underground drain connects the washing area/toilet with the septic tank. A surface water drain runs across the hard standing area and into an underground drain which discharges eventually into the River Colligan.

The volume of foul water discharge is estimated to be in the order of 225l/d. The liquid effluent which leaves the septic tank would only have a BOD value of approximately 240mg/l, this would decrease further on leaving the septic tank and passing through the soils and groundwater/surface water. This discharge would have a minimal impact on the surrounding environment.

D.1.l All other services

All other appropriate services include the following:

- Water Supply
- Power
- Telecommunications

D.1.m Plant, sheds, garages and equipment compound

A number of small sheds exist on site to house various items such as the shredded wood chips from the shredder.

D.1.n Site accommodation

A site office exists in the civic amenity area as shown on drawing DG0502. A full time operator is present during the opening hours of the civic amenity area to supervise the type of material being accepted from the public.

D.1.o A fire control system, including water supply

The civic amenity area is connected to a public water supply system and also has a hydrant for the fire services to connect to if necessary. The site office also contains a fire extinguisher in the event of an emergency.

D.1.p Civic Amenity Facilities

Despite the closure of the Landfill, a civic amenity area is still in operation in accordance with Waste Licence 32-2 and accepts standard household waste for recycling including:

- Glass
- Paper & Cardboard
- Newspapers/magazines
- Plastics
- Garden Waste
- Construction & Demolition waste
- Wood
- Waste cooking oils
- Batteries
- Oil Filters
- Waste paint
- Mixed residual waste
- Bulky waste (furniture, mattresses etc.)
- WEEE
- Mixed dry recyclables including tetra-pak
- Textiles
- Scrap metal
- Aluminium & tin cans

The facility also incorporates a compost facility that was initially licensed to accept 1,000 tonnes of biodegradable and green waste with the provision to increase tonnages thereafter upon the agreement of the Agency.

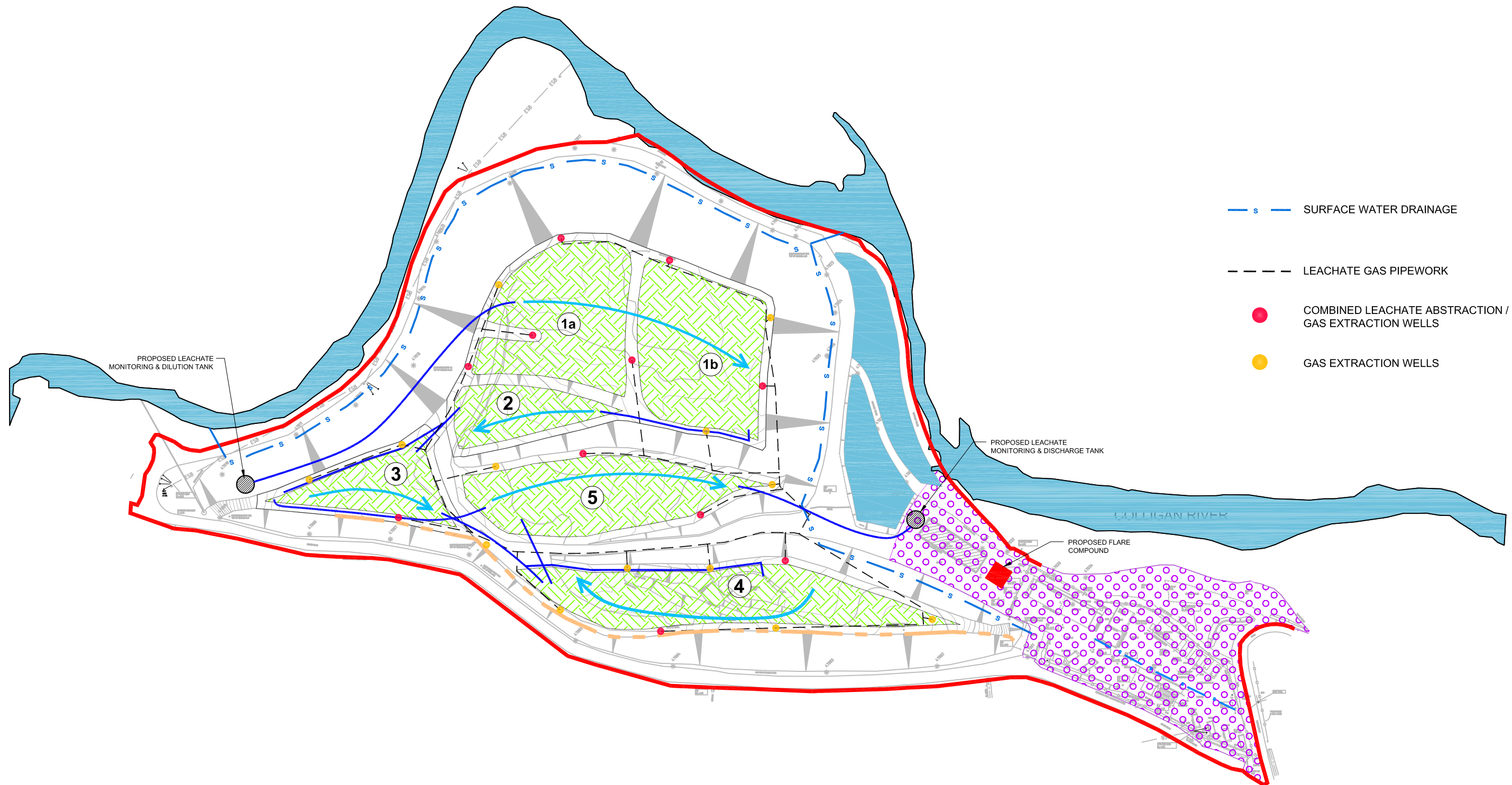
The waste is transferred to either composting facilities or Powerstown Landfill in County Carlow.

D.1.q Any other waste recovery infrastructure

LEGEND



- s — SURFACE WATER DRAINAGE
- - - - LEACHATE GAS PIPEWORK
- COMBINED LEACHATE ABSTRACTION / GAS EXTRACTION WELLS
- GAS EXTRACTION WELLS



NOTES

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 WATERFORD COUNTY COUNCIL Comhairle Chiontae Phort Láirge Civic Offices, Dungarvan, Co. Waterford Phone: 058 22000 Fax: 058 42911			
Drawn By	Checked By	Approved By	Date
RH	BOK	MS	April 2008

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Project	
DUNGARVAN LANDFILL WASTE LICENCE APPLICATION	
Drawing Status	Scale / Sheet Size
Final	1:1000 @ A1 1:2000 @ A3

Drawing Number	Rev
MDR0350/DG0504	F01
Title	
INTEGRATED CONSTRUCTED WETLAND SYSTEM	

A waste transfer station exists between the civic amenity area and the landfill (see drawing DG0502). The building itself is an open faced, steel framed construction supporting steel roof trusses and plastic coated cladding panels. The waste is unloaded within the building itself, reducing noise, odour and dust impacts on the external environment, and is re-loaded for removal within 48 hours also within the transfer station building thus mitigating odour nuisances. The waste is transferred to Powerstown Landfill in County Carlow.

D.1.r Composting facility

A composting facility exists on site beside the civic amenity area. The facility consists of;

- An open sided shed of dimensions 8mx8m with an adjacent concrete slab for the holding of raw materials.
- Temporary wood shredder is brought in once a month to shred the green waste raw materials for composting;
- Auger waste blender/integral bin lifter;
- 2 ^{No.} enclosed in-vessel units for 14 day maturation (not in use as the facility only accepts green waste for composting hence odour is not an issue);
- Curing bunkers of dimensions 10mx35m with aeration slots and associated biofilter;

It is proposed to divert surface water run off from this area to the leachate treatment system (i.e. the Integrated Constructed Wetlands), prior to discharge to the River Colligan.

D.1.s Construction and Demolition waste infrastructure

Small volumes of construction and demolition waste are accepted from the general public at the site. Currently construction waste in the form of subsoil is accepted at the site. This is to facilitate the completion of the capping works as early as possible. Once work on the final capping is complete it is not intended to accept construction and demolition waste from professional building or engineering firms.

D.1.t Incineration Infrastructure

Not applicable

D.1.u Any other infrastructure

Not applicable

D.2 Facility Operation

In **Attachment D 2** describe the plant, methods, processes and operations of the waste facility, as required by the *Guidance Note*.

Attachment included	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
----------------------------	---	-----------------------------	---

Attachment D.2

Unit Operations

Drawing DG0502 shows the layout of the waste acceptance areas. The main activity is the temporary storage of waste prior to transfer to another facility for recycling/recovery, processing or disposal. The main types of waste accepted are household waste. The full range of materials accepted is;

- Recyclable Plastics
- Cardboard
- Paper
- Scrap Metal
- Inert Construction & Demolition Waste
- Scrap Wood – processed in wood shredding facility on site
- Biodegradable/green waste

Unit operations descriptions and flow diagrams

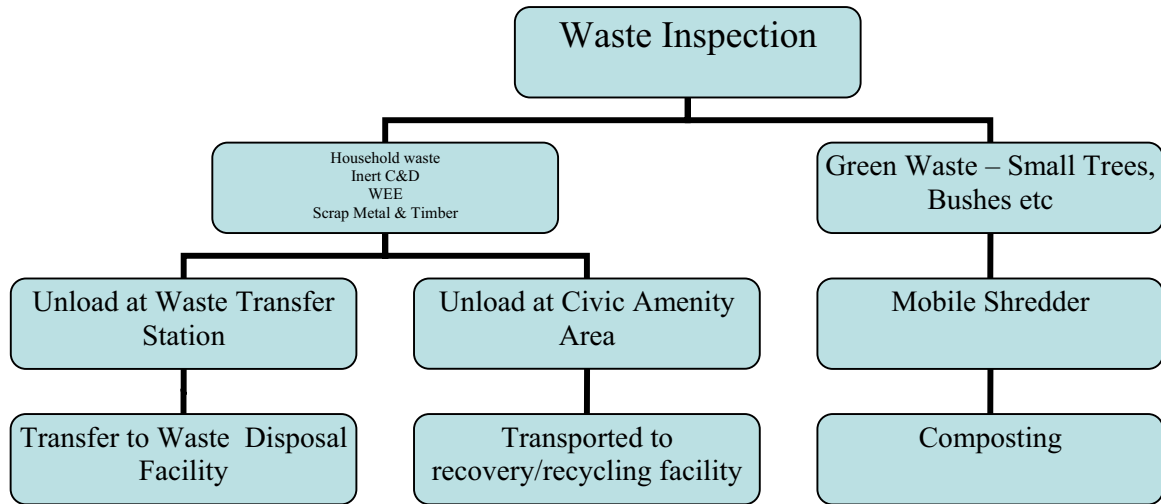
1) Waste Acceptance

The civic amenity area accepts various waste materials in labelled containers as shown in drawing DG0502. When each container is full, it is sent to another recovery facility nearby (also owned by the Applicant) for further processing or recovery and is replaced by an empty container.

A mobile shredder is brought onto site once a month to shred any green waste (small trees, bushes etc.) that is brought onto site. This material is then transferred to the composting facility. At the composting are the shredded material is placed on the curing slab for maturation. The material spends approximately two months on the maturation slab and is turned every two week. Whilst on the slab the material is kept under negative air pressure which aids in the decomposition of the green waste and also prevents odours from escaping into the atmosphere. Air is pulled through the green waste and this air is then passed through a biofilter. The biofilter strips the air of odours before it is released into the atmosphere.

The biofilter is made up of various layers of compost and mulch retained within a 2m high structure built with large concrete blocks.

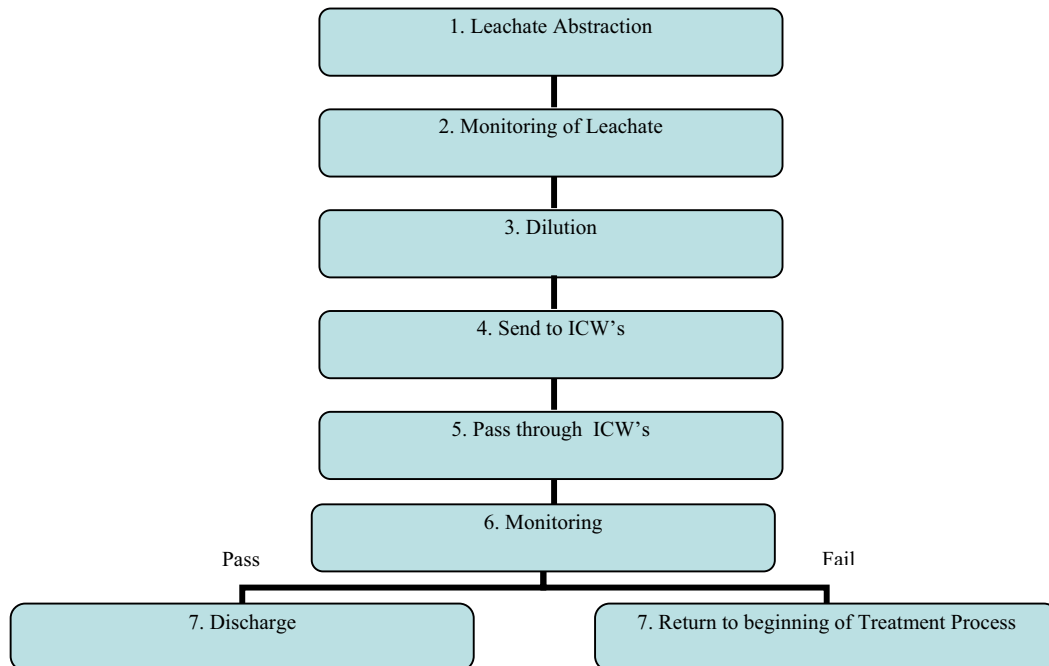
WASTE Application Form



2) Leachate Treatment

It is proposed to install a leachate treatment system at the site. The treatment system consists of a series of 6 wetland ponds, planted with a variety of emergent plant species. Leachate is abstracted from the site, monitored, diluted before being pumped into the wetland ponds. The leachate flows through the ponds where the plants ‘clean’ the leachate. Once the treated leachate exits the wetland system it is monitored again and is either discharged or sent back into the system depending on the results of the monitoring.

A full description of this treatment system is contained in the document entitled “Response to EPA Request for Information on Leachate Treatment” which accompanies this waste license review application, in Appendix A.



LANDFILLS

The following Sections D3 to D7 should only be completed for Landfill Applications. Reference should be made to the Agency landfill manual ‘Landfill Site Design (2000)’ when completing this section.

D.3 Liner System

Complete the following table regarding the liner system to be used for the landfill/landfill extension and detail the information requested as **Attachment D.3. Items D3c to D3g should only be completed for immediate projects only (i.e. Years 1 & 2)**. A schedule of Liner construction activities for the medium to long term need only be listed in item D3a below, since Condition 3 of any licences granted will provide reporting requirements for any future projects.

TABLE D.3 LINER SYSTEM

		y/n	Comments
D.3.a	Provide information to fulfil Annex 1 of the Landfill Directive		Not applicable
D.3.b	What type of liner system is specified?		Not applicable
D.3.c	Has a Quality Control Plan been specified?		Not applicable
D.3.d	Has a Quality Assurance Plan been specified?		Not applicable
D.3.e	Have independent, third-party supervision, testing and controls been specified?		Not applicable
D.3.f	Have basal gradients for all cells and access ramps to the cells been designed?		Not applicable
D.3.g	Has a leak detection survey been specified?		Not applicable

D.4 Leachate Management

Complete the following table detailing leachate management arrangements. Further information should be included in **Attachment D.4**.

TABLE D.4.1 LEACHATE MANAGEMENT ARRANGEMENTS

		y/n	Comments
D.4.a	Is there a Leachate Management Plan?	Y	See Attachment
D.4.b	Have annual quantities of leachate been calculated?	N	See Attachment
D.4.c	Has the total quantity of leachate been calculated?	Y	See Attachment
D.4.d	Have the size of the cells been specified taking account of the water balance calculations?	N	Not Applicable
D.4.e	Has a leachate collection system been specified?	Y	See Attachment
D.4.f	Has a leachate storage system been specified?	Y	See Attachment
D.4.g	Has a system for monitoring the level of leachate in the waste been designed?	Y	See Attachment
D.4.h	Is leachate recirculation proposed/practised?	N	Not Applicable
D.4.i	Has leachate treatment on-site been specified?	Y	See Attachment
D.4.j	Has leachate removal been specified?	N	Not Applicable

Attachment D.4 Leachate Management Plan

A leachate management plan has been submitted in conjunction with the Waste License Application. It is entitled “Response to EPA Request for Information on Leachate Treatment” and is contained within Appendix A of this document. This document contains the information required above, more specifically on the abstraction, storage, treatment and monitoring of leachate at the site.

D 5 Landfill Gas Management

All landfill sites should have suitable arrangements for the management of landfill gas. **Attachment D.5** should contain the appropriate documentation. Information provided should follow the sequence, and use the headings, established in Table D.5. ***Items D5g to D5m should only be completed for immediate or current gas collection projects only (i.e. Years 1 & 2).*** A schedule of gas management aspects for the medium to long term need only be listed in item D5f below, since Condition 3 of any proposed decision/licence will provide reporting requirements for any future projects.

Table D.5. Landfill Gas Management

		y/n	Comments
D.5a	Is there a Landfill Gas Management Plan? Provide estimates of the volumes of landfill gas which will be produced by the waste disposed of in the site for the next 20 years, and compare to the EPER list for methane:	Y	See Attachment
D.5b	Is there a passive venting system?	N	Not Applicable
D.5c	Does the passive system cover all of the filled area?	N	Not Applicable
D.5d	Have gas alarm systems been installed in the site buildings?	Y	See Attachment
D.5e	Have measures been installed to prevent landfill gas migration (e.g. barriers)?	Y	See Attachment
D.5f	Has a time-scale been proposed for the installation of landfill gas infrastructure?	Y	See Attachment
D.5g	Is gas flaring undertaken at the site?	N	See Attachment
D.5h	Is there an active (i.e., pumped) landfill gas extraction system?	N	See Attachment
D.5i	Does the active system cover all of the filled area?	Y	See Attachment
D.5j	Is landfill gas used to generate energy at the site?	N	Not Applicable
D.5k	Have emissions from the flarestack and utilisation plant been assessed for source, composition, quantity and level and rate?	N	See Attachment
D.5l	Has a maintenance programme for the control system been specified?	Y	See Attachment
D.5m	Has a condensate removal system been designed?	Y	See Attachment

Attachment D.5 Landfill Gas Management

D.5.a Landfill Gas Management Plan

Background

As part of the remediation works for the landfill, 23 gas extraction wells (including 9 combined gas/leachate extraction wells) were installed in the capping system. It is intended that these abstraction wells will be connected to a gas flare. A contract has been awarded for the supply, installation and commissioning of a gas flare. Once the flare has been installed gas abstraction and flaring will commence.

Flare Capacity

A computer model (GasSim) was used to model the landfill gas generation in the landfill. The model indicated that a flare of capacity of 500m³/hr would be required to flare the gas generated. Despite the results generated from this model the contractor responsible for installing the flare system is required to validate the computer model by carrying out a pumping trial, by flaring gas via a temporary flare and determining the gas production at the site. The contractor is required to maintain and operate the temporary flare during while the permanent flare is being fabricated.

Flare Specification

The flare will be designed to burn landfill gas, with methane content of between 20% and 65%, continuously. The flare system will be designed to operate with automatic temperature control and shall operate between 1000°C and 1200°C.

The emissions from the flare shall comply with the emissions criteria set out in the German TA-Luft 1986 Standard and the standards imposed by the EPA in WL0032-02 and any subsequent licence. This is an indicative performance standard that is required to meet the emission standard. Alternative performance standards may be deemed more appropriate if compliance with the emission standards is suitably demonstrated. The flare shall be equipped with all the necessary instrumentation, telemetry and ports necessary to enable the monitoring of emissions and processes, to be in compliance with the Waste Licence WL0032-2. The emission limits in the existing Waste Licence are as follows:

Parameter	Flare(enclosed) Emission Limit Value Note 1,2
Nitrogen oxides (NO X)	150 mg/m ³
CO	50 mg/m ³
Total Volatile Compounds (VOC's)	50 mg/m ³
Total non-Methane VOC's	5 mg/m ³

Note 1: Dry gas referenced to 5% oxygen by volume for utilisation plants and 3% oxygen by volume for flares.

Note 2: These emission limit values may be revised with the agreement of the Environmental Agency on the basis of the technology employed.

Monitoring Requirements

The following parameters will be monitored in accordance with Waste Licence W0032-02.

Parameter Inlet	Flare(enclosed) Monitoring Frequency	Analysis Method ^{Note 1} / Technique ^{Note 2}
Methane (CH ₄) %v/v	Continuous	Infrared analyser or equivalent approved
Carbon Dioxide (CO ₂) %v/v	Continuous	Infrared analyser or equivalent approved
Oxygen (O ₂) %v/v	Continuous	Electrochemical or equivalent approved
Total Sulphur	Annually	Ion chromatography
Total Chlorine	Annually	Ion chromatography
Total Fluorine	Annually	Ion Selective Electrode
Process Parameters		
Combustion Temperature	Continuous	Temperature Probe/datalogger
Residence Time	Quarterly	To be agreed
Outlet		
CO	Continuous	Flue gas analyser/datalogger or equivalent approved
NO _x	Annually	Flue gas analyser or equivalent approved
SO ₂	Annually	Flue gas analyser or equivalent approved
TOC	Annually	Flame ionisation
Hydrochloric acid	Annually	Impinger/ Ion Chromatography
Hydrogen fluoride	Annually	Impinger/ Ion Chromatography

The analytical system shall contain a datalogger capable of providing a digital readout that will be capable of retaining six months continuous monitoring data. The datalogger will be able to record the inlet analysis as well as the continuous CO, methane, carbon dioxide and oxygen monitoring on the outlet for later download.

Commissioning and Maintenance

The contractor is required to enter a 5 year maintenance contract for the flare unit and is required to have a set of specified spare parts for the flare unit on site in the event of an emergency breakdown. The flare unit will also have a 5 year warranty as part of the contract. A comprehensive maintenance program has been specified at the tender stage.

The contractor also has an obligation to train members of the Waterford County Council site staff to manage the system and control the levels of gas intake into the flare.

D.5.d Have gas alarm systems been installed in the site buildings?

A gas alarm has been installed in the administration building at the facility. The alarm monitors carbon dioxide (CO₂) and methane (CH₄).

D.5.e Have measures been installed to prevent landfill gas migration (e.g. barriers)?

A capping system is currently being put in place to prevent gas migration. The make up of the capping system has been designed in accordance with the EPA Landfill Site Design Manual and details are given in **Attachment D.6 below**.

D.5.f Timescale for installation of landfill gas infrastructure

The gas flare and associated infrastructure are due to be installed and commissioned by early 2009.

D.5.g Is gas flaring undertaken at the site?

Gas flaring is not currently being carried out on site, however this will be undertaken once the gas flare is commissioned.

D.5.h Active landfill gas extraction system

An active gas extraction will be in place by early 2009 once the flare is commissioned. The gas extraction wells have been bored and the pipework will be complete by end 2008 with gas flare being commissioned early 2009. Details of this extraction system is given in **Attachment D.5.a** above.

D.5.i Does Active System cover all of the filled area?

Yes the active system does cover all of the landfill area. All wellheads have been strategically positioned to extract the optimum quantity of gas from the waste body.

D.5.k Have emissions from the flarestack and utilisation plant been assessed for source, composition, quantity and level and rate?

No the emissions from the flarestack and utilisation plant have not been assessed for source, composition, quantity and level and rate because it is not yet in place. When the system is in place, emissions from the flarestack will be assessed.

D.5.1 Maintenance programme for the control system

As part of the Contract for the supply and installation of the flare, the supplier is obliged to enter into a 5 year maintenance contract which includes maintenance of the control system

D.5.m Condensate removal system

A series of knock out pots will be in place before the gas enters the flare unit itself. The knock out pots will collect any condensate in the gas extraction system which in turn will be pumped into the leachate management system for treatment.

D.6 Capping System

Complete the following table detailing the design of the capping system. **Attachment D.6** should contain the appropriate documentation. **Items D6e to D6k should be completed for immediate projects only (ie Years 1 & 2).** Condition 10 of any proposed decision/licence will provide reporting requirements for capping requirements beyond this timeframe.

Table D.6 Capping System

		y/n	Comments
D.6a	Has the daily cover been specified?	N	Not applicable
D.6b	Has the intermediate cover been specified?	N	Not applicable
D.6c	Has the temporary capping been specified?	N	Not applicable
D.6d	Has the Capping System been designed and does it meet the requirements of the Landfill Directive Annex 1 (3.3)?	Y	See Attachment
D.6e	Does the Capping System include a flexible membrane liner?	Y	See Attachment
D.6f	Have all capping materials been specified?	Y	See Attachment
D.6g	Has a Method Statement for construction been produced?	Y	See Attachment
D.6h	Has a Quality Control Plan been produced?	Y	See Attachment
D.6i	Has a Quality Assurance Plan been produced?	Y	See Attachment
D.6j	Has a programme for monitoring landfill stability been developed?	Y	See Attachment
D.6k	Has a programme for monitoring landfill settlement been developed?	N	See Attachment

Attachment D.6.d

The final capping layer on the landfill has been designed in accordance with the requirements set in the Landfill Directive Annex 1 (3.3) and Waste Licence W0032-02. Capping of the landfill was complete in mid 2008.

Attachment D.6e

The capping of the landfill contains a 1mm thick smooth LLDPE Liner, except on the steeper slopes where the LLDPE is double-sided textured. The geomembrane is composed of linear low density polyethylene sheet manufactured by flat die extrusion from polyethylene resin produced in a low pressure ethylene polymerisation process according to DIN 16 776, Parts 1 and 2. The LLDPE resin and the final LLDPE product will be as specified by the **Geosynthetic Research Institute Test Method GM17 (GRI Test Method GM17)**.

The sheet is made from a resin with a minimum density of 0.915 g/cc (prior to addition of carbon black). The manufacture of the sheets is carried out by an extrusion process using pure linear low density polyethylene entirely free from plasticisers or other filler materials and containing a minimum of 2% of carbon black for stabilisation against weathering influences.

Attachment D.6f

All capping materials were specified at the tendering process of the capping contract. The materials were specified to meet the design requirements set in the Landfill Directive Annex 1 (3.3).

Attachment D.6g

A method statement was produced by each Contractor at the tendering stage of the capping contract. The Contract was awarded to the Contractor based on a set of Criteria set out at the tendering stage whereby points or weightings were awarded to each contractor based on the adequacy of a number of factors, one of which was the adequacy of the method statement submitted.

Attachment D.6h

Regular on site testing of capping material took place during the lining period of the capping construction. Independent material testers were appointed to carry out tests on each geomembrane as well as regular tests on the various welds performed on the lining.

Attachment D.6i

A construction quality assurance (CQA) validation has been carried out in accordance with condition 3.12.3 of Waste Licence W0032-02 for all Specified Engineering Works. A CQA report is available for submission to the Agency on request in accordance with Condition 3.12.3 of W0032-02.

Attachment D.6j

A programme for monitoring landfill stability has been developed and is set out in the Closure, Restoration and Aftercare Management Plan (CRAMP) that was produced in accordance with Waste Licence W0032-02.



WASTE Application Form

Attachment D.6k

As of 2004 waste has no longer been accepted at the landfill. Since that time extensive re-grading and re-profiling works have been undertaken as part of the capping of the site. It is not envisaged that any further significant settlement will take place. It is requested that the Agency consider reducing the requirement to carry out an annual topographical survey.

SECTION E EMISSIONS

Give particulars of the source, location, nature, composition, quantity, level and rate of emissions arising from the activity and, where relevant, the period or periods during which such emissions are made or are to be made.

The applicant should address in particular any emission point where the substances listed in the Schedule of S.I. 394 of 2004 are emitted.

E.1 Emissions to Atmosphere

Details of all point emissions to atmosphere should be supplied. Table E.1.(i) (for Landfill Gas Flare emissions) must be completed for all landfills with a flare. Complete Table E.1(ii) and E.1(iii) for all other main emission points, including stack sources (incinerator stacks, landfill gas utilisation plants, air handling unit emissions etc.). Complete Table E.1(iv) for minor/fugitive/ground emission points.

Attachment E.1 Emissions to Atmosphere

Apart from the proposed landfill gas flare due to be installed in early 2009 and the leachate discharge to the river, which will commence once permission from the Agency is received, there are no point emissions to atmosphere associated with activities at the facility. All loading and unloading of waste associated with the transfer station takes place within the building itself. Results from dust monitoring undertaken in 2006 show that dust deposition rates are considerably lower than the 350mg/m³/day specified in Waste Licence W32-02. Monitoring was undertaken at five locations around the site and dust deposition rates range from 17–34 mg/m²/day.

In addition generation of dust is mitigated by:

- The restriction of waste activities to within the main building
- Regularly cleaning all hardstanding areas within the facility with road-sweeping equipment.
- Water-spraying of hardstanding areas in periods of dry weather.

There is potential for odour generation associated with temporary storage of putrescible / biodegradable waste. This material is mainly contained within the main waste building and this waste stream is removed off-site within 48 hours of arrival.

E.2 Emissions to Surface Waters

Attachment E.2 Tables E.2(i) and E.2(ii) should be completed where relevant.

Attachment E.2 Emissions to Surface Waters

The surface water system in the civic amenity area consists of a series of gullies, grills and pipes. Surface water from the civic amenity area is collected through the gullies and passes through the oil interceptor prior to discharge into the River Colligan. Surface water collected from the green waste acceptance area and the compost facility will be connected to the leachate treatment system for the landfill. The surface water run-off from the landfill side slopes will be collected by the

surface water carrier drains at the bottom of the slopes and discharged into the River Colligan. All drainage infrastructure is and will be regularly checked to ensure effective surface water flows are being maintained.

The assimilative capacity of the Colligan River has been calculated. These calculations are included in the accompanying document entitled “Response to EPA Request for Information on Leachate Treatment”. This document contains specific details on the proposed leachate treatment system for the site including an assessment of the impacts on the Colligan River.

E.3 Emissions to Sewer

Attachment E.3 Tables E.3(i) and E.3(ii) should be completed, where relevant.

Attachment E.3 Emissions to Sewer

There are no emissions to a sewer

E.4 Emissions to Groundwater

Describe the existing or proposed arrangements necessary to give effect to Articles 3,4,5,6, and 7 of Council Directive 80/68/EEC of 17 December 1979 on the protection of groundwater against pollution by certain dangerous substances.

Table E.4(i) should be completed, as relevant, for each source.

Supporting information should form **Attachment E.4**

Attachment E.4 Emissions to Groundwater

The landfill is an unlined landfill, thus there exists the potential for leachate to infiltrate groundwater. However, a thick layer of low permeability clay exists beneath the landfill body. This reduces the potential for leachate to infiltrate the groundwater. In addition, a capping system has recently being constructed at the site. This will prevent any significant rainfall infiltration into the landfill body thus further minimising leachate generation.

As part of the capping system a leachate abstraction system is also being installed. This abstraction system will ensure that the leachate reservoir that exists within the landfill body is continuously being reduced.

The combination of the layer of low permeability clay, the capping system and the leachate abstraction system will ensure that potential leachate infiltration into the groundwater is minimised.

E.5 Noise Emissions

Give particulars of the source, location, nature, level, and the period or periods during which the noise emissions are made or are to be made.

Table E.5(i) should be completed, as relevant, for each source.

Supporting information should form **Attachment E.5**



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Attachment E.5 Noise Emissions

Potential noise emissions at the site are:

- The mobile shredder which comes to the site once a month to shred green waste.
- Vehicles bringing waste to and from the waste transfer station.
- The collection of full containers from the Civic Amenity Area.
- Construction vehicles involved in the capping of the landfill.

As the landfill has ceased accepting waste the level of traffic movement both in and around the site has reduced considerably. As vehicle movement was one of the primary sources of noise at the site it is predicted that once the capping works are complete noise emissions at the facility will not be an issue. Noise monitoring conducted at the site in 2007 demonstrated that the noise emission limits of 55 dB Leq(30) daytime, and 45 dB Leq(30) night-time were not breached.

E.6 Environmental Nuisances

Attachment E.6 should contain the appropriate documentation. Information provided should follow the sequence, and use the headings as relevant established in Table D.6. Additional advice on completing this section is provided in the *Guidance Note*.

TABLE E.6 ENVIRONMENTAL NUISANCES

Bird Control	Control method specified	yes <input type="checkbox"/>	no <input checked="" type="checkbox"/>	not applicable <input type="checkbox"/>
	Attachment included	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
Dust Control	Control method specified	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
	Attachment included	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
Fire Control	Control method specified	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
	Attachment included	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
Litter Control	Control method specified	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
	Attachment included	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
Traffic Control	Control method specified	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
	Attachment included	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
Vermin Control	Control method specified	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
	Attachment included	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
Road Cleansing	Control method specified	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
	Attachment included	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>

Attachment E.6 Environmental Nuisances

Bird Control

All waste going to the transfer station is unloaded within the building itself and remains on site for a maximum of 48 hours. As a result of this, any waste associated with the transfer station is not available to birds. As the compost facility accepts green waste only there is no food source associated with it. Good housekeeping practises ensure that the facility is clean and tidy at all times thus mitigating the possibility of bird nuisance.

Dust Control

The potential main dust source at the site is vehicle movement due to construction work which is currently ongoing. However, this work is due for completion in early 2009 and so will not be an issue from then onwards. Haul roads are sprayed as necessary as part of the works.

Once construction works are completed the main source of dust at the facility is associated with waste being loaded and unloaded in the waste transfer station. These activities take place within the waste transfer station which contains an air handling unit. The unit consists of three overhead pipes connected to three extractor fans which vent any air to the outside at the rear of the building approximately 3m above ground level. The effects of dust relating to waste transfer activities are therefore mitigated against.

Another potential source of dust is the hard standing area around the civic amenity area, the compost facility and the transfer station. These surfaces are regularly cleaned with road-sweeping equipment and sprayed with water during dry periods, thus minimising potential dust problems.

Fire Control

All reasonable measures are employed at the site to prevent the outbreak of fire. Fire extinguishers are kept in the weighbridge and a strict ban on smoking around the landfill area is also enforced.

Emergency procedures in the event of a fire breaking out on site are detailed in *Attachment J*.

Litter Control

It is management policy that all vehicles transporting waste to/from the facility are covered. The loading and unloading of waste associated with the transfer station takes place within the building itself thus reducing the possibility of windblown litter. All containers within the civic amenity area are covered thus reducing the possibility of loose rubbish escaping from the containers.

The site is also regularly inspected and litter picking is carried out as required.

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Traffic Control

The facility is approximately 2km north west of Dungarvan, off the N25 road on the Southern Bank of the Colligan River. Traffic generated by the facility is not significant in terms of the overall traffic on the adjacent road

Vermin Control

All waste is stored within the transfer station itself for a maximum of 48 hours, before being removed from site, thus reducing the potential for vermin nuisance.

Litter control measures also ensure that the site is kept clean.

A pest control company set poison on the site every 6-8 weeks year round. There are no other rat control substances kept on site.

Road Cleansing

The hard standing area surrounding the civic amenity area, the compost facility and the waste transfer station are regularly cleaned with a roadsweeper and power-washer. Roads leading to the facility are regularly inspected and if necessary are also cleaned.

SECTION F CONTROL & MONITORING

F.1: Treatment, Abatement and Control Systems

Describe the proposed technology and other techniques for preventing or, where this is not possible, reducing emissions from the installation/facility. Details of treatment/abatement systems (air and effluent emissions) should be included, together with appropriately scaled schematics ($\leq A3$) as appropriate.

For each Emission Point identified complete Table F.1 of the Annex, and include detailed descriptions and appropriately scaled schematics ($\leq A3$) of all abatement systems.

Attachment F.1 should contain any supporting information.

Attachment F.1 Treatment, Abatement and Control Systems

To Atmosphere

The main emission point to the atmosphere at the facility is the air handling unit in the transfer station. The air handling unit extracts air from the transfer station and vents it to the rear of the building approximately 3m above ground level. This mitigates the odour and dust within the building itself. As waste is not permitted to remain within the building for over 48 hours the waste is not allowed to degrade hence odour problems are not a significant issue.

The management of the site including waste handling activities serve as successful abatement techniques. The inspection and monitoring of incoming waste to the civic amenity area control the types of waste coming into the facility. The litter control procedures such as the covering of containers in the civic amenity area and the regular road sweeping of hard standing areas control the level of litter and dust escaping into the atmosphere.

To Surface Water/Sewer/Ground (water)

The surface water drainage from the side slopes of the landfill will run-off towards the surface water carrier drain, which has recently been constructed as part of the capping works. The carrier drain will then discharge into the River Colligan.

All waste water collected from the compost facility and waste transfer station will be connected to the leachate treatment system in the landfill. Surface water from the civic amenity area is collected via a series of gullies and channels and is passed through an oil interceptor prior to discharge into the River Colligan. The oil interceptor is regularly cleaned to ensure maximum efficiency.

F.2 - F. 9. Monitoring and Sampling Points

Programmes for environmental monitoring should be submitted as part of the application. These programmes should be provided as **Attachments F.2 to F.6** and

meet the advice published by the Agency in the relevant BAT Note. For Landfills the additional **Attachments F.7 to F.8** should be completed. Furthermore for a landfill application the applicant must refer to the Agency *Landfill Monitoring Manual (2003)* for further details on monitoring requirements for proposed facilities.

Include details of monitoring/sampling locations and methods.

F.2 Air

- to include Dust, Odour

Monitoring Arrangements specified	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
Monitoring points identified, (plus 12-figure grid references)	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
Attachment included	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>

Attachment F.2

Dust

Dust will be monitored quarterly, twice during the period May to September. The Standard Method VD12119 is used. The Dust monitoring locations are specified in DG0505.

Daily and weekly site inspections will be carried out to check for evidence of excessive generation of airborne dust especially during dry weather.

Dust can arise from:

- Loading/Unloading of waste at the working area.
- Traffic on internal roads and access road.
- During high wind on dry areas and areas without grass or plants.

As loading/unloading of the bulk of waste at the working area takes place within the transfer station itself, the impact of dust on the surrounding environment is greatly reduced. Because the landfilled has ceased accepting waste, traffic on internal roads has reduced significantly. The use of a water bowser on dry days mitigates the level of dust rising within the facility. The seeding of the landfill body itself also will reduce the movement of small particles and dust from the final capping system.

Odour

If it is required an odour management plan will be implemented. Odours will be monitored frequently if odour problems are observed. As waste is no longer accepted for disposal at the site and only green waste is accepted for the compost facility it is not envisaged that odour will be a major issue at the site. In addition to

this all compost at the site is kept under negative air pressure and the air is passed through a biofilter prior to being emitted to the atmosphere.

The monitoring programme for dust and odour at the compost facility is outlined in the following table:

Parameter	Monitoring Location	Monitoring Frequency	Analytical Method
Dust	B1-B4, D1	Quarterly	VDI 2119
Odour	B1-B4,D1	Daily	Inspection at monitoring point and recording in odour report log

F.3 Surface Water

Monitoring of surface water shall be carried out at not less than two points, one upstream from the waste facility and one downstream.

Monitoring Arrangements specified	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
Monitoring points identified, (plus 12-figure grid references)	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
Attachment included	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>

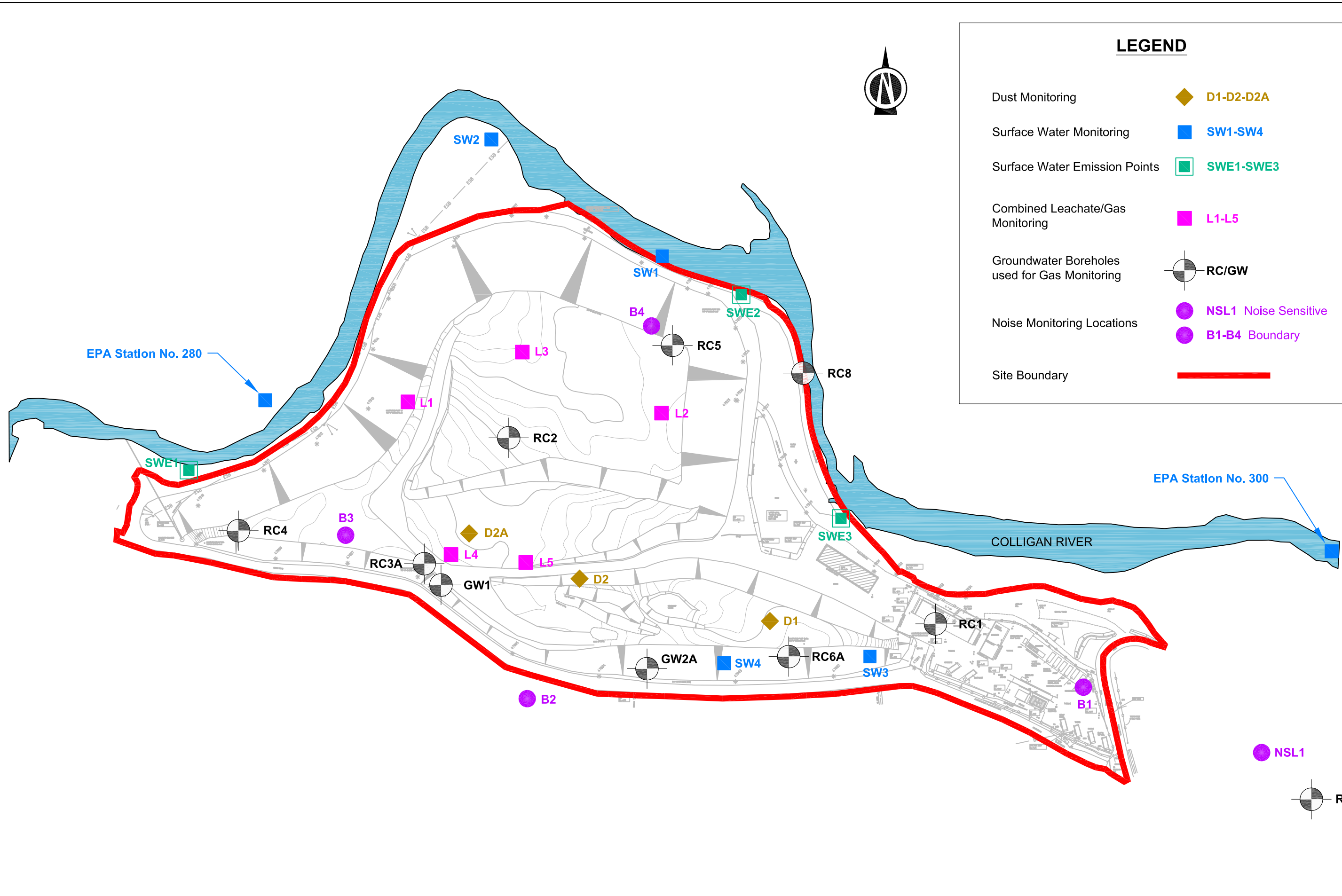
Attachment F.3

Monitoring is currently being undertaken as per Waste License 032-02. It is proposed that this monitoring regime be continued. The proposed surface water monitoring programme to be implemented as set out in Waste Licence W0032-02 is illustrated in the table below:





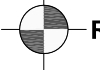


Parameter	Monitoring Location	Monitoring Frequency	Analytical Method
Biochemical Oxygen Demand	SW1, SW2, EPA280, EPA 300	Monthly	Standard Method
Oils, Fats & Greases/Mineral Oils	SW1, SW2, EPA280, EPA 300	Monthly	Standard Method
Suspended Solids	SW1, SW2, EPA280, EPA 300	Monthly	Standard Method
Toxicity	SW1, SW2, EPA280, EPA 300	As may be required	To be agreed with Agency
Visual Inspection	SW1, SW2, EPA280, EPA 300	Weekly	Sample & examine for colour and odour

F.4 Sewer Discharge

There is no discharge to sewer at the site.



LEGEND

Dust Monitoring		D1-D2-D2A
Surface Water Monitoring		SW1-SW4
Surface Water Emission Points		SWE1-SWE3
Combined Leachate/Gas Monitoring		L1-L5
Groundwater Boreholes used for Gas Monitoring		RC/GW
Noise Monitoring Locations		NSL1 Noise Sensitive B1-B4 Boundary
Site Boundary		

NOTES

1. This drawing is the property of RPS. It is a confidential document and must not be copied, used, or its content divulged without prior written consent.
2. All Levels refer to Ordnance Survey Datum, Malin Head.
3. DO NOT SCALE, use figured dimensions only, if in doubt ask.

No.	Date	By	App	Amendment / Issue
F01	Dec '08	RH EB	EB	Final Issue
D01	Apr. 08	RH BOK	MS	Draft Issue

Client

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Project: **DUNGARVAN LANDFILL WASTE LICENCE APPLICATION**

Drawing Status: Final
 Scale / Sheet Size: 1:1000 @ A1, 1:2000 @ A3

Drawing Number: **MDR0350/DG0505**
 Rev: **F01**

Title: **MONITORING LOCATIONS**

Monitoring Arrangements specified	yes <input type="checkbox"/>	no <input type="checkbox"/>	not applicable <input checked="" type="checkbox"/>
Monitoring points identified, (plus 12-figure grid references)	yes <input type="checkbox"/>	no <input type="checkbox"/>	not applicable <input checked="" type="checkbox"/>
Attachment included	yes <input type="checkbox"/>	no <input type="checkbox"/>	not applicable <input checked="" type="checkbox"/>

F.5 Groundwater

Groundwater monitoring is required at all landfill facilities; and certain other waste facilities depending on waste activities and the underlying aquifer vulnerability.

Monitoring Arrangements specified	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
Monitoring points identified, (plus 12-figure grid references)	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
Attachment included	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>

Attachment F.5 Groundwater

Groundwater monitoring takes place on a quarterly basis at locations shown on DG0505 in accordance with Waste Licence W32-02. Recent monitoring has shown elevated levels of ammonia, iron and manganese. Because of the landfills proximity to the River Colligan, which is known to be tidal, it is perceived that the tidal influence has an effect on these results. Also, many complex reactions, which occur naturally in ground formations can give rise to more soluble forms of iron, which will therefore be present in water passing through such formations.

The proposed groundwater monitoring regime is outlined in the table below. Monitoring will be carried out at the following locations: GW1, GW2A, RC3A, RC4, RC6A, RC7 and RC8.

Parameter	Groundwater Monitoring Frequency
Visual inspection / odour	Quarterly
Groundwater level	Monthly
Ammoniacal Nitrogen	Quarterly
Chloride	Quarterly
Dissolved Oxygen	Annually
Electrical Conductivity	Quarterly
pH	Quarterly
Temperature	Quarterly
Cadmium	Annually
Chromium (Total)	Annually
Copper	Annually
Cyanide (Total)	Annually
Iron	Quarterly
Lead	Annually
List I/II organic substances	Annually
Magnesium	Annually
Manganese	Annually
Mercury	Annually
Nickel	Annually

Potassium Sulphate	Annually
Total Alkalinity	Annually
Total Phosphorous / orthophosphate	Annually / Quarterly
Total Oxidised Nitrogen	Annually
Zinc	Annually
Phenols	

F.6 Noise

Monitoring Arrangements specified	yes <input type="checkbox"/>	no <input checked="" type="checkbox"/>	not applicable <input type="checkbox"/>
Monitoring points identified, (plus 12-figure grid references)	yes <input type="checkbox"/>	no <input checked="" type="checkbox"/>	not applicable <input type="checkbox"/>
Attachment included	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>

Attachment F.6 Noise

The only possible noise issue arising within the facility are the use of the mobile shredder which is brought on site once every month. Because it is not running every day it does not appear to be a nuisance. The fact that the landfill body itself has actually ceased accepting waste has greatly reduced the level of traffic on site and on the surrounding roads.

It is not proposed to carry out any noise monitoring at the site.

F.7 Meteorological Data

Monitoring Arrangements specified	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
Monitoring points identified, (plus 12-figure grid references)	yes <input type="checkbox"/>	no <input checked="" type="checkbox"/>	not applicable <input type="checkbox"/>
Attachment included	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>

Attachment F.7 Meteorological Data

All meteorological data at present is acquired from the Irish Meteorological Services Station at Roches Point and Dungarvan. As per Waste License 032-02 it is proposed that the following meteorological data be obtained:

- Precipitation volume
- Temperature (min/max)
- Wind Speed
- Wind Direction
- Atmospheric Pressure

A weather station is not proposed for the site due to the end-of-operation of the landfill.

Application for Landfills require the additional Attachments F.7 to F.8, to be completed:

F.8 Leachate

Monitoring Arrangements specified	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
Monitoring points identified, (plus 12-figure grid references)	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
Attachment included	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>

Attachment F.8 Leachate

It is proposed to maintain the leachate monitoring in the landfill facility as per Waste Licence W0032-02 until the Agency sees fit to reduce or cease monitoring. Waste Licence W0032-02 stipulates the following leachate monitoring programme:

PARAMETER	MONITORING FREQUENCY
Visual Inspection/Odour	Daily
Leachate Level	Weekly
BOD	Quarterly
COD	Quarterly
Chloride	Annually
Ammoniacal Nitrogen	Annually
Electrical Conductivity	Annually
pH	Annually
Metals/non metals	Annually
Cyanide (Total)	Annually
Fluoride	Annually
List I/II organic substances	Annually
Mercury	Annually
Sulphate	Annually
Total P/orthophosphate	Annually
Total Oxidised Nitrogen	Annually

In addition to the above monitoring of the leachate abstracted from the landfill as part of the proposed leachate treatment works at the site will also be carried out. This will include monitoring of the treated leachate for pH, suspended solids, Total P, BOD and Total Ammonia. This is addressed in the document entitled “Response to EPA Request for Information on Leachate Treatment”.

F.9 Landfill Gas

Complete each of the following tables to show whether information has been included on aspects of landfill gas monitoring. **Attachment F.9** should also contain information to show whether the data given in Tables F.9.(a) and F.9.(b) below represents actual or anticipated data. Complete Table F.9 as follows:

Attachment F.9 Landfill Gas

The following tables contain the same parameters set down in Waste Licence W0032-02. The Applicant intends to comply with these once the gas flare is in place at the site. The installation of the flare is due to occur in the first quarter of 2009.

Table F.9 (a) Landfill Gas Monitoring for existing landfill gas flares / utilisation plants

Parameter	Concentration (mg/Nm ³)	Proposed Frequency of Analysis	Info Included Y/N	Method of Analysis	Info Included Y/N
Inlet (flare – enclosed)					
Methane (CH ₄) % v/v	Not known at this stage.	Continuous	N	Infrared analyser or equivalent approved.	N
Carbon dioxide (CO ₂) %v/v	Not known at this stage.	Continuous	N	Infrared analyser or equivalent approved.	N
Oxygen (O ₂) % v/v	Not known at this stage.	Continuous	N	Electrochemical or equivalent approved.	N
Outlet (flare – enclosed)					
Volumetric Flow Rate	Not known at this stage.	Continuous	N	Not known at this stage.	N
SO ₂	Not known at this stage.	Biannually	N	Flue gas analyser or equivalent approved.	N
Nox	150mg/m ³	Biannually	N	Flue gas analyser or equivalent approved.	N
CO	50mg/m ³	Continuous	N	Flue gas analyser/ datalogger or equivalent approved.	N
Particulates	Not applicable	Not applicable	N	Not applicable	N
TA Luft Class I, II, III organics	Class I = 20mg/m ³ , Class II = 100 mg/m ³ , Class III = 150 mg/m ³		N		N
Hydrochloric acid	Not known at this stage.		N		N
Hydrogen Fluoride	Not known at this stage.		N		N

Table F.9(b) Landfill Gas Monitoring

Parameter	Proposed Frequency of Analysis		Information Included Y/N	Method of Analysis	Information Included Y/N
	Gas boreholes / vents/ wells/ perimeter locations	Facility Office			
Methane (CH₄) % v/v	As required to balance gas field	Continuous	N	InfraRed Analyser/FID or other method agreed	N
Carbon Dioxide (CO₂) % v/v	As required to balance gas field	Continuous	N	InfraRed or other method agreed	N
Oxygen (O₂) % v/v	As required to balance gas field	Continuous	N	Electrochemical Cell or other method agreed	N
Atmospheric Pressure	As required to balance gas field	Not proposed	N	Standard Method or other method agreed	N
Temperature	As required to balance gas field	Not proposed	N	Standard Method or other method agreed	N

Table F.9 (c) Landfill Gas Infrastructure

Equipment	Monitoring Frequency	Information Included Y/N	Monitoring Action	Information Included Y/N
Gas Collection System	As described above.	Above	Above	Above
Gas Control System	As described above.	Above	Above	Above

STANDARD FORM - TABLE E.1(i) LANDFILL GAS FLARE EMISSIONS TO ATMOSPHERE

Emission Point:

Emission Point Ref. N ^o :	Gas Flare
Location :	Within entrance area of site
Grid Ref. (12 digit, 6E,6N):	224,588E; 094,605N
Vent Details Diameter: Height above Ground(m):	Discharge height - minimum 5m; maximum 9m.
Date of commencement of emission:	Predicted to be 1 st quarter 2009.



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Characteristics of Emission :

CO	<50 mg/m ³		
Total organic carbon (TOC)	N/A		
NO _x	<150 mg/Nm ³ 0°C. 3% O ₂ (Liquid or Gas), 6% O ₂ (Solid Fuel)		
Maximum volume of emission	Predicted to be 500m ³ /hr		
Temperature	Operation temp of 1,200 °C(max)	Operation temp of 1,000 °C (min)	Between 1,000 and 1,200 °C(avg)

- (i) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up/shutdown to be included*):

Periods of Emission (avg)	56* min/hr 22* hr/day 340* day/yr
	*Assuming 7% down time.

Monitoring Arrangements specified	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
Monitoring points identified, (plus 12-figure grid references)	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
Attachment included	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>

TABLE E.1(iv): EMISSIONS TO ATMOSPHERE - Minor /Fugitive

Emission point Reference Numbers	Description	Emission details ¹				Abatement system employed
		material	mg/Nm ³⁽²⁾	kg/h.	kg/year	
A2 – 1	Dust emissions from Waste Transfer Area	Dust	Not Applicable			All Loading/Unloading of waste is limited to inside main building. All hardstanding areas on site are cleaned regularly especially in dry windy conditions
A2 – 2	Odour from Waste Transfer Station	Odour	Not Applicable			Storage of Waste is limited to inside main Building. Maximum standing time for all incoming waste is 48 hours

- 1 The maximum emission should be stated for each material emitted, the concentration should be based on the maximum 30 minute mean.
- 2 Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0°C/101.3kPa). Wet/dry should be clearly stated. Include reference oxygen conditions for combustion sources.

SECTION G RESOURCES USE & ENERGY EFFICIENCY

G.1 Raw Materials, Substances, Preparations and Energy

Attachment G.1 should contain a list of all raw, product and ancillary materials, substances, preparations, fuels and energy which will be utilised in or produced by the activity. Information on any insecticides, herbicides or rat poisons etc. should also be provided with their respective data and safety sheets. The Standard Forms, provided in Annex 1, should be used in the description of these materials, substances, etc., where relevant. Additional advice on completing this section is provided in the *Guidance Note*.

Attachment included	yes <input checked="" type="checkbox"/> no <input type="checkbox"/> not applicable <input type="checkbox"/>
----------------------------	---

Attachment G.1 Raw Materials, Substances, Preparations and Energy

Substances used on the site are as follows:

Domestic Cleaning Agent (Jeyes Fluid)	500ml per annum
Fly Killer (Kapchem Dimethoate)	10 litres per annum
Rat Poison (Not kept on site)	Used all year round

The rat poison is set by a Pest Control company every 6 weeks throughout the year.

Fly spray is used throughout the year.

Other materials used on site relate to machine maintenance e.g., grease and oil.

Fuel Usage at the site is approximately 150 litres per day. Fuel is not stored on site but is brought in by a local fuel merchant who refills the machinery on site as required.

G.2 Energy Efficiency

A description of the energy used in or generated by the activity must be provided in **Attachment G.2**.

Attachment included	yes <input checked="" type="checkbox"/> no <input type="checkbox"/> not applicable <input type="checkbox"/>
----------------------------	---

Attachment G.2 Energy Efficiency

Estimated annual energy consumption is 14,200(kWh). The primary electricity demands at the facility are from the office and the transfer station.

SECTION H MATERIALS HANDLING

H.1 Waste Types and Quantities – Existing & Proposed

Provide an estimation of the quantity of waste likely to be handled in relation to each class of activity applied for. This information should be included in Table H.1(a).

TABLE H.1(A). QUANTITIES OF WASTE IN RELATION TO EACH CLASS OF ACTIVITY APPLIED FOR

Waste Management Act 3rd Schedule (Disposal) Activities			Waste Management Act 4th Schedule (Recovery) Activities		
Class of Activity Applied For		Quantity (tpa)	Class of Activity Applied For		Quantity (tpa)
Class 1			Class 1		
Class 2			Class 2		1,120
Class 3			Class 3		50
Class 4			Class 4		88
Class 5			Class 5		
Class 6			Class 6		
Class 7			Class 7		
Class 8			Class 8		
Class 9			Class 9		
Class 10			Class 10		
Class 11			Class 11		100
Class 12			Class 12		
Class 13		10,000	Class 13		1,450

In Table H. 1 (B) provide the annual amount of waste handled/to be handled at the facility. Additional information should be included in **Attachment H.1**. The tonnage per annum should be given of that expected for the life of the licence, with at least the next five years tonnages provided. For Landfill Review applications provide an estimate of the quantity of waste already deposited in (i) lined cells; (ii) unlined cells.

TABLE H.1(B) ANNUAL QUANTITIES AND NATURE OF WASTE

Year	Non-hazardous waste (tonnes per annum)	Hazardous waste (tonnes per annum)	Total annual quantity of waste (tonnes per annum)
2008	6,000	60*	6,060
2009	6,500	100*	6,600
2010	8,000	150*	8,150
2011	9,000	150*	9,150
2012	10,000	200*	10,200

*Hazardous waste accepted as per Waste Licence W0032-02 Condition 8.4

A detailed inventory of the types and quantities of wastes currently handled at the site and proposed to be handled should be submitted as Table H.1 (C).

TABLE H.1 (C) WASTE TYPES AND QUANTITIES

WASTE TYPE	TONNES PER ANNUM (existing)	TONNES PER ANNUM (proposed)	TOTAL (over life of site**) tonnes
Household	5,227	10,000	200,000
Commercial			
Sewage Sludge			
Construction and Demolition	252	252	5,040
Industrial Non-Hazardous Sludges			
Industrial Non-Hazardous Solids			
Hazardous *(Specify detail in Table H 1.2)	60	400	8,000
Inert Waste imported for restoration purposes	48,990	20,000	20,000*

* Restoration of landfill due to be completed in 2009

** Based on a 20-year life span, however it is anticipated that the facility will operate over an open-ended time span

*** TABLE H.1.2 HAZARDOUS WASTE TYPES AND QUANTITIES**

HAZARDOUS WASTE	DETAILED DESCRIPTION * REFERENCE SHOULD BE MADE TO THE RELEVANT EUROPEAN WASTE CATALOGUE CODES AS PRESENTED BY COMMISSION DECISION 2000/532/EC	Tonnes Per Annum (Existing)	(Tonnes Per Annum Proposed)
Waste Oil	20 01 25*	0.98	1.5
Oil filters	15 02 03*	0.4	0.8
Asbestos	Not Applicable		
Paint and Ink	20 01 28*	1.14	1.7
Batteries	20 01 33*	3.6	4
Fluorescent Light Bulbs	20 01 21*	0.62	0.75
Contaminated Soils			
OTHER HAZARDOUS WASTE (APPLICANT TO SPECIFY)			
Aerosols	20 01 23*	0.11	0.15
Fridges	20 01 23*	31.5	100
Other Electrical Equipment	20 01 35*	21.2	290

TABLE H.1(i): WASTE - Hazardous Waste Recovery/Disposal

Waste material	EWC Code	Main source ¹	Quantity		On-site Recovery/Disposal (Method & Location)	Off-site Recovery, reuse or recycling (Method, Location & Undertaker)	Off-site Disposal (Method, Location & Undertaker)
			Tonnes / month	m ³ / month			
Flourescent Lamps	20 01 21	Civic Amenity Area	0.05			Irish Lamp Recycling, Athy, Co. Kildare. ENVA Ireland Ltd. Portlaoise, Co. Laois.	
Aerosols	20 01 23	Civic Amenity Area	0.009				
Cooking Oil	20 01 25	Civic Amenity Area	0.08				
Paint	20 01 28	Civic Amenity Area	0.095				
Car Filters	15 02 03	Civic Amenity Area	0.033				
Batteries	20 01 33	Civic Amenity Area	0.3				

¹ A reference should be made to the main activity / process for each waste.

TABLE H.1(ii) WASTE - Other Waste Recovery/Disposal

Waste material	EWC Code	Main source ¹	Quantity		On-site recovery/disposal ² (Method & Location)	Off-site Recovery, reuse or recycling (Method, Location & Undertaker)	Off-site Disposal (Method, Location & Undertaker)
			Tonnes / month	m ³ / month			
Mixed Household	20 03 01	Waste Transfer Station	404.42				Disposed at Powerstown Landfill Co. Carlow.
Dry Recyclables	15 01 06	Civic Amenity Area	8.64			Removal to Recovery Facility owned by the Applicant nearby in Dungarvan.	
Textiles	20 01 11	Civic Amenity Area	0.32				
Rubble	17 01 07	Waste Transfer Station	7.41		Used in site restoration, upkeep.		
Garden Waste	20 02 01	Civic Amenity Area	2.69		Treated in on-site compost facility.		
Timber	15 01 03	Civic Amenity Area	9.65			Mr. Binman, Kilmallock, Co. Limerick.	
Scrap Metal	17 04 07	Civic Amenity Area	3.98				
Fridges	20 01 23	Civic Amenity Area	2.63			KMK, Tullamore, Co. Offaly.	
TV's & Monitors	20 03 01	Civic Amenity Area	1.76				
Glass	20 01 02	Civic Amenity Area	0.39			Rehab Recycling, Ballyfermot, Dublin 10.	

1 A reference should be made to the main activity/ process for each waste.

2 The method of disposal or recovery should be clearly described and referenced to Attachment H.1

It should be noted that an applicant may be issued with a licence which restricts the type of wastes which may be deposited.

H.2 Waste Acceptance Procedures

Procedures for checking waste loads as they arrive at the facility must be included. These should follow the requirements of the Agency's Waste Acceptance Manual. A copy of these procedures and other associated documentation should be included as **Attachment H.2.**

Attachment H.2 Waste Acceptance Procedures

The civic amenity area accepts waste from the public only – it does not accept any commercial waste. Types and quantities are inspected by site personnel prior to disposal and if acceptable, the individual is directed to the correct location for disposing/unloading the material.

The compost facility accepts green waste only i.e. small trees, bushes, branches etc. it does not accept any other biodegradable waste (e.g. food).

Waste accepted at the waste transfer station is first weighed at the weighbridge before being unloaded within the transfer station. Within 48 hours the waste is loaded into a trailer within the station before being transferred to either a composting facility or to Powerstown Landfill, Co. Carlow. All vehicles transporting waste into and out of the site must be covered.

H.3 Waste Handling

Waste handling and the operating procedures used at the facility including waste treatment processes should be described in **Attachment H.3.** Included in the attachment should be information on the plant used on site and on the methods and processes for handling waste on-site. Special requirements hold for contaminated soil facilities, see *Guidance Note*.

Attachment H.3 Waste Handling

As the landfill has ceased accepting waste and is undergoing measures as part of the Closure, Restoration and Aftercare Management Plan submitted to the EPA in accordance with Waste Licence W0032-02, the bulk of the waste handling in the facility takes place within the Waste Transfer Station.

As mentioned in Attachment D.1.q, the waste is unloaded within the building itself, reducing noise, odour and dust impacts on the external environment, and is re-loaded for removal within 48 hours also within the transfer station building thus mitigating odour nuisances. The waste itself is sent to a composting plant for recovery or to Powerstown Landfill, County Carlow for disposal.

Green waste accepted at the site is shredded once a month or sooner if required. Once it is shredded it is transferred to the curing slab where it stays for approximately 2 months. While it is on the curing slab it is turned every couple of weeks. Through

means of a fan and a venting system incorporated within the slab the green waste is kept under negative air pressure to encourage decomposition of the waste. The fan pulls air through the waste and exhausts this air through the biofilter. The biofilter “cleans” the air thus minimising potential odour issues.

In addition, an application for a Landfill requires Section H.3.a to be completed:

H.3a Waste Handling at the Landfill Facility

State whether all waste will be subject to treatment prior to landfilling. Provide information as to the quantities of biodegradable municipal waste and how the targets of the Landfill Directive (1999/31/EC) relating to that waste type are to be achieved. In particular describe how the following will be achieved:

- (a) a reduction by 16/07/06 to 75% by weight of the total amount of biodegradable municipal waste produced in 1995 or the latest year before 1995 for which standardised Eurostat data is available;
- (b) a reduction by 16/07/09 to 50% by weight of the total amount of biodegradable municipal waste produced in 1995 or the latest year before 1995 for which standardised Eurostat data is available;
- (c) a reduction by 16/07/16 to 35% by weight of the total amount of biodegradable municipal waste produced in 1995 or the latest year before 1995 for which standardised Eurostat data is available;
- (d) Evidence should be provided to show that energy will be used efficiently.

Attachment H.3.a Waste Handling at the Landfill Facility

As the landfill no longer accepts waste for end disposal, this section is not applicable.

H.4 Waste Arisings

Waste Arisings should be considered for all contaminated soil applications. Details of all waste materials generated on the site including, name, description and nature as well as the source(s) should be identified. The quantities of each type of waste generated on an annual/monthly basis should be calculated and stated in Tables H.1(i) and H. 1(ii) of the application form. Applicants should also provide conversion factors used to relate volume (m³) and tonnage (t) for their waste stream.

Attachment H.4 Waste Arisings

Not Applicable.



SECTION I EXISTING ENVIRONMENT & IMPACT OF THE FACILITY

Detailed information is required to enable the Agency to assess the existing environment. This section requires the provision of information on the ambient environmental conditions at the site prior to the commencement of waste management activities or prior to the receipt of a review application.

Where development is proposed to be carried out, being development which is of a class for the time being specified under Article 24 (First Schedule) of the Environmental Impact Assessment Regulations, the information on the state of the existing environment should be addressed in the EIS. **In such cases, it will suffice for the purposes of this section to provide adequate cross-references to the relevant sections in the EIS.**

I.1. Assessment of atmospheric emissions

Describe the existing environment in terms of air quality with particular reference to ambient air quality standards.

Provide a statement whether or not emissions of main polluting substances (as defined in the Schedule of S.I. 394 of 2004) to the atmosphere are likely to impair the environment.

Give summary details and an assessment of the impacts of any existing or proposed emissions on the environment, including environmental media other than those into which the emissions are to be made.

Attachment I.1 should also contain full details of any dispersion modelling of atmospheric emissions from the activity, where required.

Attachment I.1 Assessment of Atmospheric Emissions

The principal activity in the immediate vicinity of the landfill is farming with a number of dairy herds and a sow unit in the lands surrounding the site. There are approximately 24 houses within 500m of the landfill although not all of these are in view of the landfill. The main views into the site from the public domain are from a number of individual properties to the west and from the farm on the Cappoquin road to the north.

Although the local residents have lived with the landfill for a number of years there have been complaints in the past over the general operation of the site particularly in relation to the tannery waste which has been historically disposed of at the site and also in relation to nuisances arising from birds and odours.

Due to the closure of the landfill, nuisances relating to odour, dust and noise have greatly depleted. As the civic amenity area, waste transfer station and compost facility are already in full operation, it is not envisaged that there will be an increase in emissions to the atmosphere in terms of odour and dust. Dust Deposition rates have been proved (from monitoring) to be less than the limit of 350mg/m³/day set out in Waste Licence W32-02.

I.2. Assessment of Impact on Receiving Surface Water

Describe the existing environment in terms of water quality with particular reference to environmental quality standards or other legislative standards. Table I.2(i) should be completed

Provide a statement whether or not emissions of main polluting substances (as defined in the Schedule of S.I. 394 of 2004) to water are likely to impair the environment.

Give summary details and an assessment of the impacts of any existing or proposed emissions on the environment, including environmental media other than those into which the emissions are to be made.

Full details of the assessment and any other relevant information on the receiving environment should be submitted as **Attachment I.2.**

Attachment I.2 Assessment of Impact on Receiving Surface Water

In general the quality of the receiving surface water (Colligan River) is good. A biological survey of the river undertaken in 2006 suggested a water quality rating of fair to good. The 2007 AER was submitted to the Agency which contains the full report and it is also attached here in Appendix C.

Measures are being carried out at present in accordance with the Closure, Restoration and Aftercare Management Plan (CRAMP) to minimise/reduce the impact of the landfill on the surface water. These measures will have the overall effect of reducing the amount of leachate which currently reaches the Colligan River and should result in a gradual improvement in the surface water quality.

As part of the capping works an Integrated Constructed Wetland is being constructed on the landfill body. This ICW will be used to treat leachate that is abstracted from the landfill. The treated leachate will be discharged to the Colligan River subject to monitoring. The impact of this treated effluent on the Colligan River is addressed in the document entitled "Response to EPA Request for Information on Leachate Treatment".

All surface water coming from the civic amenity area will be passed through an oil interceptor prior to discharge into the River Colligan while waste water from the waste transfer station and compost facility will be directed into the leachate treatment system.

The surface water discharge details and locations have been discussed in detail in Attachment E.2 and results provided as part of the 2007 AER.

I.3. Assessment of Impact of Sewage Discharge.

Give summary details and an assessment of the impacts of any existing or proposed emissions on the environment, including environmental media other than those into which the emissions are to be made.

Full details of the assessment and any other supporting information should form **Attachment I.3.**

Attachment I.3 Assessment of Impact of Sewage Discharge

Not Applicable.

I.4 Assessment of impact of ground/groundwater emissions

The scope and detail of this assessment will depend to a large extent on the extent and type of ground emissions at any site, which in turn are related to the risk. Details should be included in **Attachment I.4.** Comprehensive guidelines are contained in the *Application Guidance Note*, and include particular requirements for landfill and brownfield facilities.

Describe the existing groundwater quality. Tables I.4(i) should be completed.

Attachment I.4 Assessment of ground/groundwater emissions

Dungarvan Water Supply is located approximately 700m to the west of the site. In June 1998 the GSI identified the perimeter of the zone of contribution lying a minimum of 300m to the west of the landfill. The zone of contribution is based on a 100-day time of travel located predominantly to the west and north west of the public supply well.

In the study the GSI did not express any concern about the location of the landfill in relation to the public water supply and by all accounts monitoring results of the public water supply indicate that the landfill is not having any impact on the water quality of the supply.

It should be noted that the groundwater beneath the landfill is an unusable source of water supply due to saline infiltration as a result of the tidal movements of the Colligan Estuary.

The locations of groundwater monitoring points at the site are shown on Drawing DG0505. Groundwater monitoring will be carried out in accordance with the EPA manual on Landfill Monitoring.

Full analysis of groundwater monitoring is available to the Agency in the Annual Environmental Report for 2007 which was submitted to the Agency and is attached here in Appendix C.

I.5 Ground and/or groundwater contamination

Summary details of known ground and/or groundwater contamination, historical or current, on or under the site must be given.

Full details including all relevant investigative studies, assessments, or reports, monitoring results, location and design of monitoring installations, appropriately scaled plans/drawings ($\leq A3$), documentation, including containment engineering, remedial works, and any other supporting information should be included in **Attachment I.5**.

Attachment I.5 Ground and/or groundwater contamination

Monitoring has indicated significant levels of ammonia, iron and manganese in the groundwater at the landfill. However it cannot be confirmed that this arises from the landfill body itself as the River Colligan is tidal at the location of the landfill. Despite the fact that the landfill is unlined, a continuous layer of low-permeable clay exists underneath the landfill body which would offer considerable protection to groundwater.

In addition to the layer of low permeability clay the landfill has recently been capped. As part of the capping works a leachate abstraction system is being installed. The combination of the capping system and the abstraction system will greatly reduce the volume of leachate infiltrating the groundwater.

I.6 Noise Impact.

Give details and an assessment of the impacts of any existing or proposed emissions on the environment, including environmental media other than those into which the emissions are to be made.

Ambient noise measurements

Complete Table I.6(i) in relation to the information required below:

- (i) State the maximum Sound Pressure Levels which will be experienced at typical points on the boundary of the operation. (State sampling interval and duration)
- (ii) State the maximum Sound Pressure Levels which will be experienced at typical noise sensitive locations, outside the boundary of the operation.
- (iii) Give details of the background noise levels experienced at the site in the absence of noise from this operation.

Prediction models, appropriately scaled maps ($\leq A3$), diagrams and supporting documents, including details of noise attenuation and noise proposed control measures to be employed, should form **Attachment I.6**.

Attachment I.6 Noise Impact

As the landfill is no longer accepting waste noise produced from operational practises at the site is minimal. No noise monitoring is stipulated in Waste License 032-02 and it is not proposed to carry out any further monitoring for noise at the site.

I.7 Assessment of Ecological Impacts & Mitigation Measures

The ecology of the site and the surrounding area should be assessed in the vicinity of the largescale waste facilities such as landfill or incinerator developments. An assessment of the ecology should form **Attachment I.7**. Comprehensive guidelines are contained in the *Application Guidance Note*

Attachment I.7 Assessment of Ecological Impacts & Mitigation Measures

An Assessment of the Ecological Impacts and Mitigation Measures was submitted to the Agency as part of the Closure, Restoration & Aftercare Management Plan (CRAMP) as required in Waste Licence W0032-02.

SECTION J ACCIDENT PREVENTION & EMERGENCY RESPONSE

Describe the existing or proposed measures, including emergency procedures, to minimise the impact on the environment of an accidental emission or spillage.

Also outline what provisions have been made for response to emergency situations outside of normal working hours, i.e. during night-time, weekends and holiday periods.

Describe the arrangements for abnormal operating conditions including start-up, leaks, malfunctions or momentary stoppages.

Supporting information should form **Attachment J**.

Attachment included	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
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Attachment J Accident Prevention & Emergency Response

Emergency Response Procedures

Scope

The Emergency Response Procedures apply but is not limited to the following incidents occurring:

- Fire / Explosions
- Spillages
- Migration of Landfill Gas
- Environmental Pollution
- Injury or serious accident to persons
- Any other incident, which may pose a significant threat to persons or the environment.

Responsibility

1. The Facility Manager is responsible for the implementation of the Emergency Response Procedure and for the training of all landfill personnel and contractors in effective emergency response procedures.
2. In the event of a major fire or an explosion the Senior Rostered Fire Officer will be notified immediately.
3. In the event of a serious accident or injury to a person the Ambulance service will be contacted
4. In the event of other incidents e.g. spillages or environmental pollution the Senior Environmental Engineer will be notified and will assume responsibility along with the Facility Manager.

Procedure

In the event of an accident occurring the following procedure will be adopted:

WASTE Application Form

- Evacuate the immediate area within the site if necessary.
- Inform other site users.
- Remain upwind of any hazard area.
- Contact site office and advise in detail of the emergency.
- Ensure entrance/exit gate is not obstructed.
- Contact fire Brigade, Ambulance, Gardaí, and / or Senior Engineer, Waterford County Council as required by dialing 999 or 112.
- If incident occurs outside office hours an emergency telephone contact number is provided on the site notice board.
- Personnel shall report to the designated assembly point at the site office.
- All areas affected by the incident shall remain closed until given the all-clear by an authorised person.

In the event of landfill gas being detected in the site office the following procedure will be followed:

- Raise the alarm.
- Evacuate the site office.
- Notify relevant senior personnel in Waterford County Council or emergency services if necessary.
- Immediately conduct gas survey to identify source.
- Remedy cause of problem.
- Document incident properly.

In the event of a spillage, the Facility Manager shall apply a suitable absorbent material to contain and absorb any spillage at the facility. Once contained the Facility Manager shall have regard to the Corrective Action Procedure.

In the event of a serious threat to the environment, the Facility Manager shall take all necessary short-term action to minimise any further impact and allow the Corrective Action Procedure.

Records

Details of any incident will be recorded in a written register, which will be maintained at the site office and the Agency will be informed as required by the Waste Licence.

SECTION K REMEDIATION, DECOMMISSIONING, RESTORATION AND AFTERCARE

Describe the existing or proposed measures to minimise the impact on the environment after the activity or part of the activity ceases operation, including provision for post-closure care of any potentially polluting residuals.

For Landfill Applications, capping proposals are required, and reference should be made to the *Landfill Manual on 'Restoration and Aftercare'* published by the Agency, when completing this section.

Attachment included	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
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Attachment K.1 Remediation, Decommissioning, Restoration & Aftercare

It is envisaged that the site (with the exception of the landfill) will operate in the long-term. It is proposed that the site will be restored to a natural wildlife habitat. A Closure, Restoration and Aftercare Management Plan (CRAMP) has been submitted to the Agency and was drawn up in accordance with Waste Licence W0032-02. The CRAMP contains further details on the remediation, decommissioning, restoration and aftercare of the site. The facility will continue to be monitored in the aftercare period until it is fully decommissioned and until there is no potential for emissions to the environment.

SECTION L STATUTORY REQUIREMENTS

L. 1 Section 40(4) WMA

Indicate how all the requirements of Section 40(4)[(a) to (i)] of the Waste Management Acts 1996 to 2003 will be met.

Applicants should also describe how the proposed facility will comply with the requirements of BAT. In particular reference should be made to the considerations referred to in Annex IV of Council Directive 96/61/EC concerning integrated pollution prevention and control.

Attachment L.1 should contain the documentation requested above, along any relevant additional information.

Attachment included	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
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Attachment L.1 Statutory Requirements

Compliance with Emission Standards

Waterford County Council will operate the facility so as to comply with all emission standards and limits set out by the Environmental Protection Agency in the Waste Licence.

Avoidance of Environmental Pollution

The facility is designed and operated to ensure that the operation of the facility will not cause environmental pollution.

Best Available Technology (BAT)

Waterford County Council will employ sites practices and best available technology in accordance with BAT principles to avoid any environmental pollution and prevent and mitigate any nuisance emissions from the facility.

This policy is consistent with the operation of Waterford County Council's other licensed facilities.

Financial Provision

Waterford County Council, as a Local Authority, are fully aware of their responsibilities to make financial provision in respect to the operation of a waste recovery facility as set out in Section 53 of the Act.

L.2 Fit and Proper Person

The WMA in Section 40(4)(d) specifies that the Agency shall not grant a licence unless it is satisfied that the applicant (if the applicant is not a local authority) is a fit and proper person. Section 40(7) of the WMA specifies the information required to enable a determination to be made by the Agency.

- Indicate whether the applicant or other relevant person has been convicted under the Waste Management Acts 1996 to 2003, the EPA Act 1992 and 2003, the Local Government (Water Pollution) Acts 1977 and 1990 or the Air Pollution Act 1987.
- Provide details of the applicant’s technical knowledge and/or qualifications, along with that of other relevant employees (Link to Section C.1 of the application).
- Provide information to show that the person is likely to be in a position to meet any financial commitments or liabilities that may have been or will be entered into or incurred in carrying on the activity to which the application relates or in consequence of ceasing to carry out that activity (Link to Section K of the application).

Supporting information should be included as **Attachment L 2** with reference to where the information can be found in the application.

Attachment included	yes <input checked="" type="checkbox"/>	no <input type="checkbox"/>	not applicable <input type="checkbox"/>
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Attachment L.2 Fit and Proper Person

Mr. David Regan who is responsible for the operation of the site is currently undertaking the FAS Waste Management course.

No employee of the applicant, Waterford County Council, has been convicted of an offence under the Waste Management Act 1996.

Technical Competence & Site Management

Waterford County Council is required as a local Authority to follow instructions set out by the EPA and has extensive experience in waste management. Waterford County Council has also extensive experience and in operating licenced facilities and will operate the facility in strict accordance with the Waste Licence. Attachment C.1 sets out the staff structure for the management of the facility.

SECTION M DECLARATION

Declaration

I hereby make application for a licence / revised licence, pursuant to the provisions of the Waste Management Acts 1996 to 2003 and Regulations made thereunder.

I certify that the information given in this application is truthful, accurate and complete.

I give consent to the EPA to copy this application for its own use and to make it available for inspection and copying by the public, both in the form of paper files available for inspection at EPA and local authority offices, and via the EPA's website. This consent relates to this application itself and to any further information, submission, objection, or submission to an objection whether provided by me as Applicant, any person acting on the Applicant's behalf, or any other person.

Signed by: _____
(on behalf of the organisation)

Date : _____

Print signature name: _____

Position in organisation : _____

Company stamp or seal:

**Appendix A – Response to EPA re. Further
information on Leachate Treatment**



Dungarvan Landfill

Response to EPA Request for Information on Leachate Treatment

DOCUMENT CONTROL SHEET

Client	Waterford County Council					
Project Title	Dungarvan Landfill Remediation					
Document Title	Response to EPA Request for Information on Leachate Treatment					
Document No.	MDR0350Rp0008					
This Document Comprises	DCS	TOC	Text	List of Tables	List of Figures	No. of Appendices
	1	1	19	-	-	1

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
F01	Issue for Client Comment	M. Spillane / P. Martin	E. Boland	E. Boland	West Pier	August 2008

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1 INTRODUCTION

1.1 TERMS OF REFERENCE

This report contains information requested by the Environmental Protection Agency (EPA) relating to the proposal to use an Integrated Constructed Wetlands (ICW) System for the treatment of leachate from Dungarvan Landfill. This report should be read in conjunction with the waste license review for the site.

Waterford County Council are working in parallel with Dr Rory Harrington, Senior Scientist/Programme Manager, Integrated Constructed Wetlands Initiative, Department of Environment, Heritage and Local Government to develop a ICW system to treat leachate at Dungarvan Landfill with a view towards discharging the treated effluent to the River Colligan.

ICWs have been used to treat polluted water in Ireland in recent years, in particular in the treatment of point source pollution from agriculture. To date, ICWs have not been used in the treatment of landfill leachate in Ireland; it is intended to appropriately monitor the performance of the Dungarvan ICW system with a view towards producing peer-reviewed publication(s).

1.2 BACKGROUND

An integrated constructed wetland (ICW) is a surface flow wetland, which mimics the role and structure of natural wetlands. Wetlands are effective in cleansing nutrients and pollutants. These wetlands have shallow water depths and are planted with emergent plant species and can cleanse liquids through physical, chemical and biological processes.

ICWs are a specific design approach to the widely used concept of constructed wetlands. ICWs are distinguished from other constructed wetland approaches because they are designed to facilitate the widest possible range of ecological conditions normally found in natural wetlands, including those of soil, water, plant and animal ecology. In addition the ICW concept strives to achieve 'Landscape fit' and 'Habitat Restoration/Creation' into its designs. These added values necessitate the required larger land areas used in the ICW design compared with those generally used in other constructed wetland designs. This relatively larger land area facilitates a greater range of the physical, chemical and biological processes that occur in the wetland environment including those required for the removal of the more difficult contaminants.

The primary vegetation types used in ICWs are emergent plant species (helophytes). These species have evolved to enable them to root in soils with no available or limited oxygen, growing vertically through the water column with most of their leaves in the air. They have specially adapted tissues that facilitate oxygen storage and its transportation from the leaves through the stem to the roots. Soil and water characteristics influence the type and performance of plant species for each wetland segment of an ICW.

Capping works in Dungarvan were completed in mid 2008. The final capping has been installed in accordance with the waste licence and consists of the following:

- Regulation layer 0-500mm overlain by;
- Gas geocomposite layer overlain by;
- 1mm LLDPE layer overlain by;
- Surface water geocomposite layer (on the side slopes only) overlain by;
- Geogrid (on the side slopes only) overlain by;
- 1m subsoil/topsoil (on the side slopes only, 300mm of subsoil within the ponds)

The ICW system consists of five fully lined ponds with 300mm depth of subsoil that will allow for the establishment of vegetation and provide for the protection of the geosynthetic barrier layer.

The surface area available for the ICW system at Dungarvan was limited by the existing profile of the raised landfill waste body. The surface area of the wetlands is approximately 20,500m². Sizing of ICW is typically based on an average requirement of 100m² per 1m³ through-flow of diluted leachate per day; this would equate to a maximum daily loading of 205m³.

1.3 BRIEF OVERVIEW OF SYSTEM

The ICW consists of a series of six wetland ponds through which the leachate is passed sequentially where it will be treated by means of the plants within the ponds before being discharged to the Colligan River. Two leachate storage tanks, leachate collection pipework and monitoring equipment will be operated in tandem with the wetlands themselves to ensure that the system operates as designed. See DG0504.

Leachate abstracted from the site via the leachate abstraction boreholes (refer to drawing DG0504 for the location of the boreholes) will be pumped to Storage Tank 1. Monitoring equipment in this tank will analyse the leachate and determine the concentration of ammonium and therefore whether dilution of the leachate is required or not. The maximum concentration of ammonium allowable within the leachate is 100mg/l, this is to prevent shock loading of the wetland plants at the inlet point.

If dilution of the leachate is required water from the river will be used to dilute the leachate to the required concentration in Storage Tank 1 before being pumped to the wetland system. If no dilution is required the leachate will be pumped directly from Storage Tank 1 to the wetland system.

Once leachate is discharged to the wetland system it flows sequentially through Ponds 1-5 before being discharged to Storage Tank 2. Once in this tank the leachate is again monitored and based on the results of this monitoring the leachate will either be discharged to the Colligan River or it will be pumped back into the wetland system for further treatment.

2 OVERVIEW OF OPERATION OF ICW SYSTEM

2.1 INFRASTRUCTURE

Connection:

The ICW consists of a series of five individual cells each connected to the preceding cell by means of a HDPE pipe buried within the subsoil layer of the capping system. As previously discussed untreated leachate is discharged to the first cell and then flows through each of the cells before being discharged to a storage tank for monitoring and eventual discharge to the Colligan River. The flow is regulated through the wetlands to ensure adequate retention time is achieved within the ponds before being stored and monitored prior to discharge. A SCADA system is being designed which will control flows to the ICW, leachate storage tanks and outlets and will base flows on parameter monitoring to ensure compliance with outlet parameters and avoid overloading the wetlands.

Capping:

The landfill was capped prior to the construction of the wetlands. As part of the final capping works the surface of the landfill was re-graded to specific levels to ensure a suitable flow of leachate from cell to cell in the wetlands. Each cell was levelled so leachate could be contained within the cells. Once re-graded the landfill was capped with a layer of gas geocomposite and a layer of LLDPE liner. The LLDPE liner provides the base for the wetland system.

Once the LLDPE liner was installed, the floor of each of the cells was covered with 300mm of clay and the sides of the ponds were constructed by means of clay berms (1000mm high). The berms were then lined with LLDPE liner. The liner was secured by means of an extrusion weld to the existing capping liner on the inside of the ponds and by means of an anchor trench at the top of the berms. Please see DG0506.

Leachate Flow:

The leachate flow is monitored and regulated by means of a series of tanks, pipework and monitoring systems. The monitoring results are relayed back to the software system which will be stored in the administration building and dependent on these results the leachate is either discharged to the Colligan River or back into the wetland system. This is discussed in more detail in Section 2.3.

Storage Tanks:

The storage tanks are to be glass-fused-to-steel tanks which are constructed to BS 7543:1992 and ISO 15686. Tank 1 has a capacity of 25m³ and tank 2 has a capacity of 25m³. All tanks have been designed with a minimum freeboard of 0.5m.

Plants:

Each cell has been planted with a variety of different plant species. Included in the planting scheme were 8,000 *Glyceria maxima* (sweet water grass), 3,000 *Typha latifolia* (reedmace), 10,000 *Carex riparia* (common sedge) and a mix of 9,000 *Typha angustifolia* (lesser reedmace), *Scirpus lacustris* (bulrush), *Iris pseudacorus* (yellow flag iris) and *Sparganium erectum* (burreed). The planting density is approximately 1 plant / 0.6m².

2.2 MANAGEMENT & MAINTENANCE

A fundamental requirement of the ICW concept and its design is that they be as self-managing and as self-maintaining as possible. Their initial management requirements must be achieved within the physical, chemical and biological dynamics of wetland ecosystem function. The key operational necessity to achieve this is that water depths (100-200 mm) for the various ICW segments should be maintained.

If left unmanaged the accumulation of sediment and decaying organic matter combined with changing vegetation structure will eventually cause channelling-type flow to develop thus reducing retention time and plant contact. To minimise such channelling, surface flow must be maintained through the incremental raising of the water level in the various wetland segments. This is achieved through raising and lowering pipe invert levels, as appropriate. The pipe invert levels will only have to be raised subject to the increase in the depth of the bed in the ponds, i.e. the depth of the initial clay base and the depth of the accumulating sediment and decayed organic matter. It is envisaged that the pipes will only have to be raised every 3-5 years.

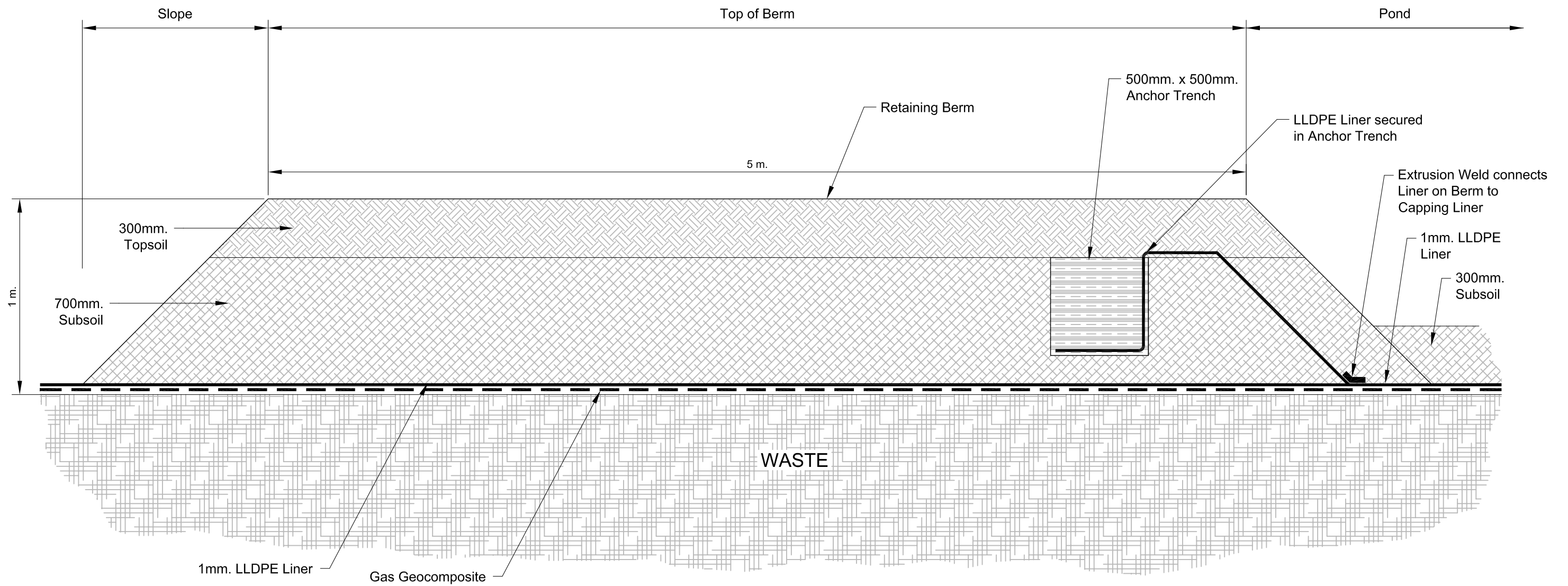
Given the nature of the through-flowing water it is not expected that there will be a need for much more than inspection (initially on a daily basis, subsequently on a weekly basis) to ensure that through-flow is being maintained after initial installation. These inspections will be carried out by Waterford County Council in conjunction with Dr. Rory Harrington. The presence of biological indicator species such as emergent macrophytes, which are to be planted at the outset, will also be monitored as part of these inspections. If these are not thriving it is an indication that there is too much ammonia or too much salt in the system.

The ICW concept is particularly focused on fluxes in through-flows, this combined with its elevated position, make it is extremely unlikely that the risk from flooding is significant, in addition, sufficient freeboard has been allowed within the system to allow for extreme rainfall events. Similarly, during periods of drought there is little likelihood of problems arising as the vegetation has an innate capacity to cope with this. In the event that additional water must be added to the system in drought periods it can be abstracted from the Colligan River.

As water depth and contaminant concentration, especially that of ammonia-N composition, can impact synergistically on emergent plants (a key element in this exercise), the overall impact of increasing the water depth on the vegetation must be anticipated and carried out in small incremental steps. In addition, it is undesirable to radically reduce a wetland cell's water level through the release of water from one segment to the next as water, especially from the more polluted upper segments, as this may contain excessive ammonium, which could negatively impact on more sensitive vegetation. If there is a need to reduce levels, lowering the pipe/sluice when there is freeboard or by small incremental amounts over protracted periods, is appropriate.

In brief the establishment and monitoring of the ICW system will proceed as follows:

- Hydrate the ICW.
- Plant the specified plant species.
- Once the plants are established begin introducing the leachate incrementally.
- Monitor the condition of the wetland ecosystem.
- The monitoring will allow a balance to be established between the volume of leachate being treated and the performance of the ICW system.
- The development of the biological indicator species will be the limiting factor in determining the performance of the system.



RETAINING BERM CONSTRUCTION DETAILS

Scale 1:20

NOTES

1. This drawing is the property of RPS. It is a confidential document and must not be copied, used, or its content divulged without prior written consent.
2. All Levels refer to Ordnance Survey Datum, Malin Head.
3. DO NOT SCALE, use figured dimensions only, if in doubt ask.

No.	Date	By	App	Amendment / Issue
F01	Dec '08	RH	EB	Final Issue
A01	Aug '08	RH	BOK	Issue for Approval

Client			
 WATERFORD COUNTY COUNCIL Comhairle Chiontae Phort Láirge Civic Offices, Dungarvan, Co. Waterford Phone: 058 22000 Fax: 058 42911			
Drawn By	Checked By	Approved By	Date
RH	BOK	PM	Aug. 2008

Project	
DUNGARVAN LANDFILL WASTE LICENCE APPLICATION	
Drawing Status	Scale / Sheet Size
Final	NTS @ A1 1:20 @ A3

Drawing Number	Rev
MDR0350/DG0506	F01
Title	
RETAINING BERM CONSTRUCTION DETAILS	

2.2.1 Procedures in the Event of Flooding

Each cell has been constructed such that there is 500mm of freeboard in each cell at all times. This freeboard makes it extremely unlikely that flooding will occur due to overtopping of the cell walls. The largest one day rainfall (as per Rosslare records) was 79.1mm. The freeboard within the ponds are of ample size to cope with this level of rainfall.

If flooding were to occur it would occur in Tank 2, the storage tank prior to discharge to the river, since this is downhill of the ponds and flow out from the tank. Tank 2 will be fitted with a high level alarm. If this high level alarm is activated the pumps in the abstraction boreholes will automatically shut down and the inlet valve to Tank 2 will also close. The tank will be inspected and an assessment of the conditions made. If necessary the effluent in Tank 2 will be lowered by tankering the effluent to a local WWTP.

2.2.2 Procedures in the Event of Non-Operation of the System

As part of the installation of the SCADA control system a maintenance contract will be entered into with the system suppliers. This contract will include an annual systems check and will also include for emergency call outs in the event of non-operation of the SCADA control system.

With regard to the wetland itself the monitoring detailed in section 2.2 of this report will ensure that any operational issues are identified early and that suitable remedial works are undertaken.

2.2.3 Measures to Establish the Cause of any Significant Pollution

Owing to the nature of the construction of the ICW it is anticipated that if pollution were to occur it would be due to the one of the following:

1. The wetland cell walls having failed or having been overtopped.
2. One of the storage tanks having failed.
3. The monitoring system having failed.

In the event of any significant pollution the wetland walls and storage tanks will be inspected immediately. If the inspection reveals that the failure has occurred the pumps in the abstraction boreholes will be shut down and works to repair any faults will be instigated immediately.

If the inspection reveals that neither the cell walls or any of the storage tanks have failed the SCADA system will be checked and if necessary the monitoring system installators will be called to carry out a more detailed inspection and repair any faults.

However, measures have been taken at the design and construction stage to minimise the possibility of any of the above occurring. The wetland cell walls have been constructed from compacted clay and the LLDPE lining has been inspected by an independent quality control inspector. The cells walls have also have a 500mm freeboard which minimises the risk of overtopping. All the cells are also interlinked by gravity feeds so unless a blockage occurs in the interconnecting pipework flooding should only occur in Tank 2. The storage tanks are glass fused to steel and have been constructed to BS 7543:1992 and ISO 15686. A reinforced concrete base provides a stable platform for each tank. As discussed in section 2.2.2 above a maintenance contract will be entered into with the suppliers of the monitoring system ensuring that the system is regularly inspected and tested.

2.3 MODE OF OPERATION OF CONTROL SYSTEM

1. Leachate is extracted from the 9 combined wells and pumped to the leachate-balancing and dilution tank (Tank 1).
2. Once a certain level has been reached in Tank 1, inflow is stopped and the concentration of the leachate (from the 9 different wells) is analysed to determine the concentration of NH_4 . The maximum concentration of the diluted leachate to enter the wetland cells is 100mg/l NH_4 .
3. Based on the concentration analysis of the leachate in Tank 1, if required, the feed source pump will pump water from the Colligan River to dilute the leachate sample to the required NH_4 concentration. If the sample shows that the concentration is less than 100mg/l NH_4 ; the leachate can be pumped directly to Wetland Cell 1a from Tank 1, otherwise it will be diluted.
4. Further analysis is undertaken in Tank 1 to ensure that the required dilution has been achieved. If this has been achieved then the diluted leachate will be pumped to Wetland cell 1a.
5. The diluted leachate flows sequentially through each of the six ponds.
6. Flow from the last wetland cell (Cell 5) will discharge to a treated leachate tank (Tank 2). The concentration of the treated effluent is continuously monitored to determine the concentration of NH_4 .
7. If the treated effluent achieves the discharge limit values, it can be discharged to the river Colligan. If the sample is above the discharge limit values the sample is redirected to the balancing tank or Wetland Cell 1a.
8. The treated effluent may also be used to dilute the leachate abstracted prior to pumping to Wetland Cell 1a.
9. There is to be a shut off level in Tank 2 which when reached will shut off the abstraction pumps and the gate valve on the inlet to the tank, until this level drops again. The treated leachate is allowed to continue to drain from the six cells and a freeboard will be created to accommodate this.

2.4 POST CLOSURE CARE

Heavy metals will be contained in the detritus and necromass of the ICW system. They can be removed as appropriate and the metals recovered through combustion for thermal energy or by dewatering and removal to landfill. It should be noted however that the expected lag-time for this is about 30 –100 years and as it is determined by berm-height (holding capacity) which may be increased by additional appropriate earthworks.

Once it has been established that treatment of the leachate is no longer required the ICW may be decommissioned. The SCADA system, storage tanks and pumps will all be decommissioned, re-used if possible and disposed of appropriately otherwise.

Possible options for the utilisation of the site will be examined on closure of the ICW system.

3 MASS BALANCE

3.1 LEACHATE VOLUMES

Since the site has now been capped with a geomembrane liner, ongoing leachate generation due to infiltration of rainfall is assumed to be negligible, approximately 1% of precipitation. The waste body itself is assumed to contain a certain amount of leachate. This is most likely in the form of local reservoirs retained between the layers of clay that would have been placed historically as a daily cover material.

As part of the capping works 23 gas and leachate abstraction boreholes were installed. The total depth of the boreholes and the leachate levels in each of the boreholes was recorded. From this information the leachate head across the landfill and the base of the boreholes was modelled. The difference in volume between these two planes (120,000m³) gives the total volume of saturated waste within the landfill from which leachate is to be abstracted. It is assumed that the waste has an overall moisture content of 25% within this area.

Therefore the total volume of leachate to be abstracted from the landfill is c.30,000m³. In addition this leachate is under a driving head in comparison with groundwater levels in the immediate area, which means that some of the leachate is lost to groundwater through the base of the landfill each year.

A surface water drainage system is being installed as part of the capping & restoration works which will divert surface runoff from the landfill.

3.2 DISCHARGE VOLUMES

Recent analyses from monitoring points show that concentrations of ammonia range from 210 mg/l to 910 mg/l (more detailed data is contained in Table 4.1). The plants being used in the system can tolerate levels of ammonia up to 100mg/l. The concentration of leachate within the landfill varies considerably; the concentration of leachate within the balancing tank (tank 1) will determine the dilution required and consequently the volumes of diluted leachate to be treated. Table 3.1 below illustrates the volume of effluent to be discharged for various abstraction rates from the landfill.

Table 3.1: Leachate Mass Balance

Leachate Abstracted (m ³)	Plus Dilution Water ¹ (m ³)	Plus Precipitation ² (m ³)	Less P.E. ³ (m ³)	Discharge (m ³ /day)
5	25	49.2	32.9	46.3
10	50	49.2	32.9	76.3
12	60	49.2	32.9	88.3
15	75	49.2	32.9	106.3
20	100	49.2	32.9	136.3
25	125	49.2	32.9	166.3
30	150	49.2	32.9	196.3

Note 1: A dilution factor of 5 has been assumed using an average NH₄ level of 500mg/l in the raw leachate based on analysis of the leachate within the landfill.

Note 2: Precipitation has been taken from Rosslare weather station. The annual total has been distributed evenly throughout the year.

Note 3: Potential evapotranspiration has been taken from Casement Aerodrome and has been distributed evenly throughout the year.

3.3 CAPACITY

The available surface area in the six wetland cells is approximately 20,500m². The depth of the wetlands system is designed on the basis of 300mm of soil on top of the capping system covered by 200mm depth of diluted leachate with approximately 500mm of freeboard. This gives a normal capacity of 4,100m³ with a maximum capacity of 14,350m³ if required. Retention times will depend on the daily input to the system; retention times for a range of input values are illustrated in the table below.

The minimum retention time will be determined empirically. Initial loading of the wetlands will be minimal. Once it is established that the wetlands are adequately treating this loading (based on monitoring of the effluent) the loading will be increased. As before, if this increased loading is treated adequately the volume of leachate being discharged to the wetlands will be again augmented. This process will continue until such time as the maximum volume of leachate that can be abstracted from the landfill is being treated or until monitoring demonstrates that the ICW cannot treat the volume of leachate being discharged to it. In this case the volume of leachate being discharged to the ICW will be decreased to a level to which the ICW has sufficient capacity to treat.

The integrity of the ICW ecosystem will be maintained at all times through visual inspections and by the sampling and monitoring of the influent and effluent.

Daily input of diluted leachate (m ³)	Retention time* (Days)
30	89
50	62
100	35
150	24
180	21

* Based on normal capacity of 4,100m³, includes average precipitation less evapotranspiration.

Table 3.2: Retention Times of the ICW

4 TREATMENT PROCESS

4.1 INTRODUCTION

ICWs are ecologically engineered systems. They are distinguished from most other constructed wetlands because they are designed at the outset to facilitate the widest possible range of structures and processes found in natural wetland ecosystems, including those of soil, water, plant and animal ecology. They are particularly designed to achieve sufficient hydraulic residence time for the capture of phosphorous, the parameter demanding most surface area. The preference for the use of local soil material to achieve appropriate water infiltration/retention and a wide variety of native/local wetland plant species in ICWs are features that particularly distinguish them from 'reed bed' systems that typically feature only a single species.

4.1.1 Plant functions

The macrophytic vegetation used in the ICW design essentially performs a variety of functions; its primary function is the support of biofilms (slime layer) which carry out the principal cleansing function of the wetland. It also facilitates the sorption of nutrients and acts as a filter medium and through the use of appropriate emergent vegetation can control odours and pathogens. While the vegetation has the capacity to filter suspended solids it also increases the hydraulic gradient, thus increasing residence time. The appropriate choice of plant species and the density at which they are planted are important in the overall functioning of the wetland.

4.2 LEACHATE ANALYSIS

The leachate composition results available for Dungarvan landfill indicate that the composition of leachate from different parts of the landfill varies greatly; leachate composition varies considerably according to the type of waste deposited, landfill age and the degree of waste stabilisation. The range of values for different parameters measured at a set of monitoring points within the landfill over the last two years are indicated in the table below.

Table 4.1: Pre-Treatment Leachate Analysis Data

Parameter	L1	L2A	L3	L5A	L6 Lagoon	Average of L1, L2A, L3 and L5A	Typical Leachate Analysis (EPA, 1997)
Ammonia mg/l N	420	220	210, 320	910	53, 0.14	416	453
BOD mg/l O ₂	50	28	15, 16.5, 17	59	8.2, 4.2	31	270
COD mg/l O ₂	719	420	281, 583, 365	474	93	474	954

As the main focus of this wetland is the removal of ammonia-N and the capture of other pollutants, particularly heavy metals, the necessary recycling of the through-flow and the fact that it is an open system that is subject to precipitation, make it extremely difficult to give a treatment efficiency at this

stage. As discussed in section 5 below no discharge to the Colligan River will take place until it has been determined that the system is operating as intended.

Discharge will be totally controlled and will only be allowed when appropriate levels of ammonia-N have been attained.

There is no previous experience of the efficiencies for landfill leachate management using the ICW concept. Nevertheless, there is evidence of very successful performance for ICW systems treating and managing farmyard dirty water with very variable concentrations of contaminants and that include the degrees of contamination expected in the leachate. The threshold parameter, ammonia-N concentration, is known to be the factor limiting vegetation growth and this will be managed through re-cycling through-flow.

4.3 OTHER ICW SYSTEMS

Within the Annewstown-Dunhill catchment area (25km²) a network of ICWs have been constructed. These ICWs primarily capture farmyard run-off from the 19 working farms within the area. The run-off typically consisted of yard and dairy washings, rainfall on open yard and farmyard roofed areas and silage and manure effluents.

A total of 13 ICWs were constructed within the catchment area between 2000 and 2001. A monitoring programme has since been carried out and a summary of some of the results of this programme can be seen below.

Table 4.2: Summary of results from ICW systems In Annewstown - Dunhill

	ICW	BOD (mg/l)		SS (mg/l)		NH ₄ ⁺ -N (mg/l)		PO ₄ ³⁻ -P (mg/l)	
		In ³	Ef ⁴	In	Ef	In	Ef	In	Ef
Mean ¹	1	6040.8	11.1	1013.2	11.6	153.6	0.3	75.69	0.22
N ²		23	26	24	24	26	27	25	28
Mean	2	429.9	12.9	146.2	146.2	64.6	0.4	15.46	0.27
N		21	26	24	24	28	27	28	28
Mean	3	417.1	19.8	112.6	112.6	62.9	1.3	18.13	3.38
N		28	34	30	30	48	60	49	62
Mean	4	619.5	27.6	1019	1019	110.6	2.5	22.75	1.62
N		43	35	49	49	69	55	71	59
Mean	5	357.7	17.3	180.6	180.6	71.8	0.5	14.33	0.24
N		24	25	24	24	24	27	25	28
Mean	6	213.2	16.3	192.3	192.3	41.2	0.3	10.76	0.13
N		22	25	23	23	26	26	27	28
Mean	7	337.6	17.2	286.3	286.3	52.2	22.5	7.51	5.25
N		25	27	26	26	32	63	33	64
Mean	8	56.1	11.9	39.2	39.2	19.4	0.2	1.46	0.04
N		22	22	24	24	25	26	26	27
Mean	9	520.2	11.9	408.6	408.6	41	0.6	11.59	0.44

N		30	34	29	29	51	57	52	58
Mean	10	149.6	8.8	306.5	306.5	26.6	0.2	5.27	0.06
N		3	18	4	4	5	40	5	40
Mean	11	569.7	20.2	309.4	309.4	42.2	0.4	12.02	0.96
N		47	41	54	54	109	109	112	114
Mean	12	317.3	18.3	210	210	129.5	1.1	43.67	0.53
N		6	35	4	4	12	51	14	52
Mean	13	45.8	15.1	171.3	171.3	10.5	0.1	0.94	0.06
N		19	19	21	21	22	24	21	24

Note 1: the mean is the average of all the results taken.

Note 2: N is the number of readings taken.

Note 3: Influent

Note 4: Effluent

As can be seen from the table there are significant reductions in all parameters in each of the individual ICW ecosystems.

The effluent from each of the ICWs flows into the Annestown Stream. The biological water quality status of the stream has improved from a rating of Q2 (seriously polluted) in 1999 to a rating of Q3/4 (slightly polluted) in 2001 (EPA 2002). Further evidence suggests that the water quality has since improved to Q4 (unpolluted). Sea trout have returned to the stream after many decades of absence. The common newt has become abundant in all ICWs in the catchment [Scholz et al 2007].

5 DISCHARGE TO RIVER

It is proposed to discharge the treated effluent to the Colligan River once the concentrations of specific parameters are below allowable concentrations specified by the EPA and discharge to the Colligan River will only commence when a sufficient body of results are available to ensure compliance with the EPA limits.

In the event that the treated effluent does not meet the limits specified by the EPA it will be transported and discharged to a local wastewater treatment plant.

5.1 RECEIVING WATER BODY

Historical flow measurements for the River Colligan are available from the Poulnaskeha Hydrometric Station; given that this station is now no longer in operation the most recent measurements available are from July 2003. The 95%ile flow at the Poulnaskeha Station was estimated at 0.5m³/s. The DWF at the Poulnaskeha Station was estimated at 0.32m³/s. Please see drawing DG0505 illustrating the location of the surface water monitoring locations.

There is one EPA monitoring station immediately upstream of the landfill site, EPA station 280, as well as two monitoring stations, SW1 and SW2, adjacent to the landfill site. These monitoring stations are sampled and monitored quarterly. The average of the highest result, for each parameter, from each monitoring event in 2007, has been calculated and is shown in Table 5.1 below. Orthophosphate results were taken from 2006, the last period from which results are available.

Parameter	SW1	SW2	EPA Station 280	Average of SW1, SW2 and 280
Ammonia (mg/l N)	0.049	0.052	0.035	0.045
0-Phosphate (mg/l P)	-	-	<0.006	<0.006
BOD (mg/l O ₂)	1.3	0.9	0.8	1
Dissolved Oxygen (%)	124.4	118.8	107.0	116.73
COD	15.0	25.0	<8	20
Conductivity (µS/cm)	457	235	151	281
PH	7.9	8.0	7.7	7.8
Suspended Solids (mg/l)	<6	<6	7	7
Chloride (mg/l Cl)	95.0	36.0	14.00	43.33

Table 5.1: Monitoring Results from the Colligan River

5.1.1 Assimilative Capacity

The EPA has proposed Environmental Quality standards for BOD of 5mg/l in Rivers in Ireland (EPA 1997). According to the EU-Salmonid regulations (SI No 293 of 1988) the concentration of NH₄ must not exceed 1 mg/l in the river and the concentration of suspended solids must not exceed 25 mg/l. Although the Colligan is not a Salmonid river the limits in these standards will be applied in the proposed assimilative calculations.

There is no limit included in the Salmonid Regulations for phosphorous, however according to the Interim Statutory Standards for Rivers as per the EPA document "Parameters of Water Quality Interpretation and Standards" a limit of 0.03 mg/l P (MRP) should be applied to rivers with a Q rating 3-4. Ecological monitoring undertaken at the landfill site in 2006 concluded that the Colligan River had a water quality of fair to good around the site. Q ratings could not be assigned to the stretch of river around the site due to the tidal nature of the river at this point.

The average of the highest results from each of the three monitoring stations, as detailed above, has also been applied in the calculations.

The allowable concentrations in the effluent have been estimated based on the allowable concentrations in the river, taking into consideration the flow of the Colligan and the flow of effluent to be discharged. The calculations have been carried out as follows.

The concentration of a chemical substance downstream of the discharge point can be estimated as:

$$C_a = (Q_i C_i + Q_s C_s) / (Q_i + Q_s); \text{ where}$$

Q_i = Flow of the River upstream of the discharge point

C_i = Concentration of the substance upstream of the discharge point

Q_s = Flow of effluent from the discharge point

C_s = Concentration of the substance in the effluent

From the above equation it is seen that the concentration of substance in the effluent can be estimated as:

$$C_s = (C_a Q_i + C_a Q_s - C_i Q_i) / Q_s.$$

The concentration of NH_4 upstream of the proposed discharge point is 0.040 mg/l N. By inserting the maximum allowable concentrations in the river of NH_4 the maximum allowable concentration in the effluent for a range of discharge rates have been compiled in Table 5.2.

As previously discussed as this is a pilot scheme the exact treatment efficiency of the ICW is unknown at this stage. Once operational a full suite of monitoring will take place to assess the effectiveness of the system.

Table 5.2 Maximum allowable concentrations of P, NH_4 , BOD and Suspended Solids

Daily Discharge (m ³ /day)	Actual Discharge* (L/s)	Allowable Maximum Concentrations in Discharge			
		O-Phosphate (mg/l P)	NH4 (mg/l)	BOD (mg/l O2)	Suspended Solids (mg/l)
40	0.46	16.62	664.55	2,955.73	13,157.80
60	0.69	11.09	443.36	1,972.16	8,780.20
80	0.93	8.32	332.77	1,480.37	6,591.40
100	1.16	6.67	266.42	1,185.29	5,278.12
120	1.39	5.56	222.18	988.58	4,402.60
140	1.62	4.77	190.58	848.07	3,777.20
160	1.85	4.18	166.88	742.68	3,308.20
180	2.08	3.72	148.45	660.72	2,943.20

*Actual discharge based on daily volume to be discharged.

5.1.2 Proposed Emission Limits

As can be seen from Table 5.2 above the Colligan River has ample assimilative capacity to receive large volumes of treated effluent from the ICW. However it is proposed to abstract a maximum of 20m³ of leachate from the landfill each day. Based on the discharge volumes illustrated in Table 3.1 this will result in an average discharge of 136.3m³ per day. Table 5.3 below details the proposed emission limits that are to be applied to the treated effluent.

Parameter	Emission Limit (all units in mg/l except pH)
PH	6 - 9
BOD	45
Suspended Solids	50
Orthophosphate (mg/l P)	2
Total Ammonia (as N)	5

Table 5.3: Proposed Emission Limits

Using the above limits the concentration of each of the above substances downstream of the discharge location was calculated. It was assumed that the concentration of each substance in the discharge was at its maximum proposed concentration. Table 5.4 below illustrates the concentration of each parameter in the Colligan River downstream of the site and the corresponding statutory limits for each of these parameters.

	BOD (mg/l)	Suspended Solids (mg/l)	Orthophosphate (mg/l)	Total Ammonia (mg/l)
Conc. Downstream	1.215	7.21	0.016	0.069
Statutory Limits	5	25	0.03	1

Table 5.4: Downstream Concentration of Emission Parameters

As can be seen from the above table the concentration of each of the parameters in the effluent is significantly below both the statutory limits as detailed in Section 5.1.1 above as well as the assimilative capacity of the Colligan River.

5.1.3 Monitoring Regime

As previously discussed as this is a pilot scheme the exact treatment efficiency of the ICW is unknown at this stage. Once operational a full suite of monitoring will take place to assess the effectiveness of the system. Continuous monitoring will be carried on the treated effluent for pH and ammonia. A 24 hour composite sample will be taken from the effluent each day and stored on site. Once a week one of the composite samples will be chosen at random and monitored for BOD, suspended solids and Orthophosphate.

Grab samples will be taken annually and will be monitored for the following:

- BOD
- COD
- Chloride
- Ammoniacal Nitrogen

- Electrical Conductivity
- pH
- Metals / non-metals¹
- Cyanide (total)
- Fluoride
- List I/II organic substances
- Mercury
- Sulphate
- Orthophosphate
- Total Oxidised Nitrogen

Note 1: to include boron, carbon, cadmium, chromium (total), calcium, copper, iron, lead, magnesium, manganese, nickel, potassium, sodium and zinc

5.2 IMPACT OF ICW DISCHARGE ON RECEIVING WATER

As discussed above when calculating discharge limits for the treated effluent, limits taken from the EU Salmonid Regulations were applied. In addition to this, the proposed emission limits are well below the assimilative capacity of the receiving water. The implementation of both these control measures will ensure that there is negligible impact on the receiving waters. The SCADA monitoring system will ensure that both these measures are implemented fully.

5.3 ECOLOGY OF SURROUNDING AREA

An ecological survey of the landfill and its surrounding areas is carried out annually in accordance with Condition 8.1 of Waste License 32-02. A full copy of the 2006 report is contained in Appendix 1.

According to the report the site and its surrounding environs continue to support a diversity of wildlife due to the variety and aquatic habitats present. In particular, the habitats associated with the River Colligan are valuable in terms of the flora and fauna they support. The mammal survey highlighted extensive use of the site by several mammal species. In particular a number of well established sprainting sites continue to be used by the Annex I species otter and there is a hot spot of otter activity on a bank behind the transfer station. This indicates the presence of favourable environmental conditions for this species.

Annex I bird species Little Egret appear to have increased their use of the River Colligan adjacent to the landfill site and numerous other bird species utilise the habitats within and surrounding Dungarvan landfill. In particular the Annex I species Kingfisher continues to hold a territory along this stretch of river.

Biological assessment of the River Colligan suggested a fair to good water quality at the five sampling sites. There were some concerns with regard to the level of macrophyte growth in the river which may have had an impact upon the macroinvertebrate communities. However, macropyte growth is not directly attributable to landfill activities and a variety of nutrient sources and other factors are most likely responsible for its abundance.

5.3.1 Sediment Quality

Small concentrations of metals exist naturally in the environment and living organisms require trace amounts in order to exist. However some metals can be hazardous to the environment if concentrations exceed certain thresholds. Monitoring of the sediment in the Colligan River is required

under Waste License 32-02. The last monitoring event for which results are available was carried out in 2005, the results of which are shown below.

Background trace metals in estuarine sediments generally reflect the occurrence and abundance of metals in the geological formations in the catchment area of the estuary, and any metals discharged to the environment due to human activities.

Prior to their closure, Dungarvan Crystal and Dungarvan Tannery were licensed to discharge lead and chromium to Dungarvan Harbour.

Samples of sediment (approx 2 kg) were taken on 18/8/05 at five sampling points, shown on fig 5.1.

- S1 – just upstream of disused railway bridge upstream of landfill (EPA stn 280)
- S2 – immediately upstream of the landfill site
- S3 – opposite most downstream drain from the landfill
- S4 – 150 m downstream of landfill
- S5 – Ballyneety Bridge, downstream of landfill (EPA stn 300)

The samples were hand mixed on-site, and a portion (approx 200g) taken for analysis. The samples were dried at 105 deg for two days, and pulverized with mortar and pestle in Adamstown laboratory. Portions of the powdered samples were analysed for metals at Euro Environmental Services Laboratory, Drogheda. QC and reference materials were processed with the samples.

Table 5.3: Sediment Quality Results

Site	Arsenic ¹ (mg/kg)	Chromium ¹ (mg/kg)	Copper ¹ (mg/kg)	Lead ¹ (mg/kg)	Zinc ¹ (mg/kg)
S1	1.6 [2.5] (5.2)	5.5	5.9 [6.1] (7.4)	4.5 [17.1] (13)	23.8 [38.6] (43)
S2	1.4 [2.7] (6.5)	5.9	6.2 [5.7] (9.3)	5.7 [5.7] (23)	48.8 [40.8] (49)
S3	1.9 [2.1] (3.7)	9.6	9.5 [6.6] (7.2)	8.2 [6.9] (10)	35.7 [31.5] (88)
S4	1.3 [3.5] (3.5)	5.9	5.1 [8.7] (6.4)	7.2 [35.2] (10)	27.9 [38.8] (450)
S5	1.5 [3.7] (4.6)	6.0	4.7 [204] (13.6)	5.4 [72] (14)	21.8 [1526] (41)
Waterford Harbour EPA survey, average of five samples (2003)	8.0	20.0	9.8	26	141
Wexford Harbour EPA survey, average of four samples (2002)	8.6	31.0	11.4	15	70
Dungarvan Harbour EPA survey, average of four samples (2004)	6.7	22.8	23.4	93	102

Sediment Quality Standards (Jeffery et al)			50.0		100
---	--	--	-------------	--	------------

Note 1: Results from [2004] and (2003) are shown in brackets.

As can be seen from the above table the sediment quality in 2006 is broadly similar to that of 2004 and 2005. The sediment also compares extremely favourably to samples taken from other parts of the south-east coastline.

5.3.2 Shellfish

Mussels samples (*Mytilus edulis*) were taken at a location downstream of the landfill, at the N25 Bridge at Dungarvan bypass road, on 11/12/06. Twelve individual mussels, of 6 cm average length, yielding approximately 30 grammes wet weight of flesh were sampled.

Mussels were depurated overnight in clean aerated estuarine water before de-shelling. The flesh was blotted dry and dried at 60deg for 3 days. The dried flesh was ground to powder and portions were analysed for metals at Euro Environmental Services Laboratory, Drogheda. QC and reference materials were processed with the samples. The results of this analysis are shown in Table 5.4 below.

Table 5.4: Mussel Sample Analysis

Site	Arsenic (mg/kg) ²	Cadmium (mg/kg) ²	Chromium (mg/kg) ²	Iron (mg/kg) ²	Lead (mg/kg) ²	Manganese (mg/kg) ²	Zinc (mg/kg) ²
Dungarvan Mussels ¹	1.9 {2.2} [9.8] (2.6)	0.07 {0.1} [0.34] (0.03)	0.15 {0.5}	15.8 {66.4} [212] (49)	0.72 {2.1} [15.4] (3.8)	0.65 {2.4} [18] (1.4)	8.3 {11.6} [51] (13.2)
Waterford Harbour EPA survey	3.7	0.4	1.1	115	1.5	5.7	39
Waterford Harbour EPA survey	1.6	0.1	0.9	62	<0.4	3.4	22.4
Dungarvan Harbour EPA survey	-	0.2	0.9	140	7.5	2.5	26
Shellfish Quality Standards	-	1.0	-	-	1.5	-	-
Marine Institute Study	-	0.44	0.86	-	0.77	-	28.5

Note 1: {2005}, [2004] and (2003) results are in brackets.

Note 2: Wet weight

The level of heavy metals present within the mussels sampled in 2006 is similar to that of the preceding years with most parameters actually decreasing in quantity. The mussels sampled downstream of the landfill also compare favourably with those sampled from other locations along the southeast coastline.

5.4 IMPACT OF ICW DISCHARGE ON SURROUNDING ECOLOGY

As discussed above there will be a strict control and monitoring regime associated with the ICW ecosystem. This regime will ensure that effluent will only be discharged when it meets the emission limits set down in Section 5.1.2 of this report. Once these limits are not breached the impact of the effluent on the surrounding waters and flora and fauna will be minimal.

6 CONCLUSION

Integrated Constructed Wetlands are a unique approach to the use of constructed wetlands in water quality management. They have the capacity to effectively and economically treat a wide range of types of contaminated water in a sustainable way, to enhance site values, as well as turning wastewater into significant economic, social and environmental resources.

Although ICWs have not yet been used to treat landfill leachate they have been used very successfully in a number of wastewater applications in the southeast. With this in mind it has been proposed that a significant monitoring system be installed as part of the ICW. This monitoring system is designed such that no treated effluent will be discharged that does not meet the criteria set down in this document. In addition this monitoring system will provide data on the efficiency of the system thus allowing further research on the technology to take place.

Considering the advantages of wetland systems over traditional methods of treating leachate it is likely that the treatment of leachate through the use of wetland systems will become more widespread dependent on the success of this pilot project.

7 REFERENCES

- Harrington, A., 2005. The relationship between plant vigour and ammonium concentrations in surface waters of constructed wetlands used to treat meat industry wastewaters in Ireland. In: Nutrient Management in Agricultural Watersheds: A Wetlands Solution, edited by E. J. Dunne, K.R. Reddy and O.T. Carton. Wageningen Academic Publishers, The Netherlands. 219-223.
- Harrington, R. E. J. Dunne, E. J., P. Carroll, P., J. Keohane, J., and C. Ryder, C., (2005) The concept, design and performance of integrated constructed wetlands for the treatment of farmyard dirty water. In: Nutrient Management in Agricultural Watersheds: A Wetlands Solution, edited by E. J. Dunne, K.R. Reddy and O.T. Carton. Wageningen Academic Publishers, The Netherlands. 179-188.
- Harrington, R., and C. Ryder. 2002. The use of integrated constructed wetlands in the management of farmyard runoff and waste water. In Proceedings of the National Hydrology Seminar on Water Resource Management: Sustainable Supply and Demand. Tullamore, Offaly. 19th Nov. 2002. The Irish National Committees of the IHP and ICID, Ireland. 55-63.
- [Harrington, R., Carroll, P., Carty, A., Keohane, J., Ryder, C., 2007, Integrated Constructed Wetlands : concept, design, site evaluation and performance, International Journal of Water, Vol. 3, No.3 pp. 243 - 256](#)
- Scholz M., Sadowski A. J., Harrington R. and Carroll P., 2007, Integrated Constructed Wetlands Assessment and Design for Phosphate Removal, Biosystems Engineering, 97 (3), 415-423.
- Scholz M., Harrington, R., Carroll, P., Mustafa, A., 2007, The Integrated Constructed Wetland (ICW) Concept, WETLANDS, Volume 27, No. 2, June 2007.
- Lewis, Lesley J., 2006, Ecological Survey of Dungarvan Landfill and Environs.

Appendix 1
2007 Ecology Survey



**LIMOSA ENVIRONMENTAL
ECOLOGICAL AND ENVIRONMENTAL CONSULTANCY**

Ecological Survey of Dungarvan Landfill and Environs



Report for

**Waterford County Council
September 2006**

Report Reference:

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Draft:

Draft Report

Prepared by:

Dr Lesley J. Lewis.

Date:

September 2006.

Signature:

Lesley J Lewis

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1.0 GENERAL INTRODUCTION

1.1 Background

Limosa Environmental was commissioned by Waterford County Council to conduct an ecological survey of Dungarvan Landfill and Environs as part of the on-going requirements of Condition 8.11 of the Dungarvan Waste Disposal Site waste licence (Reg. No. 32-1). After 30 years of operation, Dungarvan landfill was closed and capped in 2003. However, an area of built surfaces in the east of the site is still in operation as a site office and public recycling centre.

1.2 Ecological Setting

Dungarvan Landfill site is bordered to the south by agricultural land and to the east, north and west by a thin margin of land that separates it from the River Colligan (Figure 1). Beyond the landfill site (to the east) the river flows beneath Ballyneety Bridge and into the River Colligan Estuary before entering Dungarvan Harbour.

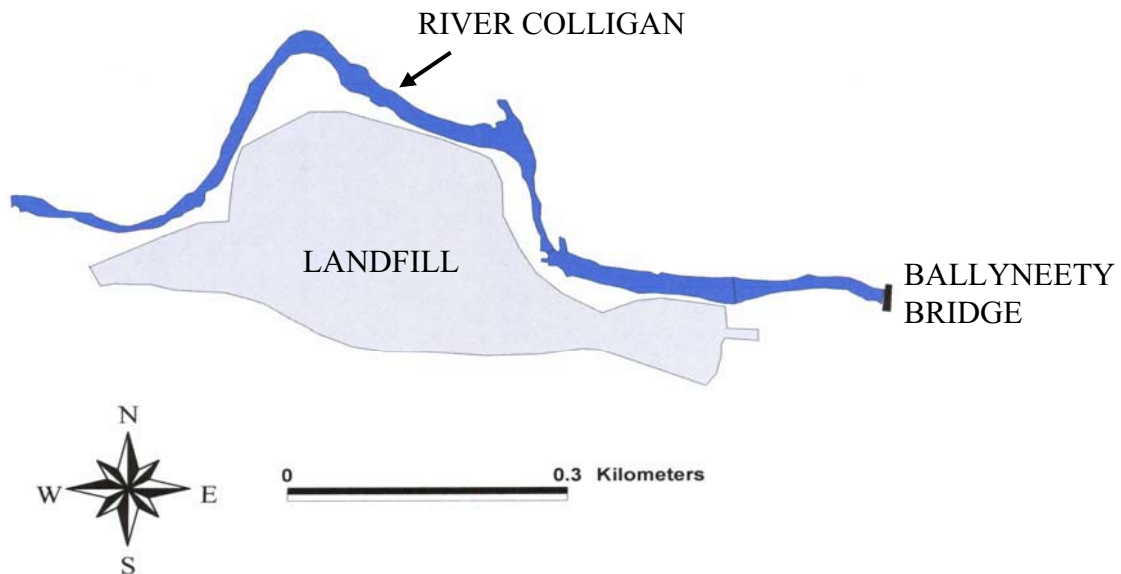


Figure 1. Showing location of Dungarvan Landfill in relation to the River Colligan and Ballyneety Bridge.

Dungarvan Landfill Site lies in close proximity to areas that have been designated for their ecological and conservation importance. These areas are legally protected under legislation as outlined in Box 1.

- Dungarvan Harbour is a designated Special Protection Area (SPA) under the terms of the EU 'Birds Directive'. The designated site (Code 032) covers an area of 1,041 hectares, and extends up the River Colligan estuary as far as Ballyneety Bridge, directly east of Dungarvan Landfill. The same area is also a designated Ramsar Site (Site Code 835).
- Dungarvan Harbour is also a Natural Heritage Area (NHA). The NHA site boundary extends above Ballyneety Bridge, and therefore adjacent to the landfill site boundary. The NHA site synopsis is presented in Appendix 1.1

Box 1**Designated Areas for Nature Conservation**

Designated areas for conservation are areas that are designated under national and/or European laws in order to conserve habitats and species of national or international conservation importance.

- **Natural Heritage Areas (NHA):** a national designation given legal status by the Wildlife Amendment (2000) Act.
- **Special Areas of Conservation (SAC):** areas considered of European and national importance whose legal basis is the EU Habitats Directive (92/43/EEC), transposed into Irish law through the European Union (Natural Habitats) Regulations, 1997.
- **Special Protection Areas (SPA):** sites of conservation importance for birds whose legal basis is the EU Birds Directive (79/409/EEC).
- **Wildfowl Sanctuary:** designated under the 1976 Wildlife Act.
- **Ramsar Site:** European designation based on the Ramsar Convention, 1984.

1.3 Report Format

This report details the results of ecological surveys that were carried out during August 2006. The study area encompassed the landfill site and the immediate surrounding habitats including the corridor of the River Colligan.

The report is presented in five further sections. Section 2 presents a habitat and botanical survey of Dungarvan Landfill and environs. Section 3 presents the results of a freshwater biological (freshwater macroinvertebrate) survey carried out at pre-determined sites along the River Colligan. Section 4 details the results of a mammal survey. Section 5 assesses the bird communities of the landfill and reviews data for Dungarvan Harbour from the Irish Wetland Bird Survey (I-WeBS). Section 6 concludes the report and gives recommendations for the future.

Appendix 1.1

NHA SITE SYNOPSIS Dungarvan Harbour (Site Code 0663).

In landscape terms Dungarvan Harbour lies at the eastern end of the Blackwater valley, though this river now turns south at Cappoquin, vacating its more obvious (and former) course. All that remains to the Harbour is the small Colligan River, running south from the Comeragh Mountains to enter the bay by Dungarvan itself. The absence of the larger river means that the bay is essentially a marine habitat though it dries out at low tide to give extensive mud and sand flats. It is extremely sheltered, the linear Cunnigar spit (which almost closes the bay on the east) adding to the effect of hills in the south and south-west.

The rock type of most of the area is limestone though this is only exposed on flat rocks at Ballynacourty. Elsewhere saltmarsh, glacial drift and sand form the shore with a narrow stony beach in places. The most natural saltmarsh occurs at Kilminnin on the north shore and west of the Cunnigar on the south. It is a community in which Sea Purslane (*Atriplex portulacoides*), Sea Lavender (*Limonium humile*), rushes (*Juncus gerardii*, *J. maritimus*) and sedges (*Carex distans*, *C. otrubae*) are prominent along with other typical species like Sea Spurrey (*Spergularia* spp.), Sea Arrowgrass (*Triglochin maritimum*) and, in the upper parts, Parsley Water Dropwort (*Oenanthe lachenalii*). In several places the saltmarshes, having been reclaimed for a period, have been flooded again and are reverting to their natural vegetation. There is an abundance of Sea Rush (*Juncus maritimus*) in such places often mixed with grasses, with Reed (*Phragmites australis*) or Sea Clubrush (*Bolboschoenus maritimus*) in drains. Sometimes this community gradually blends with a freshwater marsh including Tufted Hair Grass (*Deschampsia maritimus*) in drains. Sometimes this community gradually blends with a freshwater marsh including Tufted Hair Grass (*Deschampsia cespitosa*), Soft rush (*J. effusus*), Brown Sedge (*Carex disticha*) and Fleabane (*Pulicaria dysenterica*). Eelgrass (*Zostera* sp.) has been recorded in the area.

There are two beach and dune systems in the area, a tiny one where the old railway line crosses the bay at Skehacrine, and the major (2.6km) Cunnigar running north from the southern shore. The latter consists of narrow and low ridges separated at the southern end to give marshy 'slacks' between them but running together to the north. The beach plants include such species as Yellow Horned Poppy (*Glaucium flavum*), Sea Holly (*Eryngium maritimum*), Sea Radish (*Raphanus raphanistrum*) and Sand Sedge (*Carex arenaria*) while the large Sharp Rush (*Juncus acutus*) as well as Knotted Pearlwort (*Sagina nodosa*) occur in wetter sites.

A major part of the ecological importance of the bay is the wintering birdlife which is present in large numbers. Surveys in the winters 1984/85 - 86/87 showed that Brent Goose (694), Black-tailed Godwit (1329) and Bar-tailed Godwit (1029) occurred in numbers of international importance, while thirteen other species were nationally important. These are Shelduck (1721), Wigeon (1015), Red-breasted Merganser (50), Grey Plover (359), Golden Plover (1095), Lapwing (2748), Knot (705), Sanderling (83), Dunlin (4559), Redshank (930) and Turnstone (254). All figures are average peak populations. A further ten species were found in numbers of regional or local importance emphasising that Dungarvan supports a greater diversity of species than any other site on the south coast except for Wexford Harbour. It is now a Special Protection Area under the E.U. Birds Directive.

The sand flats to the east of the Cunnigar support an extensive oyster farming operation so there are clearly possible grounds for impact between these shellfish and the invertebrates on which some of the bird species depend. There is also concern that displacement of waterfowl and disturbance may be a problem on the shellfish farming area. At present the bird numbers are higher than in the previous survey (1971-75)

**National Parks and Wildlife Service (formerly Dúchas)
13 February 1995.**

2.0 HABITAT AND BOTANICAL SURVEY OF DUNGARVAN LANDFILL AND ENVIRONS

2.1 Introduction and Methodology

A habitat survey was carried out on the 28th August 2006. The survey area encompassed the landfill site and adjacent habitats including the corridor of the River Colligan to the north of the site.

The survey followed Phase 1 methodology (JNCC, 2003) as laid out in '*Draft Habitat Survey Guidelines*' (Heritage Council, 2002). Habitats within the study area were classified using habitat descriptions and codes set out in the Heritage Council's "*A Guide to Habitats in Ireland*" (Fossitt, 2000).

Target notes were made for all habitats encountered including notes on dominant vegetation and an assessment of habitat change since the 2005 survey. Plant species lists were drawn up for each habitat present.

Vascular plant names follow Stace (1997) and their frequency of occurrence within Ireland follows Webb *et al.* (1996). Throughout the text Latin names are given at first mention.

2.2 Results

The study area was determined by Waterford County Council and comprised the landfill itself, plus habitats within the immediate surrounding area.

The landfill site is comprised of five main habitats: **spoil and bare ground, recolonising bare ground, buildings and artificial surfaces, scrub and wet grassland.**

An area of **reed and large sedge swamp** separates a **leachate pond** from the **depositing/tidal river** (River Colligan) that flows along the northern edge of the site.

The landfill site is bordered to the north and south by agricultural habitats including **improved agricultural grassland, wet grassland and arable crops**. **Scrub** and **Treelines** occur throughout the agricultural landscape. Upper **saltmarsh** and **mudflats** occur above Ballyneety Bridge (to the east of the landfill site)

A habitat map is given in Figure 2.1.

Landfill habitats

Dungarvan Landfill site consists predominantly of a capped mound, in various stages of re-vegetation, access roads and tracks across the site and an area of hard standing in the south-east that supports an office, weigh-bridge and various recycling containers.

Spoil and bare ground ED2



This category includes areas of bare ground and heaps of spoil and rubble which are either transient in nature or persist over longer periods due to ongoing disturbance (Fossitt, 2000). Vegetation cover is less than 50% (Fossitt, 2000).

The gravel track around the perimeter of the site is included in this category as it has the potential to be colonised by plants – unlike tarmac and other artificial surfaces that must be broken down first.

Areas of capped landfill that were re-vegetating in 2005 have been recently cleared of vegetation and are classified as spoil and bare ground in the current survey. The amount of ED2 habitat has therefore increased since the 2005 survey.

Plant species are typically represented by ruderal species and those that are good colonisers e.g. Ragwort (*Senecio jacobaea*).

Species List:

Latin Name	Common Name	Frequency of occurrence in Ireland
<i>Agrostis stolonifera</i>	Creeping Bent	Abundant
<i>Anagallis arvensis</i>	Scarlet Pimpernel	Occasional to frequent
<i>Matricaria discoidea</i>	Pineappleweed	Abundant
<i>Plantago lanceolata</i>	Ribwort Plantain	Abundant
<i>Polygonum aviculare</i> agg.	Knotgrass	Abundant
<i>Rumex obtusifolius</i>	Broad-leaved Dock	Abundant
<i>Senecio vulgaris</i>	Groundsel	Abundant
<i>Senecio jacobaea</i>	Common Ragwort	Abundant
<i>Tripleurospermum inodorum</i>	Scentless Mayweed	Disturbed ground, occasional

Recolonising bare ground ED3

This category is used for any areas of formerly bare ground/soil that have been invaded by vegetation (Fossitt, 2000). Vegetation cover should be greater than 50% cover (Fossitt, 2000).



Recolonising bare ground can be a species rich habitat due to its recolonising nature with a variety of plants managing to co-exist before competition and succession leads to the domination of fewer species. Because of this, the species list is extensive but not all species are found in every area of this habitat.



Visually the habitat will differ at different times of year with the visually dominant species being those in flower at the time of survey. For example, the capped landfill cell was visually dominated by Scentless Mayweed (*Tripleurospermum inodorum*) at the time of survey; earlier in the flowering season the habitat would have looked different.

Within the site, vegetation cover varies greatly and in some places is close to 100%. Areas that have been undisturbed for some time are developing mature vegetation with plants such as Gorse (*Ulex europaeus*) dominating. If left undisturbed these areas will eventually become Scrub (WS1) habitat.

Other plant species that tend to dominate include Docks (*Rumex* spp.), Thistles (*Cirsium* spp.) Willowherb species and Common Ragwort (*Senecio jacobaea*). A mounded area in the south-east of the site was completely dominated by Lesser Burdock (*Arctium minus*).

Species List:

Latin Name	Common Name	Frequency of occurrence in Ireland
<i>Achillea millefolium</i>	Yarrow	Abundant
<i>Aethusa cynapium</i>	Fool's Parsley	Frequent
<i>Agrostis stolonifera</i>	Creeping Bent	Abundant
<i>Alnus glutinosa</i>	Alder	Abundant
<i>Anagallis arvensis</i>	Scarlet Pimpernel	Occasional to frequent
<i>Arctium minus sens.</i>	Lesser Burdock	Frequent
<i>Arrhenatherum elatius</i>	False Oat-grass	Abundant
<i>Atriplex patula</i>	Common Orache	Frequent
<i>Bellis perennis</i>	Daisy	Abundant
<i>Brassica rapa</i>	Turnip	Frequent in the south
<i>Calystegia sepium</i>	Hedge Bindweed	Frequent
<i>Capsella bursa-pastoris</i>	Shepherd's-purse	Abundant
<i>Centaurea nigra</i>	Common Knapweed	Abundant
<i>Cerastium fontanum</i>	Common Mouse-ear	Abundant
<i>Chamaerion angustifolium</i>	Rosebay Willowherb	Locally frequent
<i>Chenopodium album agg.</i>	Fat-hen	Frequent
<i>Cirsium arvense</i>	Creeping Thistle	Abundant
<i>Cirsium vulgare</i>	Spear Thistle	Abundant
<i>Calystegia sepium</i>	Hedge Bindweed	Frequent throughout
<i>Crocosmia aurea x C. pottsii</i>	Montbretia	Locally abundant in south & west
<i>Dactylis glomerata</i>	Cock's-foot	Abundant
<i>Daucus carota</i>	Wild Carrot	Frequent near the coast
<i>Digitalis purpurea</i>	Foxglove	Very frequent
<i>Elytrigia repens</i>	Common Couch	Abundant
<i>Epilobium hirsutum</i>	Great Willowherb	Very frequent
<i>Fallopia japonica</i>	Japanese Knotweed	Introduced species
<i>Filipendula ulmaria</i>	Meadowsweet	Frequent
<i>Fumaria officinalis</i>	Common Fumitory	Frequent near the east coast, rarer elsewhere
<i>Galium aparine</i>	Cleavers	Widespread and abundant
<i>Holcus lanatus</i>	Yorkshire Fog	Abundant
<i>Juncus effusus</i>	Soft Rush	Locally abundant
<i>Lathyrus pratensis</i>	Meadow Vetchling	Abundant
<i>Lolium perenne</i>	Perennial Rye-grass	Abundant
<i>Lotus corniculatus</i>	Bird's-foot trefoil	Abundant
<i>Matricaria discoidea</i>	Pineappleweed	Abundant
<i>Medicago lupulina</i>	Black Medick	Abundant
<i>Persicaria maculosa</i>	Redshank	Abundant
<i>Petasites hybridus</i>	Butterbur	Frequent but local
<i>Phragmites australis</i>	Common Reed	Very frequent
<i>Plantago lanceolata</i>	Ribwort Plantain	Abundant
<i>Plantago major</i>	Greater Plantain	Abundant
<i>Poa annua</i>	Annual Meadow-grass	Abundant
<i>Polygonum aviculare agg.</i>	Knotgrass	Abundant
<i>Potentilla anserine</i>	Silverweed	Abundant
<i>Potentilla reptans</i>	Creeping Cinquefoil	Frequent in south & centre
<i>Prunella vulgaris</i>	Self Heal	Abundant
<i>Pulicaria dysenterica</i>	Common Fleabane	Fairly frequent in south
<i>Ranunculus repens</i>	Creeping Buttercup	Abundant
<i>Rosa canina</i>	Dog-rose	Very frequent
<i>Rubus fruticosus agg.</i>	Bramble	Abundant
<i>Rumex obtusifolius</i>	Broad-leaved Dock	Abundant
<i>Scrophularia auriculata</i>	Water Figwort	Frequent in south & west
<i>Senecio jacobaea</i>	Common Ragwort	Abundant
<i>Senecio vulgaris</i>	Groundsel	Abundant
<i>Sinapis arvensis</i>	Charlock	Frequent
<i>Sisymbrium officinale</i>	Hedge Mustard	Very frequent
<i>Sonchus asper</i>	Prickly Sow-thistle	Very frequent
<i>Sonchus oleraceus</i>	Smooth Sow-thistle	Frequent
<i>Stachys sylvatica</i>	Hedge Woundwort	Very frequent
<i>Stachys palustris</i>	Marsh Woundwort	frequent

<i>Stellaria media</i>	Common Chickweed	Abundant
<i>Taraxacum officinale</i>	Dandelion	Abundant
<i>Trifolium pratense</i>	Red Clover	Abundant
<i>Trifolium repens</i>	White Clover	Abundant
<i>Tripleurospermum inodorum</i>	Scentless Mayweed	Disturbed ground, occasional
<i>Urtica dioica</i>	Common Nettle	Abundant
<i>Veronica chamaedrys</i>	Germander Speedwell	Abundant
<i>Veronica persica</i>	Common Field-speedwell	Abundant
<i>Ulex europaeus</i>	Gorse	Abundant

Wet Grassland (GS4) and Scrub (WS1)



The steep southern bank of the landfill site was recorded as wet grassland in 2004, a habitat that had developed from recolonising bare ground. In 2005, this area appeared as a transition between recolonising bare ground and scrub, with Gorse dominating in places. In the current survey however, this area is classified as wet grassland and Gorse scrub (WS1).

The habitats intermix but the habitat map (Figure 2.1) shows large areas dominated by Gorse. The wet grassland habitat has a diversity of plant species typical of ED3 but in places is dominated by swathes of Soft Rush (*Juncus effusus*) and Silverweed (*Potentilla*

anserine).

Species List:

Latin Name	Common Name	Frequency of occurrence in Ireland
<i>Agrostis stolonifera</i>	Creeping Bent	Abundant
<i>Arrhenatherum elatius</i>	False Oat-grass	Abundant
<i>Atriplex patula</i>	Common Orache	Frequent
<i>Brassica rapa</i>	Turnip	Frequent in the south
<i>Calystegia sepium</i>	Hedge Bindweed	Frequent
<i>Capsella bursa-pastoris</i>	Shepherd's-purse	Abundant
<i>Cerastium fontanum</i>	Common Mouse-ear	Abundant
<i>Chamaerion angustifolium</i>	Rosebay Willowherb	Locally frequent
<i>Chenopodium album</i> agg.	Fat-hen	Frequent
<i>Cirsium arvense</i>	Creeping Thistle	Abundant
<i>Cirsium vulgare</i>	Spear Thistle	Abundant
<i>Calystegia sepium</i>	Hedge Bindweed	Frequent throughout
<i>Dactylis glomerata</i>	Cock's-foot	Abundant
<i>Elytrigia repens</i>	Common Couch	Abundant
<i>Epilobium hirsutum</i>	Great Willowherb	Very frequent
<i>Holcus lanatus</i>	Yorkshire Fog	Abundant
<i>Juncus effusus</i>	Soft Rush	Locally abundant
<i>Lathyrus pratensis</i>	Meadow Vetchling	Abundant
<i>Lotus corniculatus</i>	Bird's-foot trefoil	Abundant
<i>Medicago lupulina</i>	Black Medick	Abundant
<i>Mentha aquatica</i>	Water Mint	Frequent
<i>Persicaria maculosa</i>	Redshank	Abundant
<i>Plantago lanceolata</i>	Ribwort Plantain	Abundant
<i>Poa annua</i>	Annual Meadow-grass	Abundant
<i>Polygonum aviculare</i> agg.	Knotgrass	Abundant
<i>Potentilla anserine</i>	Silverweed	Abundant
<i>Potentilla reptans</i>	Creeping Cinquefoil	Frequent in south & centre
<i>Prunella vulgaris</i>	Self Heal	Abundant
<i>Ranunculus repens</i>	Creeping Buttercup	Abundant
<i>Rubus fruticosus</i> agg.	Bramble	Abundant
<i>Rumex obtusifolius</i>	Broad-leaved Dock	Abundant
<i>Scrophularia auriculata</i>	Water Figwort	Frequent in south & west
<i>Senecio jacobaea</i>	Common Ragwort	Abundant
<i>Sonchus oleraceus</i>	Smooth Sow-thistle	Frequent
<i>Stachys palustris</i>	Marsh Woundwort	frequent

<i>Taraxacum officinale</i>	Dandelion	Abundant
<i>Trifolium pratense</i>	Red Clover	Abundant
<i>Trifolium repens</i>	White Clover	Abundant
<i>Tripleurospermum inodorum</i>	Scentless Mayweed	Disturbed ground, occasional
<i>Urtica dioica</i>	Common Nettle	Abundant
<i>Veronica chamaedrys</i>	Germander Speedwell	Abundant
<i>Ulex europaeus</i>	Gorse	Abundant

Buildings and artificial surfaces BL3



This category comprises areas of concrete and hard standing, metal storage containers, office and ancillary structures in the south-east of the site. It also includes the tarmac road leading to the site.

By its nature, plant life is scarce. Evidence of weed-killing activity was evident this year although a few plant species (e.g. Dock) have still managed to take hold.

Artificial Pond FL8



A leachate pond occurs in the south-east of the landfill site classified as an artificial pond (FL8).

The pond supports little submerged or emergent vegetation but has an extensive reedbed behind it (classified separately as reed and large sedge swamp (FS1). The landward edge of the pond supports a few plant species typical of the surrounding recolonising bare ground habitats e.g. Charlock (*Sinapis arvensis*) and Broad-leaved Dock (*Rumex obtusifolius*).

Species List:

Latin Name	Common Name	Frequency of occurrence in Ireland
<i>Brassica rapa</i>	Turnip	Frequent in the south
<i>Chenopodium album</i> agg.	Fat-hen	Frequent
<i>Fumaria officinalis</i>	Common Fumitory	Frequent near the east coast, rarer elsewhere
<i>Persicaria maculosa</i>	Redshank	Abundant
<i>Polygonum aviculare</i> agg.	Knotgrass	Abundant
<i>Rumex obtusifolius</i>	Broad-leaved Dock	Abundant
<i>Salix</i> sp.	Willow	Frequent
<i>Senecio vulgaris</i>	Groundsel	Abundant
<i>Taraxacum officinale</i>	Dandelion	Abundant

Freshwater Pond



This small pond is located in the south-east of the landfill site and directly south-west of the leachate pond. It is thought to be of natural origin (P. Carroll pers. comm.). It was first identified in the 2005 survey and has since expanded in size and developed an interesting wetland flora.

Wetland plant species include Purple-loosestrife (*Lythrum salicaria*), Jointed Rush (*Juncus articulatus*) and Bulrush (*Typha latifolia*).

Species List:

Latin Name	Common Name	Frequency of occurrence in Ireland
<i>Glyceria fluitans</i>	Floating Sweet-grass	Very frequent
<i>Juncus articulatus</i>	Jointed Rush	Abundant
<i>Juncus inflexus</i>	Hard Rush	Abundant in centre, local elsewhere
<i>Lotus corniculatus</i>	Bird's-foot trefoil	Abundant
<i>Lythrum salicaria</i>	Purple - loosestrife	Abundant
<i>Persicaria amphibia</i>	Amphibious Bistort	Frequent
<i>Potentilla reptans</i>	Creeping Cinquefoil	Frequent in south and centre, rarer in north
<i>Rorippa nasturtium-aquaticum</i> agg.	Water-cress	Very frequent
<i>Scrophularia auriculata</i>	Water Figwort	Frequent in south and west, occasional elsewhere
<i>Schoenoplectus lacustris</i>	Common Club-rush	Frequent
<i>Typha latifolia</i>	Bulrush	Frequent but local

Habitats in the immediate surrounding environment**Wet Grassland GS4**

Wet grassland occurs just beyond the landfill site boundary in two places (1) to the west of the site in association with an area of alder scrub (2) between the landfill perimeter track and the River Colligan in the north.

The area to the west of the site has denser vegetation than that recorded in 2005. Wet ground species such as Water Mint (*Mentha aquatica*) and Water Forget-me-not (*Myosotis scorpioides*) were not as abundant as in 2005 and Knotgrasses (*Polygonum aviculare* agg.) dominated large patches together with Purple-loosestrife. Alder (*Alnus glutinosus*) is visibly encroaching into the grassland area; if left unchecked this will lead to the entire area becoming scrub habitat.

The area of wet grassland close to the river remains relatively unchanged since the 2005 survey although the adjacent area of Common Reed (*Phragmites australis*) is expanding.



Species List:

Latin Name	Common Name	Frequency of occurrence in Ireland
<i>Agrostis stolonifera</i>	Creeping Bent	Abundant
<i>Alnus glutinosa</i>	Alder	Abundant
<i>Arrhenatherum elatius</i>	False Oat-grass	Abundant
<i>Carex</i> sp.	Sedge species	Abundant
<i>Calystegia sepium</i>	Hedge Bindweed	Frequent
<i>Centaurea nigra</i>	Common Knapweed	Abundant
<i>Cerastium fontanum</i>	Common Mouse-ear	Abundant
<i>Cirsium arvense</i>	Creeping Thistle	Abundant
<i>Cirsium vulgare</i>	Spear Thistle	Abundant

<i>Dactylis glomerata</i>	Cock's-foot	Abundant
<i>Elytrigia repens</i>	Common Couch	Abundant
<i>Epilobium hirsutum</i>	Great Willowherb	Very frequent
<i>Equisetum fluviatile</i>	Water horsetail	Very frequent
<i>Festuca rubra</i>	Red fescue	Abundant
<i>Filipendula ulmaria</i>	Meadowsweet	Frequent
<i>Galium aparine</i>	Cleavers	Widespread and abundant
<i>Juncus effusus</i>	Soft Rush	Locally abundant
<i>Juncus inflexus</i>	Hard Rush	Abundant in centre, local elsewhere
<i>Lythrum salicaria</i>	Purple Loosestrife	Frequent in the east
<i>Mentha aquatica</i>	Water Mint	Frequent
<i>Myosotis scorpioides</i>	Water Forget-me-not	Frequent and widespread
<i>Persicaria maculosa</i>	Redshank	Abundant
<i>Phragmites australis</i>	Common Reed	Very frequent
<i>Plantago lanceolata</i>	Ribwort Plantain	Abundant
<i>Potentilla anserina</i>	Silverweed	Abundant
<i>Potentilla reptans</i>	Creeping Cinquefoil	Frequent in south & centre
<i>Pulicaria dysenterica</i>	Common Fleabane	Frequent in south half, occasional in north
<i>Ranunculus repens</i>	Creeping Buttercup	Abundant
<i>Rubus fruticosus</i> agg.	Bramble	Abundant
<i>Rumex obtusifolius</i>	Broad-leaved Dock	Abundant
<i>Salix</i> sp.	Willow	Frequent
<i>Scrophularia auriculata</i>	Water Figwort	Frequent in south & west
<i>Sonchus oleraceus</i>	Smooth Sow-thistle	Frequent
<i>Trifolium pratense</i>	Red Clover	Abundant
<i>Urtica dioica</i>	Common Nettle	Abundant
<i>Vicia cracca</i>	Tufted Vetch	Abundant

Dry Meadows and grassy verges GS2

Dry neutral grassland occurs in a few places along the bank of the River Colligan. These areas are too small to be mapped.

Species List:

Latin Name	Common Name	Frequency of occurrence in Ireland
<i>Bellis perennis</i>	Daisy	Abundant
<i>Centaurea nigra</i>	Common Knapweed	Abundant
<i>Cirsium vulgare</i>	Spear Thistle	Abundant
<i>Dactylis glomerata</i>	Cock's-foot	Abundant
<i>Festuca rubra</i>	Red fescue	Abundant
<i>Hieracium</i> sp.	Hawkweed spp.	Frequent
<i>Holcus lanatus</i>	Yorkshire Fog	Abundant
<i>Lolium perenne</i>	Perennial Rye-grass	Abundant
<i>Plantago lanceolata</i>	Ribwort Plantain	Abundant
<i>Potentilla anserina</i>	Silverweed	Abundant
<i>Potentilla reptans</i>	Creeping Cinquefoil	Frequent in south & centre
<i>Rumex acetosa</i>	Common Sorrel	Abundant
<i>Rumex obtusifolius</i>	Broad-leaved Dock	Abundant
<i>Senecio vulgaris</i>	Groundsel	Abundant
<i>Taraxacum officinale</i>	Dandelion	Abundant
<i>Trifolium repens</i>	White Clover	Abundant

Depositing River FW2/Tidal River CW2



Dungarvan Landfill site lies in a wide bend of the River Colligan; the river effectively forming a boundary to the west, north and east of the site. To the west of the landfill the river is classified as a **depositing river** (FW2). Slightly further downstream (Freshwater Sampling Site 2 onwards – See Section 3) an obvious tidal influence results in the classification **tidal river** (CW2).

During the survey, the in-stream vegetation was dominated by algae species *Cladophera* spp. and *Enteromorpha* spp with lesser amounts of moss (*Fontinalis* sp.). The algae were noted to be abundant, as also found in the 2005 survey.

Fool's Watercress (*Apium nodiflorum*) is an emergent plant in some sheltered parts of the river. River bank species are considered in the following section.

Recolonising bare ground ED3 – River Bank



The immediate banks of the river support vegetation typical of recolonising bare ground, either on bare soil or shingle substrates. In places the river bank appears to have been modified/strengthened since the 2005 survey (see photo below):

Species List:

Latin Name	Common Name	Frequency of occurrence in Ireland
<i>Achillea millefolium</i>	Yarrow	Abundant
<i>Agrostis stolonifera</i>	Creeping Bent	Abundant
<i>Bellis perennis</i>	Daisy	Abundant
<i>Beta vulgaris</i> subsp. <i>Maritima</i>	Sea Beet	Widespread but occasional
<i>Brassica rapa</i>	Turnip	Frequent in the south
<i>Cerastium fontanum</i>	Common Mouse-ear	Abundant
<i>Crocsmia aurea</i> x <i>C. pottsii</i>	Montbretia	Locally abundant in south & west
<i>Dactylis glomerata</i>	Cock's-foot	Abundant
<i>Epilobium hirsutum</i>	Great Willowherb	Very frequent
<i>Equisetum</i> sp.	Horsetail sp.	Abundant
<i>Fallopia japonica</i>	Japanese Knotweed	Introduced species
<i>Festuca</i> spp.	Fescues	Abundant
<i>Fuchsia</i> spp.	Fuchsia	Mainly in the west
<i>Lotus corniculatus</i>	Bird's-foot trefoil	Abundant
<i>Leontodon autumnalis</i>	Autumn Hawkbit	Frequent
<i>Matricaria discoidea</i>	Pineappleweed	Abundant
<i>Mentha aquatica</i>	Water Mint	Frequent
<i>Myosotis scorpioides</i>	Water Forget-me-not	Frequent and widespread
<i>Persicaria maculosa</i>	Redshank	Abundant
<i>Phragmites australis</i>	Common Reed	Very frequent
<i>Plantago lanceolata</i>	Ribwort Plantain	Abundant
<i>Plantago major</i>	Greater Plantain	Abundant
<i>Poa annua</i>	Annual Meadow-grass	Abundant
<i>Polygonum aviculare</i> agg.	Knotgrass	Abundant
<i>Potentilla anserina</i>	Silverweed	Abundant
<i>Potentilla reptans</i>	Creeping Cinquefoil	Frequent in south & centre
<i>Ranunculus repens</i>	Creeping Buttercup	Abundant

<i>Rorippa nasturtium-aquaticum</i> agg.	Water-cress	Very frequent
<i>Rumex obtusifolius</i>	Broad-leaved Dock	Abundant
<i>Scrophularia auriculata</i>	Water Figwort	Frequent in south & west
<i>Senecio jacobaea</i>	Common Ragwort	Abundant
<i>Solanum dulcamara</i>	Bittersweet	Occasional
<i>Stachys palustris</i>	Marsh Woundwort	Frequent
<i>Taraxacum officinale</i>	Dandelion	Abundant
<i>Tripleurospermum inodorum</i>	Scentless Mayweed	Disturbed ground, occasional
<i>Ulex europaeus</i>	Gorse	Abundant
<i>Urtica dioica</i>	Common Nettle	Abundant

Recolonising bare ground ED3 – well-colonised bank behind leachate pool and along River Colligan



A bank separates the River Colligan and the reed and large sedge swamp bordering the leachate pond. This diverse habitat does not easily fit into any habitat category but has developed from recolonising bare ground.

Common Reed is encroaching more and more into this area and scrub species (e.g. Gorse and Bramble) are denser this year. This area will most likely become reedbed merging into scrub habitat.

Further east, sandwiched between the landfill, built area (BL3) and the River Colligan, is a further area of well-colonised bank developed from recolonising bare ground over the past two years. This area has been planted with saplings but is very overgrown with a variety of 'weed' species. Lesser Burdock dominated at the time of survey.

Species List:

Latin Name	Common Name	Frequency of occurrence in Ireland
<i>Achillea millefolium</i>	Yarrow	Abundant
<i>Agrostis stolonifera</i>	Creeping Bent	Abundant
<i>Alnus glutinosa</i>	Alder	Abundant
<i>Arctium minus sens.</i>	Lesser Burdock	Frequent
<i>Arrhenatherum elatius</i>	False Oat-grass	Abundant
<i>Brassica rapa</i>	Turnip	Frequent in the south
<i>Chamaerion angustifolium</i>	Rosebay Willowherb	Locally frequent
<i>Cirsium</i> sp.	Thistle species	Abundant
<i>Dactylis glomerata</i>	Cock's-foot	Abundant
<i>Epilobium hirsutum</i>	Great Willowherb	Very frequent
<i>Equisetum</i> sp.	Horsetail sp.	Abundant
<i>Fallopia japonica</i>	Japanese Knotweed	Introduced species
<i>Festuca</i> spp.	Fescues	Abundant
<i>Fuchsia</i> spp.	Fuchsia	Mainly in the west
<i>Juncus effusus</i>	Soft Rush	Locally abundant
<i>Lotus corniculatus</i>	Bird's-foot trefoil	Abundant
<i>Leontodon autumnalis</i>	Autumn Hawkbit	Frequent
<i>Lonicera periclymenum</i>	Honeysuckle	Frequent and widespread
<i>Matricaria discoidea</i>	Pineappleweed	Abundant
<i>Mentha aquatica</i>	Water Mint	Frequent
<i>Persicaria maculosa</i>	Redshank	Abundant
<i>Petasites hybridus</i>	Butterbur	Frequent but local
<i>Phragmites australis</i>	Common Reed	Very frequent
<i>Plantago lanceolata</i>	Ribwort Plantain	Abundant
<i>Plantago major</i>	Greater Plantain	Abundant
<i>Polygonum aviculare</i> agg.	Knotgrass	Abundant
<i>Potentilla anserina</i>	Silverweed	Abundant
<i>Potentilla reptans</i>	Creeping Cinquefoil	Frequent in south & centre
<i>Prunus spinosa</i>	Blackthorn	Very frequent
<i>Pulicaria dysenterica</i>	Common Fleabane	Frequent in south half, occasional in north
<i>Ranunculus repens</i>	Creeping Buttercup	Abundant

<i>Rumex obtusifolius</i>	Broad-leaved Dock	Abundant
<i>Rumex crispus</i>	Curled Dock	Abundant
<i>Scrophularia auriculata</i>	Water Figwort	Frequent in south & west
<i>Senecio jacobaea</i>	Common Ragwort	Abundant
<i>Solanum dulcamara</i>	Bittersweet	Occasional
<i>Stachys palustris</i>	Marsh Woundwort	Frequent
<i>Taraxacum officinale</i>	Dandelion	Abundant
<i>Tripleurospermum inodorum</i>	Scentless Mayweed	Disturbed ground, occasional
<i>Ulex europaeus</i>	Gorse	Abundant
<i>Urtica dioica</i>	Common Nettle	Abundant
<i>Vicia cracca</i>	Tufted Vetch	Abundant

Scrub WS1, Hedgerows WL1 and Treelines WL2

Scrub is defined as areas that are dominated by at least 50% cover of shrubs, stunted trees or brambles (Fossitt, 2000). Scrub occurs in several places, most notably to the north of the River Colligan in the west of the survey area and Alder-dominated scrub in association with the wet grassland to the west of the landfill site. Gorse scrub occurs on the southern banks of the landfill and several other areas within the survey area are likely to become scrub habitat as scrub vegetation matures and dominates.

Hedgerows and treelines occur as field boundaries within the surrounding environment. The right-hand (northern) hedgerow of the roadway leading to the landfill site is comprised almost exclusively of the alien species Japanese Knotweed (*Fallopia japonica*).

Species List:

Latin Name	Common Name	Frequency of occurrence in Ireland
<i>Acer pseudoplatanus</i>	Sycamore	Abundant
<i>Agrostis stolonifera</i>	Creeping Bent	Abundant
<i>Alnus glutinosa</i>	Alder	Abundant
<i>Calystegia sepium</i>	Hedge Bindweed	Frequent
<i>Cirsium</i> sp.	Thistle sp.	Abundant
<i>Corylus avellana</i>	Hazel	Locally abundant
<i>Calystegia sepium</i>	Hedge Bindweed	Frequent throughout
<i>Crataegus monogyna</i>	Hawthorn	Locally frequent
<i>Fallopia japonica</i>	Japanese Knotweed	Introduced species
<i>Fraxinus excelsior</i>	Ash	Abundant
<i>Fuchsia magellanica</i>	Fuchsia	Mainly in the west
<i>Galium aparine</i>	Cleavers	Widespread and abundant
<i>Hedera helix</i>	Ivy	Widespread and abundant
<i>Ligustrum vulgare</i>	Privet	Garden escape
<i>Lonicera periclymenum</i>	Honeysuckle	Frequent and widespread
<i>Phyllitis scolopendrium</i>	Hart's-tongue fern	Very frequent
<i>Prunus spinosa</i>	Blackthorn	Very frequent
<i>Pteridium aquilinum</i>	Bracken	Abundant
<i>Rosa canina</i>	Dog-rose	Very frequent
<i>Rubus fruticosus</i> agg.	Bramble	Abundant
<i>Salix</i> sp.	Willow	Frequent
<i>Sambucus nigra</i>	Elder	Frequent
<i>Scrophularia auriculata</i>	Water Figwort	Frequent in south and west, occasional elsewhere
<i>Stachys sylvatica</i>	Hedge Woundwort	Very frequent
<i>Urtica dioica</i>	Common Nettle	Abundant
<i>Vicia cracca</i>	Tufted Vetch	Abundant

Reed and Large Sedge Swamp FS1

Occurring between the leachate pond and the river, this habitat is almost a mono-dominant stand of Common Reed.

Stands of Common Reed also occur in places along the southern riverbank.

Mud Shores (LS4)

An expanse of mud flats occurs above Ballyneety Bridge. This habitat consists of fine sediments (silt/clays) that occur as an intertidal area on either side of the River Colligan. Fine sediments are also visible along the river bank as far upstream as between freshwater sampling sites 3 and 4. This intertidal habitat and its flora and fauna are discussed in greater detail within Section 3.

Upper saltmarsh CM2

Saltmarshes are wetlands that are inundated twice daily by the sea (Curtis, 2003). The variation in tidal height determines the distribution of plants and animals on the saltmarsh; the lower on the shore the greater the inundation, while the higher on the shore the shorter duration of flooding. Hence saltmarshes have been classified as upper and lower.

An extensive area of upper saltmarsh occurs to the north of the River Colligan, immediately to the east of the landfill site. Subject to less frequent and less periodic inundation by brackish water, upper saltmarsh supports both salt-tolerant and terrestrial plants species (Fossitt, 2000).

Species List:

Latin Name	Common Name	Frequency of occurrence in Ireland
<i>Agrostis stolonifera</i>	Creeping Bent	Abundant
<i>Aster tripolium</i>	Sea Aster	Very frequent
<i>Beta vulgaris</i> subsp. <i>Maritima</i>	Sea Beet	Widespread but occasional
<i>Bolboschoenus maritimus</i>	Sea Club-rush	Very frequent
<i>Cochleria officinale</i>	Common Scurvey-grass	Frequent
<i>Festuca rubra</i>	Red fescue	Abundant
<i>Juncus articulatus</i>	Jointed Rush	Abundant
<i>Phragmites australis</i>	Common Reed	Very frequent
<i>Schoenoplectus lacustris</i>	Common club-rush	Frequent
<i>Triglochin maritimum</i>	Sea Arrowgrass	Very frequent

Improved Agricultural Grassland GA1

This classification describes managed or modified agricultural grassland. It occurs to the north-east of the landfill site and is currently being used for grazing (cattle and horses).

Arable Crops BC1

Three fields of arable crops occur immediately south of the landfill site. As in 2005, they are all planted with Maize in 2006.

2.3 Discussion and Conclusions

2.3.1 Ecological value of the survey area

The habitats recorded within Dungarvan landfill site can be categorised as either semi-natural habitats (e.g. recolonising bare ground) or artificial or modified habitats (e.g. spoil and bare ground). These habitats have relatively low ecological value, particularly as they are subject to intermittent disturbance. However they provide good feeding grounds for a variety of bird, mammal and invertebrate species. With reference to the latter, butterflies were very abundant this year, particularly feeding within the wet grassland habitat.

In terms of floral diversity, recolonising bare ground can have good species diversity because at this early stage of succession many plant species can co-exist. Recolonising bare ground habitats can also provide a vacant niche for 'unwanted' plants to colonise such as alien, invasive species. For instance, a stand of Japanese Knotweed has colonised the southern banks of the capped area within the landfill and will spread if allowed. This species will be discussed in greater detail below.

The natural freshwater pond located to the south-east of the leachate pond has developed an interesting wetland plant community and is likely to attract a variety of wildlife including Common Frogs (*Rana temporaria*). This small habitat should ideally be conserved during site rehabilitation.

The natural habitats surrounding the landfill site are far more valuable in terms of the flora and fauna they support. In particular the survey recorded a diversity of habitats associated with the River Colligan. These range from freshwater habitats to brackish to estuarine habitats. Each of these exhibit a range of plant species, some of which are particular to the habitat type, and thus increase the floral diversity, biodiversity and ecological importance of the area. It is therefore not surprising that the River Colligan estuary is included in the Dungarvan Harbour NHA.

The majority of plant species recorded during the survey are considered abundant and widespread throughout Ireland. None of the recorded plant species are listed as Red Data species (Curtis & McGough, 1988) or are listed on the Flora (Protection) Order, 1999.

While none of the habitats recorded are protected under the EU Habitats Directive, large and prime examples of intertidal mud flats can be selected as the Annex I habitat 'mudflats and sandflats not covered by seawater at low tide (Habitat Code 1140, EU Habitats Directive 92/43/EEC). Likewise, some estuaries are designated under this directive.

2.3.2 Comparison of the 2006 survey with previous annual surveys

The main differences between the 2006, 2005 and 2004 surveys are as follows:

- The steep southern bank of the landfill site was classified as wet grassland in 2004, a habitat that had developed from recolonising bare ground. In 2005, this area appeared to be a transition between recolonising bare ground and scrub, with Gorse (*Ulex europaeus*) dominating in places. This year large areas are classified as scrub because Gorse encroachment has continued. The remainder of the bank is classified as wet grassland (GS4) due to the presence of rushes and other characteristic wet grassland plant species.
- A larger area of the capped landfill mound is now classified as spoil and bare ground due to vegetation clearance that has been undertaken since the 2005 survey.
- There is natural Alder scrub encroachment into the wet grassland habitat to the west of the landfill boundary.
- The freshwater pond to the south-east of the leachate pond has increased in size since 2005 and has developed an interesting wetland flora around it, despite being completely surrounded by ruderal and 'weed' plant species typical of recolonising bare ground habitats. This habitat was not recorded during 2004.

- The strip of recolonising bare ground between the landfill approach roadway and the River Colligan (planted with saplings) has significantly more vegetation during 2006. As this area does not fit easily into a habitat classification it has been classified as recolonising bare ground (well-colonised bank) similar to habitat further upstream.
- There is a potential increase in the spread of Japanese Knotweed (See below).
- Himalayan Balsam (*Impatiens glandulifera*) was recorded during 2005 within ED2 habitat (behind the transfer station). This species was highlighted as an alien invasive species. The plant was not recorded during the current survey and may have been removed during weed-killing operations. Its absence is considered positive.

Comparisons between the 2006 survey and those prior to 2004 are less straightforward due to different survey methodology, timing, mapping, habitat classifications and sampling effort used. However, the saltmarsh community appears to have altered little since the reports of Goodwillie's (1998) and Lyons (2003). Likewise, the reedbed habitats have changed little apart from probably increasing in size over the years.

The threat of the alien, invasive plant species Japanese Knotweed was highlighted previously (Limosa Environmental, 2005) and must again be mentioned this year. Japanese Knotweed is an alien, invasive species, defined as a non-native species that has become established in natural or semi-natural ecosystems or habitats and an agent of change, therefore constituting a threat to native biological diversity (SSG, 2000). The threat from this plant was highlighted in the Heritage Council News (March, 2006) and the ease with which this plant can spread and the damage that it can cause to ecosystems and the built environment are well documented across Ireland and the UK. For example in the UK, all parts of the plant and soil that the plant has previously grown in are considered controlled waste under their Waste Regulations. Complete removal of established areas of Japanese Knotweed is very expensive – it is estimated that around 9.5 million pounds sterling will be needed to eradicate the plant from in and around Swansea in South Wales (information from the Japanese Knotweed Alliance); its removal from the London site of the 2012 Olympics is estimated at several hundreds of thousands of pounds (www.bbc.co.uk).



A single stand of Japanese Knotweed was recorded on the southern edge of the capped mound (See photo below). We strongly recommend that this plant is removed using correct procedures and that the area is monitored for signs of any re-growth. With careful management, this plant can be eradicated from within the site boundaries.

Outside the site, Japanese Knotweed was recorded at various locations along the River Colligan and is most invasive along the hedgerow on the right-hand side of the access road to the landfill. At the time of the 2006 survey this hedgerow had been recently cut. As highlighted by Limosa Environmental (2005) cutting this plant with a conventional tractor-mounted hedge-cutter will only aid its re-growth as the plant is very effective at spreading via fragments of stem material (Child & Wade, 2000). The growth of Japanese Knotweed in this particular area is quite extensive and at this stage a more detailed and long-term eradication programme would be needed in order to attempt to control this outbreak.

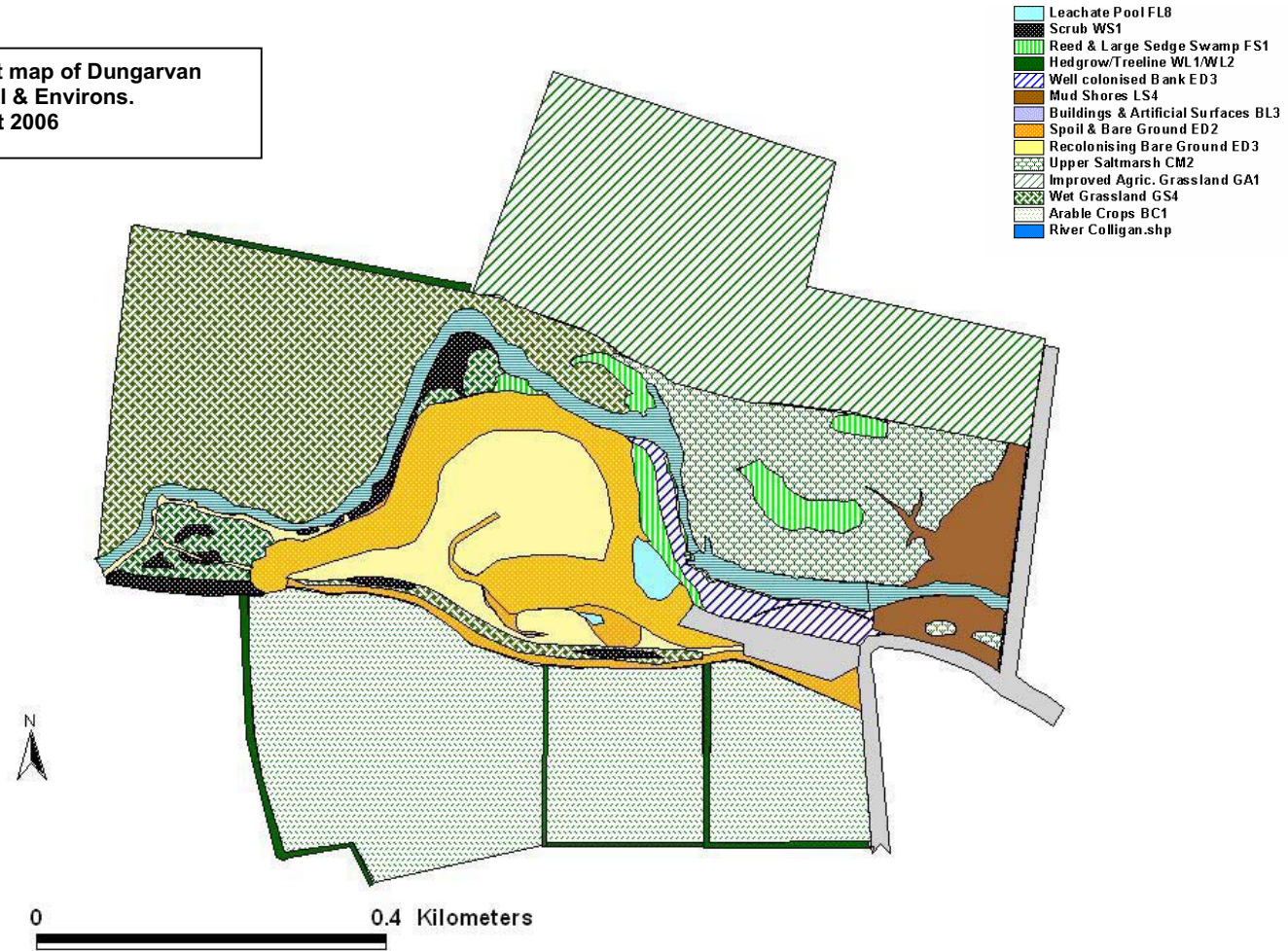
Mature flowering stand of Japanese Knotweed

(photo from Limosa Environmental files)



Figure 2.1

**Habitat map of Dungarvan
Landfill & Environs.
August 2006**



3.0 BIOLOGICAL ASSESSMENT OF THE RIVER COLLIGAN

3.1 Background

Dungarvan landfill site is bordered to the west, north and east by a thin margin of land that separates it from the River Colligan. As the river flows past the landfill site, it becomes increasingly brackish (estuarine) in nature. Beyond the landfill site (to the east) the river flows beneath Ballyneety Bridge and into the River Colligan Estuary, eventually draining into Dungarvan Harbour.

A biological assessment of the River Colligan is undertaken annually as part of the ecological investigations. This section of the ecological report details the results of the 2006 survey.

The survey is undertaken at five pre-determined sites, two of which are also EPA sampling sites as part of their River Quality Monitoring Programme. The current survey takes into account both the freshwater and estuarine nature of the river within the survey area. However, water quality can only be assessed as per the biological quality rating for rivers (Box 2) for the freshwater sites (generally Site 1 only).

BOX 2

The Biological Quality Rating System For Rivers

The longitudinal distribution of aquatic organisms along a river/stream is defined by a number of physical, chemical and biological factors. However, as groups of organisms or individual species are adapted to different conditions they also exhibit a range of sensitivities to varying environmental conditions. The presence or absence of certain groups or species may therefore be used as a means of measuring environmental change (e.g. pollution incidences). Freshwater macroinvertebrates have been used as indicators of river quality for the past 50 years (Davies, 2001).

The relationship between macroinvertebrate community structure and water quality is described by a numerical scale of values (biotic index). The index used in Ireland is the Q-Index, as set out in S.I. No. 258/1998: Local Government (Water Pollution) Act, 1977 (Water quality standards for phosphorus) Regulations, 1998 and as used by the Environmental Protection Agency (EPA).

The Q-index assigns a score (Q-value) to the macroinvertebrate community at a given site based on the proportion of individuals present and their degree of sensitivity to organic pollution. With regards to sensitivity, macroinvertebrates are divided into five indicator groups ranging from Group A (sensitive forms) through to Group E (the most tolerant forms). The greater the number and diversity of sensitive Group A organisms present, the higher the Q-value assigned. The Q-value decreases as the numbers and diversity of sensitive organisms decline and as more tolerant forms appear, become dominant and the overall macroinvertebrate diversity declines. Therefore the index runs from pristine, unpolluted water quality of Q5 through to grossly polluted waters of Q1 (McGarrigle *et al.*, 2002). Further information of the Q-value index is given in Appendix 3.1.

Q-Value Biotic Index	Water Quality Status
Q5, Q4-5, Q4	Unpolluted
Q3-4	Slightly Polluted
Q3, Q2-Q3	Moderately Polluted
Q2, Q1-Q2, Q1	Seriously Polluted

3.2 Methodology

Sampling of the River Colligan was undertaken on August 24th 2006 at five sites along the length of the river adjacent to the landfill site (Figure 3.1). The same sampling sites are used annually, the sites being determined by Waterford County Council.

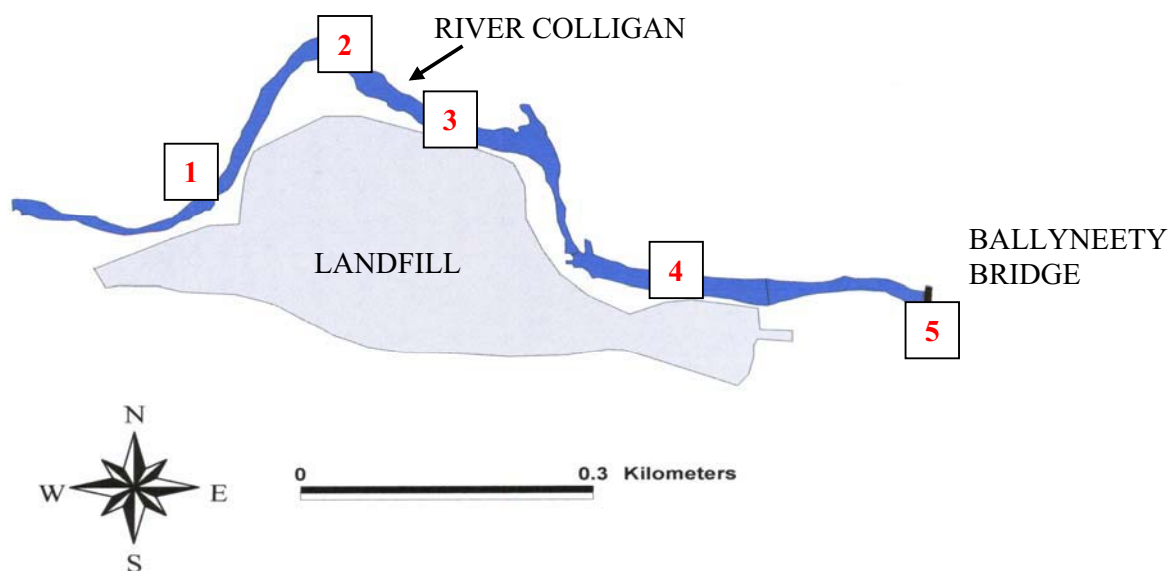


Figure 3.1 Locations of Freshwater Sampling Sites

Each site was sampled in exactly the same way. In addition to the macrofaunal samples, the following information was collected at each site:

- Grid Reference (hand-held GPS).
- Width of river.
- Depth of the river (an average of three depths measured with a metre stick).
- Colour (recorded as coloured or uncoloured).
- Odour (recorded as absent or present).
- Currents (strength).
- Predominant Substratum type: (e.g. boulders, large stones, small stones, gravel/silt).
- Presence of filamentous algae, emergent and/or submerged plants – recorded using the DAFOR Scale:

5	> 75	Dominant
4	51 – 75	Abundant
3	26 – 50	Frequent
2	11 – 25	Occasional
1	1 - 10	Rare

Riparian vegetation (river bank plants) is described within Section 2.

The macroinvertebrate community was sampled using the standard method of kick-sampling (IEA, 1995) using a D-net of 0.3-m diameter and 1-mm mesh. Each kick-sample lasted 2 minutes (McGarrigle *et al.*, 2002). Three replicate samples were taken at each sampling site and later pooled to give one collective sample per site.

After collection, each sample was sieved in the field over a 0.5mm mesh sieve and any large stones and debris removed. The samples were then transported back to the laboratory. Each sample was then sorted and the macroinvertebrate fauna retained preserved in 70% alcohol.

Macroinvertebrate identification was carried out using identification keys developed by the Freshwater Biological Association (e.g. Hynes, 1977; Croft, 1986; Wallace *et al.*, 2003).

Site 5 is located just upstream of Ballyneety Bridge where the River Colligan runs through intertidal mudflats. At this site and in addition to kick samples, three replicate core samples were also taken from the intertidal muds. Each sample was taken with a 0.01m² cylindrical core down to a depth of 15cm (Dalkin & Barnett, 2001). The three samples were pooled to give one collective sample. Core samples were sieved on site using a 0.5-mm mesh sieve and the sieve contents transported back to the laboratory for sorting and identification.


At each site the following water quality parameters were also measured with hand-held water meters:

- Temperature
- pH
- Conductivity/Total Dissolved Solids
- Dissolved Oxygen

Water meter and measurement specifications are given in Appendix 3.2.


3.3 Results

Physical Characteristics of sites


Site 1	Upstream of Disused Railway Bridge (EPA Station No. 280)
Physical characteristics	
Grid Reference	24169 94712
Average River Width (m)	8
Average River Depth (cm)	15
Currents	Moderate flow (riffles and pools present)
Colour	None
Odour	None
Reducing Conditions	None
Substratum	Predominantly Cobbles with a smaller proportion of small pebbles and larger boulders.
Vegetation	
Emergent vegetation	
Fool's Watercress <i>Apium nodiflorum</i> - occasional	
Submerged vegetation	
<i>Algae Cladophera</i> sp. – Dominant	
<i>Enteromorpha</i> sp. - Occasional	
Moss <i>Fontinalis</i> sp. - Frequent	
	

Site 2	Downstream of Disused Railway Bridge
Physical characteristics	
Grid Reference	24333 94917
Average River Width (m)	10
Average River Depth (cm)	32
Currents	Very slow flow
Colour	None
Odour	None
Reducing Conditions	None
Substratum	Predominantly Cobbles/Pebbles on a gravel base.
Vegetation	
Emergent vegetation	
Fool's Watercress <i>Apium nodiflorum</i> and Common Reed <i>Phragmites australis</i>	

Submerged vegetation
Algae Enteromorpha sp. - Dominant
Moss Fontinalis sp. - Occasional



Additional Notes
 Downstream of Site 2 and upstream of Site 3 is a small area where the water has a surface film and is rusty brown in colour (see photo below). This was also noted during the 2005 survey.



Site 3 Opposite drain from the landfill


Physical characteristics


Grid Reference	24394 94859
Average River Width (m)	10
Average River Depth (cm)	40
Currents	Moderate to swift flow
Colour	None
Odour	None
Reducing Conditions	None
Substratum	Cobbles/Pebbles on a silty base.


Vegetation

Emergent vegetation
None

Submerged vegetation
Algae Enteromorpha sp. – Frequent
Moss Fontinalis sp. - Occasional



Site 4 Downstream of Landfill	
Physical characteristics	
Grid Reference	24661 94634
Average River Width (m)	20
Average River Depth (cm)	Shallow edges (c20cm) extending to 80 cm in centre
Currents	Slow to Moderate flow
Colour	None
Odour	None
Reducing Conditions	None
Substratum	Cobbles/Pebbles on silty base.
Vegetation	
Emergent vegetation	
<i>Fucus ceranoides</i>	
Submerged vegetation	
<i>Enteromorpha</i> sp. - Occasional	
	

Site 5 Ballyneety Bridge (EPA Station No. 300)	
Physical characteristics	
Grid Reference	24834 94673
Average River Width (m)	10
Average River Depth (cm)	35
Currents	Swift flow
Colour	None
Odour	None
Reducing Conditions	None
Substratum	Mixture of pebbles and gravel
Vegetation	
Emergent vegetation	
<i>Fucus ceranoides</i>	
Submerged vegetation	
<i>Enteromorpha</i> sp. - Occasional	
Additional Notes	
Estuarine mud flats with furoid algae cover	
	

Algae Identification

Brown furoid algae recorded at sampling Sites 4 and 5 is cautiously identified as *Fucus ceranoides* in 2006. Some *Fucus spiralis* may also be present. It is believed that furoid algae were mis-identified in previous surveys – something easily done as *F. ceranoides* may be confused with *F. spiralis* and *F. vesiculosus*, especially at certain times of the year and within waters of variable salinity. Although *F. ceranoides* is considered a brackish water species, *F. spiralis* is also characteristic of inner estuaries. Species identification can therefore be problematic. Indeed genetic methods are becoming more widely used to separate species such as *F. vesiculosus*, *F. ceranoides* and *F. spiralis* (e.g. Billard *et al.*, 2005).

Samples of the alga *Enteromorpha* spp. were examined based on gross morphological features (e.g. frond structure, degree of branching) and cellular morphology (using a compound microscope 100 – 500 x magnification). Based on their anatomy, the samples are identified as either *Enteromorpha compressa* or *E. intestinalis*. These two species can be separated loosely by the presence or absence of branching, *Enteromorpha compressa* being branched and *E. intestinalis* generally being unbranched. Based on these criteria, the *Enteromorpha* at sampling Site 2 is *E. compressa*, while at Sites 3, 4 and 5 *E. intestinalis* dominates. The algae fronds at sites 3 - 5 were also markedly tubular with gas-inflated fronds – this again points to *E. intestinalis*.

However, the two species can show great variation in terms of morphology, especially cellular morphology, and exact discrimination is difficult as the two can share morphological features, especially when influenced by freshwater (Blomster *et al.*, 1998). Species identification must therefore be viewed with caution and a much wider investigation would be required to fully resolve the issue.

Macroinvertebrate fauna

The macroinvertebrate results for the five sampling sites are shown in Table 3.1. This table presents the numerical abundance of each macroinvertebrate species together with its taxonomic family and/or order. The table also lists the EPA quality category, the macroinvertebrate grouping according to its sensitivity to organic pollution (McGarrigle *et al.*, 2002). However, the Q-index is designed for freshwater macroinvertebrate communities and, as with previous annual surveys, our survey data shows that only Site 1 can be considered freshwater. The River Colligan becomes increasingly brackish/estuarine in nature as it flows downstream from Sites 1 to 5. This is evident from the increasing number of brackish/estuarine species downstream.

A Q-value of Q4 - Q3 was assigned to Site 1 largely related to the dominance of Group C species (i.e. Gammarid amphipods). Q4 – Q3 indicates unpolluted to slightly polluted waters. The macroinvertebrate fauna were dominated by species assigned to Groups C and D. A single specimen of a Group A ('Sensitive') macroinvertebrate was present, the Stone Fly *Isoperla grammatica*, and two Group B ('less sensitive') Caddis flies were also recorded.

Sites 2 and 3 were dominated by the Gammarid amphipod *Gammarus zaddachi* with no other species/taxa recorded in significant numbers. Crustaceans were the only faunal group recorded at Site 4, Common Shrimp *Crangon crangon* being the dominant form. Site 5 recorded estuarine/brackish species from the water while the macroinvertebrate fauna of the core samples was dominated by the estuarine Ragworm *Hediste diversicolor* (Table 3.2).

Table 3.1 Macroinvertebrate taxa and abundance at the five sampling sites on the River Colligan.

TAXA	FAMILY	SPECIES	EPA Quality Category	Site 1	Site 2	Site 3	Site 4	Site 5
Stone Flies (Order Plecoptera)	Perlodidae	<i>Isoperla grammatica</i>	A	1				
Caddis Flies (Order Trichoptera)	Sericostomatidae	<i>Sericostoma</i> sp.	B	2				
	Glossosomatidae	<i>Glossosoma</i> sp.	C	3				
True Flies (Order Diptera)	Chironomidae	Chironomid sp.	D	4				
	Tipulidae	Tipulidae sp.	C	2				
Beetles (Order Coleoptera)	Haliplidae	<i>Haliplus</i> sp.	C	16		1		
	Coleoptera larvae	Indent.	C	3				
(Crustacea) Order Amphipoda	Gammaridae	<i>Gammarus zaddachi</i>	C	100+	100+	100+	4	100+
Order Decapoda	Crangonidae	<i>Crangon crangon</i>			2	3	10	
	Portunidae	<i>Carcinus maenas</i>						2
	Processidae	<i>Processa</i> sp.					2	
Order Isopoda	Anthuridae	<i>Anthura gracilis</i>						11
Worms (Annelida)	Tubificidae	Tubificidae indent.	E			14		
	Nereidae	<i>Hediste diversicolor</i>						4
Mollusca	Hydrobiidae	<i>Potamopyrgus jenkinsi</i>	D	77		1		
	Lymnaeidae	<i>Lymnaea peregra</i>	D	1				
	Planorbidae	<i>Ancylus fluvialis</i>		8				
Bony Fish	Indent.				1			
	Pleuronectidae	Indent.		1				
	Anguillidae	<i>Anguilla anguilla</i>				1		
No. Species/Taxa			12	3	6	3	4	
EPA Q Value			4-3	-	-	-	-	

Table 3.2 Macroinvertebrates found within core samples at Site 5. Abundance per 0.03 m².

TAXA	ABUNDANCE
Annelida: Polychaeta	
<i>Hediste diversicolor</i>	13
Mollusca: Bivalvia	
<i>Scrobicularia plana</i>	1
Crustacea	
<i>Processa</i> sp. (Processidae)	2
<i>Gammarus zaddachi</i> (Amphipoda)	26

Water quality parameters

Results are given in Table 3.3. The recorded parameters were assessed in relation to guidance limits (e.g. (McGarrigle *et al.*, 2002; Toner *et al.*, 2005) and compared with results from previous monitoring undertaken by the Environmental Protection Agency (data kindly provided by the EPA is shown in Appendix 3.3).

Table 3.3. Water quality parameters measured at the five sampling sites along the River Colligan. (* DO values have been corrected to take into account differences in salinity).

Parameter	Units	Site 1	Site 2	Site 3	Site 4	Site 5
pH	pH	8.78	8.88	8.96	8.54	8.86
Temperature	°C	15.0	15.6	15.8	18.5	17.9
Conductivity	µS/cm	169	836	1411	> 4000	> 4000
Total Dissolved Solids	ppm	87	410	725	> 2000	> 2000
Dissolved Oxygen*	mg/L	11.0	11.4	11.6	11.4	12.6
Dissolved Oxygen*	% Saturation	110	115	115	120	122

In general, all measures fall within an acceptable range and are in line with previous results recorded by the EPA.

pH is a measure of the acidity or alkalinity of the water, extremes of which can affect water quality and chemistry and for example, fish health. The pH of most natural waters lies between 6.0 and 8.5 (Chapman, 1996) and pH results for all stations show alkaline waters within the acceptable range.

Water bodies undergo natural temperature variations in line with climatic and seasonal changes. Abnormally high temperatures can result from thermal discharges including some organic outfalls. The water temperatures recorded during the current survey are considered within an acceptable range for the time of year.

A good level of dissolved oxygen (oxygen contained in the water) is essential for aquatic life and levels above 5mg/L are considered acceptable. The values recorded during the current survey are therefore considered acceptable. The measure for Site 1 conforms to the European Communities (Quality of Salmonid Waters) Regulations, 1988 (50% > 9 mg/L). The DO readings (mg/L) were also converted to % saturation based on Figure 3.2 below:

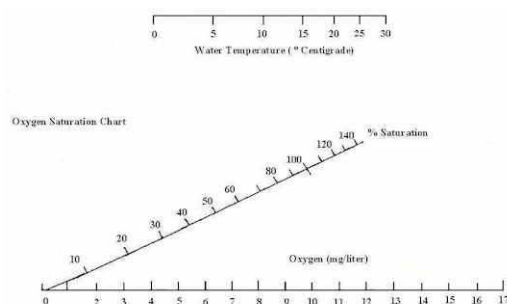


Figure 3.2 Oxygen Saturation Chart

% saturation readings varied from 110 % for Station 1 to 122 % for Station 5. Readings for all stations fall within the accepted range for intermediate (brackish) waters given by the EPA (70 > 130) (Toner *et al.*, 2005).

Conductivity is a measure of the ability of an aqueous solution to carry an electrical current (Kiely, 1998), conductivity measurements correlate to salinity and the amount of dissolved solid in water. Freshwater typically has a conductivity of 100 - 1000 $\mu\text{S}/\text{cm}$ whereas estuarine water conductivity may range from 200 - 2000 $\mu\text{S}/\text{cm}$ (Kiely, 1998). Our results therefore show that conductivity increases markedly downstream with the water becoming increasingly saline in nature as also indicated by the increasing total dissolved solids measure.

3.4 Discussion and Conclusions

3.4.1 Comparison of results with previous surveys

To aid comparison between years, the results of previous freshwater surveys are given in Table 3.4.

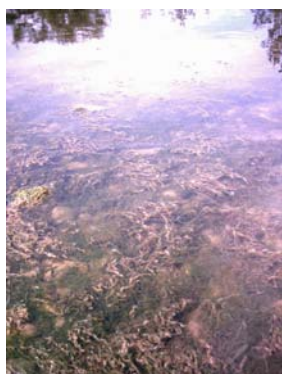
Table 3.4 Q Index scores for the current survey (2006) together with those recorded in previous years. Also shows the total number of taxa recorded at sites (kick-sampling only). (Previous surveys from Limosa Environmental, 2004, 2005; Lyons, 2003; Aquatic Services Unit, 1998).

	Time of Survey	Site 1	Site 2	Site 3	Site 4	Site 5
Q Value	August 2006	Q4-3	-	-	-	-
	September 2005	Q2	-	-	-	-
	August 2004	Q3-4	Q3-4	-	-	-
	August 2003	Q3-4	Q3-4	-	-	-
	February 1998	Q4	-	-	-	-
Number Of Taxa	August 2006	12	3	6	3	4
	September 2005	8	2	6	5	4
	August 2004	22	16	10	7	6
	August 2003	16	11	10	5	10

The results of the current survey are largely in line with previous annual surveys (1998 - 2004). 2005 was an exception in that Site 1 was assigned a value of Q2, indicating poor water quality of unsatisfactory condition. The possible reasons for this were discussed in Limosa Environmental (2005) and included factors such as low summer rainfall levels (and greater influence of salt water) and an abundance of green macrophyte algae growth within the river column. These factors may also help to explain the lower species diversity (number of species/taxa) recorded in the current survey compared to previous years (Table 3.4).

Apart from Site 1, the macroinvertebrates recorded from all other sites were almost exclusively estuarine/brackish species. The average depth of water in the river was also low as a consequence of a long dry summer with low rainfall. As highlighted by Limosa Environmental (2005) this can act as to increase salinity levels in upper estuarine areas (Attrill *et al.*, 1996) which in turn affects the freshwater macroinvertebrate communities present with freshwater species being largely replaced by brackish water species.

Also of note during the current survey was the domination of in-stream flora by green macrophyte algae *Cladophora* sp. and *Enteromorpha* sp., particularly noted at Sites 1 and 2. Aquatic plant species recorded in 2004 such as Starwort (*Callitriche* spp.) and Common Water-crowfoot (*Ranunculus aquatilis*) were absent during the current survey.



Excessive plant growth in rivers may occur as a consequence of enrichment of water by nutrients (especially N and P). This is undesirable as it can lower oxygen levels (hypoxia) in the water column, physically impede water flow and trap silt, thereby changing the environment in which macroinvertebrates live.

The abundant growth of macroalgae cannot be directly attributed to the landfill as many factors act as to enhance their growth. However, it is considered likely that the abundant growth has some effect on the macroinvertebrate community present, especially at Site 2.

Site 2

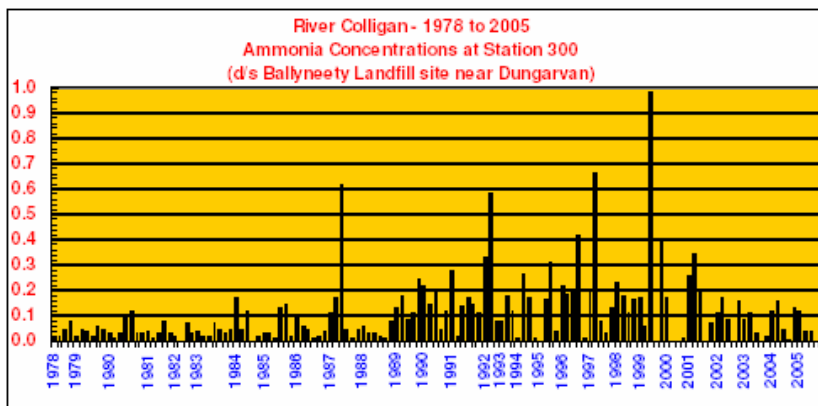
Sediment cores at Site 5 were dominated by the estuarine Ragworm *Hediste diversicolor* and gammarid amphipods. The head of the estuary is an extreme environment for macroinvertebrates to live in. They have to cope with long periods of exposure and significant variations in salinity. Upper estuarine habitats therefore support few infaunal species with the community typically dominated by polychaete worms and oligochaetes (Connor *et al.*, 2004). The survey area is loosely assigned to biotope LS.LMu.UEst.Hed (*Hediste diversicolor* in littoral mud) following the marine habitat classification of Britain and Ireland version 04.05 (Conner *et al.*, 2004).

3.4.2 Review of water quality of the River Colligan

Sampling Sites 1 and 5 are also EPA sampling stations (Nos. 280 and 300 respectively) and previous data is shown in Appendix 3.3. Biological quality ratings (Q-index) are not assigned to these sites because of their saline influence. A review of chemical data shows that the water quality of the River Colligan in the location of the landfill was generally of good quality for the period February 2001 – July 2006. The majority of data values fall within the acceptable levels (with a few exceptions) and indicate no threat to aquatic life. High chloride values for Station 300 (Ballyneety Bridge) highlight the brackish/saline influence at this site.

Previous water quality monitoring of sites upstream of Dungarvan Landfill show fair to good water quality; Q4 being assigned to Station 0250 (Killandangan Bridge between 1991 and 2004 and Q4-5 assigned to station 0180 (Colligan Bridge) between 1987 and 2004) (Clabby *et al.*, 2005).

A recent EPA report states that Ammonia levels have improved at Station 300 (Ballyneety Bridge) in recent years following restrictions in waste dumping at Dungarven Landfill and its subsequent closure (EPA, 2005).



Source: Environmental Protection Agency (2005).

The publication 'Water Quality in Ireland 2001 – 2003' (Toner *et al.*, 2005) classifies the Colligan Estuary as 'Intermediate' based on the ATSEBI System (Assessment of trophic status of estuaries and bays in Ireland). This classification scheme was designed to provide a means of identifying the occurrence of eutrophication in estuaries and is based on relevant measures of water quality. An intermediate status indicates waterbodies which do not fall into the eutrophic or potentially eutrophic classes but which have breached one or more criteria on some sampling occasions. For instance, between 1999 and 2003 the River Colligan breached inorganic nitrogen (DIN) levels and the River Colligan estuary had unacceptable dissolved oxygen levels on occasion (Appendix IV, Toner *et al.*, 2005).

3.4.3 Concluding Remarks

The survey results indicate a fair to good water quality at the five sampling sites along the River Colligan. We raised some concerns with regards the level of macrophyte growth in the river which may have had an impact upon the macroinvertebrate communities, at Site 2 in particular. Macrophyte growth is not however, directly attributable to landfill activities and a variety of nutrient sources and other factors are involved in its abundance.

The water quality parameters measured during the survey were found to be within acceptable ranges. Similarly, a review of EPA chemical water quality data (2001-2006) shows acceptable water quality within the River Colligan.

Appendix 3.1

Biological Assessment of Water quality using the Q-Value Biotic Index.

The Q-Index scheme works on the basis of 'Indicator Groups'. Macroinvertebrates are assigned to groups depending on their sensitivity to organic pollution:

- Group A Sensitive forms.
- Group B Less sensitive forms.
- Group C Tolerant forms.
- Group D Very tolerant forms
- Group E Most tolerant forms.

The macroinvertebrate groups are given in **Table 3.1a**.

Based on the macroinvertebrate community found within a water sample, a biotic index (Q value) can then be assigned. These are listed below:
(condition refers to the likelihood of interference with beneficial or potential beneficial uses).

Q5	High community diversity	Good water quality	Satisfactory condition.
Q4	Reduced community diversity	Fair water quality	Satisfactory condition.
Q3	Low community diversity	Doubtful quality	Unsatisfactory condition.
Q2	Very low community diversity	Poor quality	Unsatisfactory condition.
Q1	Little/No community diversity	Bad condition	Unsatisfactory condition.

The macroinvertebrate groupings and associated Q values are given in **Table 3.1b**.

Table 3.1a

Macroinvertebrate Groupings according to their sensitivity to organic pollution. (McGarrigle *et al.*, 2002).

Taxa	Group A Sensitive	Group B Less sensitive	Group C Tolerant	Group D Very tolerant	Group E Most tolerant
Plecoptera	All except <i>Leuctra</i> spp.	<i>Leuctra</i> spp.			
Ephemeroptera	Heptageniidae Siphonuriidae <i>Ephemera danica</i>	Baetidae (exc. <i>Baetis rhodani</i>) Leptophelbidae	<i>Baetis rhodani</i> Caenidae Ephemerellidae		
Trichoptera		Cased spp.	Uncased spp.		
Odonata		All taxa			
Megaloptera				Sialidae	
Hemiptera		<i>Aphelocheirus aestivalis</i>	All except <i>A. aestivalis</i>		
Coleoptera			Coleoptera		
Diptera			Chironomidae (exc. <i>Chironomus</i> spp). Simuliidae Tipulidae		<i>Chironomus</i> spp <i>Eristalis</i> spp.
Hydracarina			Hydracarina		
Crustacea			<i>Gammarus</i> spp. <i>Austropotamobius pallipes</i>	<i>Asellus</i> spp. <i>Crangonyx</i> spp.	
Gastropoda			Gastropoda (exc. <i>Lymnaea peregra</i> & <i>Physa</i> spp.)	<i>Lymnaea peregra</i> <i>Physa</i> spp.	
Lamellibrachiata	<i>Margaritifera margaritifera</i>				
Hirudinea			<i>Piscicola</i> spp.	All exc. <i>Piscicola</i> spp.	
Oligochaeta					Tubificidae
Platyhelminthes			All		

Table 3.1b.

Biological Assessment of water quality in eroding reaches (riffles & glides) of rivers and streams. Biotic Indices (Q values) and associated macroinvertebrate community structure. (McGarrigle *et al.*, 2002).

(Occurrence/abundance of groups refers to some but not necessarily all constituents of the group. Additional qualifying criteria apply in nearly all circumstances). Intermediate values (e.g. Q1 -2 or Q2-3) may also be used and denote transitional conditions.

Macroinvertebrate Faunal Groups	Q5	Q4	Q4 - 3	Q3	Q2	Q1
Group A	At least 3 taxa well represented	At least 1 taxon in reasonable numbers	At least 1 taxon few - common	Absent	Absent	Absent
Group B	Few - numerous	Few - numerous	Few/Absent - numerous	Few/Absent	Absent	Absent
Group C	Few	Common to numerous <i>Baetis rhodani</i> often abundant. Others never excessive.	Common to excessive (usually dominant or excessive).	Dominant to excessive	Few or Absent	Absent
Group D	Few or Absent	Few or absent	Few/Absent to common	Few/Absent to common	Dominant to excessive	Few or Absent
Group E	Few or Absent	Few or Absent	Few or Absent	Few or Absent	Few/Absent to common	Dominant

Additional Qualifying Criteria:

Cladophera spp. abundance	Trace only or none	Moderate growths if present	Abundant to excessive growths	May be excessive growths	Few or absent	None
Macrophytes (typical abundance)	Normal growths or absent	Enhanced growths	May be luxuriant growths	May be excessive growths	Absent to abundant	Present/absent
Slime growths (Sewage fungus)	Never	Never	Trace or None	May be abundant	May be abundant	None
Dissolved Oxygen Saturation	Close to 100% at all times	80% - 120%	<80% - 120%	Very unstable. Potential fish kills	Low (but > 20%)	Very low, sometimes 0.
Substratum siltation	None	May be light	May be light	May be considerable	Usually heavy	Usually very heavy and anaerobic.

The EPA further simplify the Q-value biotic index by assigning rivers to one of 4 quality classes shown below:

Biotic Index	Quality Status	Quality Class
Q5, Q4-5, Q4	Unpolluted	Class A
Q3-4	Slightly Polluted	Class B
Q3, Q2-Q3	Moderately Polluted	Class C
Q2, Q1-Q2, Q1	Seriously Polluted	Class D

Class A waters are therefore characterised by high biological community diversity, a good and unpolluted water quality and a satisfactory condition, i.e. there are unlikely to be any problems with the use of the water for e.g. amenity or fisheries purposes.

Class B and C waters are considered slightly polluted with a potential for eutrophication. This may lead to problems with the use of the water (e.g. for amenity use) and therefore the condition may be classed as unsatisfactory.

Class D waters have little or no biological diversity and are considered seriously polluted. Excessive organic loading may lead to serious deoxygenation of the waters together with other factors such as the growth of sewage fungus. Beneficial uses of the water will be severely constrained.

Appendix 3.2

Measurements of water quality

Hand-held meters (Hanna Instruments) were calibrated the day before the fieldwork was undertaken.

Instrument and measurement specifications are given below:

Parameter	Range	Resolution	Accuracy
pH	0.0 – 14.00	0.01 pH	± 0.01
Temperature	0.0 – 60 °C	0.1 °C	± 0.5 °C
Conductivity	0.0 – 3999 µS	1 µS	± 2% f.s.
Total Dissolved Solids	0.0 – 2000 ppm	1 ppm	± 2% f.s.
Dissolved Oxygen	0.0 – 19.9 mg/L	0.1 mg/L	± 1.5% f.s.

Appendix 3.3

River Colligan – Water monitoring data.
(Data kindly supplied by the EPA)

Station No. 280 1st Railway Bridge upstream of Ballyneety Bridge.

Date	Temp °C	D O % Sat	D O Mg/l O ₂	BOD Mg/l O ₂	Colour Hazen	pH	Cond µS/cm	Salinity	O-Phos mg/l P	Ammonia mg/l N	Un-Ion-Amm Mg/l NH ₃	Nitrite Mg/l N	Nitrate Mg/l N	Chloride Mg/l Cl	Alkalinity Mg/l CaCO ₃
27/02/2001	3.9	102	13.4		15	7.7	174		0.01	0.01	0.0001	0.003	3.5	16	
18/06/2001	13.2	99	10.4	0.8	30	7.6	169		0.01	0.01	0.001	0.007	2.7		
21/08/2001	14.4	95	9.7	0.8	40	7.4	122		0.01	0.01	0.0001	0.002	2.1	13	
01/11/2001	8.7	100	11.6	0.5	30	7.3	140		<0.01	<0.01		0.001	2.9	14	
24/01/2002	8.0	98	11.6	0.3	40	7.7	138		0.01	0.01	0.0001	0.002	3.1	16	
10/06/2002	11.8	109	11.8	1.1	70	7.4	124		0.01	0.01	0.001	0.004	2.4	16	
04/09/2002	13.6	112	11.6	0.7	15	8.2	144		<0.01	<0.01		0.002	2.1	17	
16/12/2002	6.7	101	12.4	0.7	15	7.5	172		0.01	0.01	0.0000	0.002	3.0	15	
04/03/2003	9.3	100	11.5	0.5	40	7.5	122		0.01	0.04	0.0003	0.002	2.2	12	
06/05/2003	9.4	105	12.0	0.7	20	7.4	190		<0.01	0.01	0.0000	0.001	2.6	29	23
28/08/2003	14.7	108	11.0	0.5	<5	7.6	161		<0.01	0.01	0.0001	0.003	2.7	15	
04/12/2003	8.4	99	11.6	0.8	30	7.6	127		<0.01	0.00	0.0000	0.002	2.6	14	
22/01/2004	9.4	100	11.4	1.8	100	7.5	102		0.05	0.09	0.0006	0.004	1.2	12	<20
14/04/2004	10.6	111	12.4	0.9	<5	7.9	161		<0.01	<0.01		0.002	2.9	18	
10/06/2004	15.5	106	10.6	1.4	10	8.0	154		0.01	0.01	0.0003	0.007	2.7	16	
05/08/2004	16.1	116	11.4	1.3	30	8.5	136		<0.006	<0.003		0.002	1.9	14	37
02/09/2004	14.3	114	11.7	0.7	20	8.1	134		0.008	0.003		0.002	2.6	18	
29/11/2004	6.5	101	12.4	0.9	15	7.9	148		<0.006	0.016		0.002	3		<20
01/02/2005	8.5	100	11.7	<0.3	5	8.1	144								
14/04/2005	7.7	110	13.1	0.7	<5	7.5	156		<0.006	0.01		0.002	2.9	15	
12/07/2005	20.2	118	10.7	1.1	5	8			<0.006	<0.003		0.007	2.8	22	34
25/08/2005	13.4	110	11.49	0.8	85	7.9	158		<0.006	0.032		<0.001	1.6	22	<20
30/11/2006	8.4	101	11.85	1.3	60	7.3	127		0.006	0.015		0.002	2.0	14	33
19/01/2006	10.2	95	10.67	0.8	15	7.5	156		<0.006	0.017			3.7	14	33
04/05/2006	10.9	99	10.94	1.4	15	7.7	229		<0.006	0.015		0.002	3.4	29	
06/07/2006	16.8	111	10.77	1.1	20	8	173		<0.006	0.023		0.006	3.2	14	46

Station No. 300 Ballyneety Bridge – Downstream of Dungarvan Landfill – Tidal.

Date	Temp °C	D O % Sat	D O Mg/l O ₂	BOD Mg/l O ₂	Colour Hazen	pH	Cond µS/cm	Salinity	O-Phos mg/l P	Ammonia mg/l N	Un-Ion-Amm Mg/l NH ₃	Nitrite Mg/l N	Nitrate Mg/l N	Chloride Mg/l Cl	Alkalinity Mg/l CaCO ₃
27/02/2001	4.0	105	13.8		15	7.5	846		0.01	0.26	0.0012	0.004	3.6	194	
18/06/2001	13.5	62	6.5	1.8	30	7.6	1129		0.01	0.20	0.0023	0.010	3.2		
21/08/2001	14.7	95	9.6	0.7	40	7.5		1.4	0.02			0.010	1.5		
01/11/2001	8.8	100	11.6	0.6	30	7.4	297		<0.01	0.07	0.0004	0.002	3.2	49	
24/01/2002	8.1	99	11.7	0.3	30	7.4	161		0.01	0.11	0.0006	0.003	3.1	20	
10/06/2002	12.2	115	12.3	1.2	70	7.5	256		0.01	0.09	0.0007	0.005	2.6	46	
04/09/2002	14.1	124	12.7	1.1	10	8.3		0.4	0.01			0.008			
16/12/2002	6.8	101	12.3	0.9	10	7.5	323		0.01	0.16	0.0009	0.003	3.2	51	
04/03/2003	9.8	101	11.5	0.9	40	7.3	738		0.02	0.09	0.0004	0.003	2.3	39	
06/05/2003	10.0	107	12.1	0.6	20	7.5	316		<0.01	0.11	0.0008	0.002	2.7	72	
28/08/2003	15.8	115	10.9	1.3	5	8.0		7.8	<0.01			0.010	1.7		
04/12/2003	8.5	99	11.6	0.9	30	7.7	394		<0.01	0.02	0.0002	0.002	2.7	86	
22/01/2004	9.5	99	11.3	2.4	100	7.7	154		<0.01	0.12	0.0013	0.005	1.3	24	
14/04/2004	10.8	121	13.4	0.8	<5	8.0	272		<0.01	0.16	0.0038	0.003	3.2	41	
10/06/2004	17.5	88	7.3	2.6	20	8.1		22.7	0.02	0.05	0.0023	0.020	1.8		
05/08/2004	16.7	97	9.4	0.9	10	8.3	177		<0.006	<0.003		0.001	2.1	62	40
02/09/2004	14.9	122	12.3	0.8	20	8.4	609		0.007	0.14		0.004	2.9		
29/11/2004	6.8	104	12.7	1	15	7.8	469		0.006	0.13		0.004	3.3		43
01/02/2005	8.4	100	11.7	0.7	5	7.9	302		0.009	0.12		0.003	3.4		42
14/04/2005	8.0	106	12.4	1.2	5	7.7		2.5	0.007	0.035		0.004	2.7		
12/07/2005		120		2	15	8.2		11.2	<0.006	0.043		0.019			80
25/08/2006	14.4	90	9.19	1.1	70	7.7			0.009			0.008	<0.06		70
30/11/2005	8.6	103	12.02	1.2	60	7.3	240		0.006	0.092		0.003	2.1	38	37
19/01/2006	10.1	95	10.7	1.1	15	7.5	398		<0.006	0.091			3.7	98	39
04/05/2006	10.8	93	10.21	1.2	15	7.7		1.5	<0.006	0.052		0.004	2.9	556	
06/07/2006	17	133	12.85	0.8	15	8.4	971		<0.006	0.15		0.01	3.2	168	78

4.0 MAMMAL SURVEY OF DUNGARVAN LANDFILL & ENVIRONS

4.1 Introduction

A dedicated mammal survey of Dungarvan Landfill site was undertaken on 24th August 2006. All areas within the boundary of the landfill site itself were thoroughly surveyed as were the adjoining lands south of, and including, the River Colligan - east as far as Ballyneety Bridge. The privately owned arable lands south of the landfill site were not surveyed but their neighbouring boundaries were checked for mammal access routes. The salt marsh and mud shores north of the River Colligan were also surveyed.

4.2 Methodology

The survey consisted of walking the survey area, paying particular attention to boundaries, and recording signs of mammal activity (*i.e.* tracks, droppings, burrows, feeding signs *etc.*) and/or direct observations of mammal species. The locations of all mammal signs were recorded in the field using detailed survey maps and signs of particular note such as otter spraints were recorded using a Handheld GPS (Global Positioning System - Garmin GPS 12 Channel receiver). The survey commenced at 0930hrs and ended at 1630hrs with low tide occurring at 1330 hrs. Weather conditions on the day were good with no rain, low cloud cover, light wind and high visibility.

4.3 Results

Species Richness

Mammal activity was widespread throughout the study site with evidence of four species recorded at multiple locations (Figure 4.1). The species were as follows:

- Rabbit (*Oryctolagus cuniculus*)
- Brown Rat (*Rattus norvegicus*)
- Fox (*Vulpes vulpes*)
- Otter (*Lutra lutra*)

Of particular importance is the presence of the otter, which is protected under the Wildlife Act of 1976 (as amended in 2000), and by the European Communities (Natural Habitats) Regulations of 1997. The otter is also protected under Annex II of the Habitats Directive, 1992, Appendix II of the Bern Convention, 1979 and is listed as a Red Data Species in Ireland (Whilde, 1993). The remaining species are unprotected under Irish Legislation.

All areas of the landfill site and surrounding lands were utilised by mammals, however a hot-spot of mammal activity was recorded between the transfer station and the River Colligan. All four mammal species utilised this site reflecting the high habitat heterogeneity here.

Species accounts

Rabbit (*Oryctolagus cuniculus*)

The rabbit was the most widespread and common mammal utilising the study site, with most activity recorded on spoil or recolonising bare ground within the landfill site itself (Figure 4.1). Very high concentrations of droppings were located in an extensive network of latrines on top of the landfill site and numerous tracks leading from the arable fields were also clearly visible. These tracks were identified as being in use by rabbits by the presence of rabbit droppings and food remains. A large rabbit warren was found under scrub in the region of wet grassland just west of the landfill site (GPS 24079 94693).

Brown Rat (*Rattus norvegicus*)

Common rats are an introduced pest species and are therefore unprotected. Two brown rat holes were found within the study site - one leading from arable land south of the landfill site and another leading

from the river, north of the transfer station. Food remains in the form of a gnawed maize-head were also found along the edge of an arable field south of the landfill site.

Fox (*Vulpes vulpes*)

The red fox is native to Ireland but is not protected. This species was widespread throughout the site with numerous droppings found within close proximity to the River Colligan (Figure 4.1). A number of tracks were also visible on recolonising bare ground inside the landfill boundary. The diet of the fox appeared to vary considerably from place to place with large amounts of crab shell present in droppings found near the salt marsh (GPS 24699 94747) and large amounts of seeds (from berries) present in droppings found in more upstream areas. The hair and bones of other mammals, most likely rabbits and rats were also present in droppings found close to the transfer station within the landfill site (GPS 24661 94688).

Otter (*Lutra lutra*)

The River Colligan is widely utilised by otters, as reflected by the numerous sprainting sites (droppings) and tracks present along the riverbank (Figure 4.1). A number of well-established sprainting sites were identified at GPS 24330 94950 and GPS 24250 94772, these also recorded during the 2005 survey. In addition a number of new sprainting sites, as well as couches (resting places) were recorded in this survey with a concentration of otter activity on a well-colonised bank north of the transfer station. Otter prey remains in the form of a frog skin turned inside-out (pers comm. P. Sleeman) were also found at this site. The skin of the common frog (*Rana temporaria*) is indigestible by otters due to poisonous glands.



Above: Frog skin turned inside-out by an otter



Above: Otter spraint on a rock (background) and fox droppings (foreground)

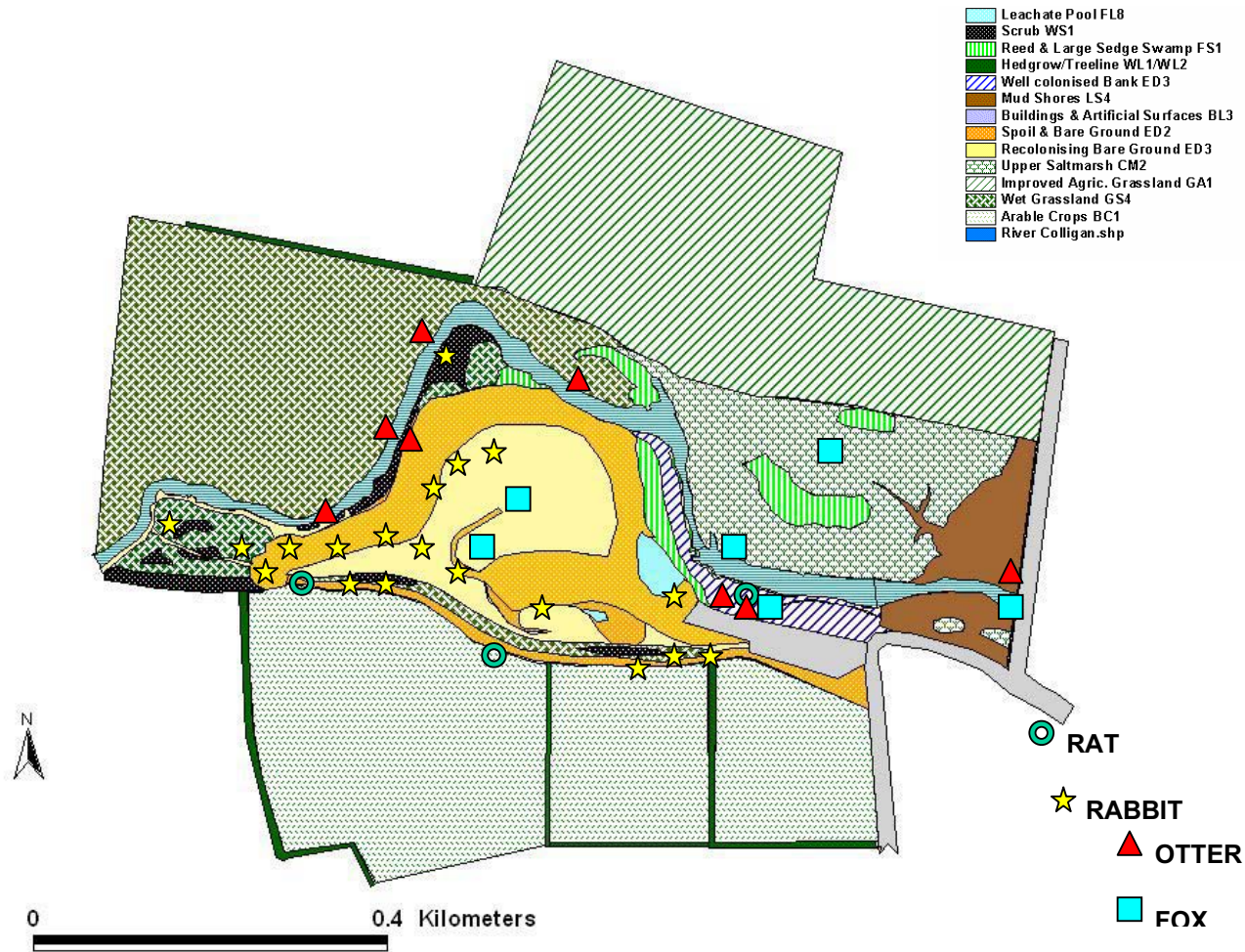


Figure 4.1 Location of mammal signs

4.4 Discussion and Conclusions

A total of four mammal species were recorded during this survey, a reduction on last years (2005) record of seven species. The species recorded in 2005 but not in 2006 were the Mink (*Mustela vison*), Pygmy Shrew (*Sorex minutus*) and Bat (most likely *Pipistrellus pipistrellus*), the latter two of which are protected under the Wildlife Act of 1976 as amended in 2000. The apparent reduction in species richness in the 2006 survey should not cause concern however because of the following reasons:

- 1) The mink is an introduced species and generally considered a pest as it preys on native bird and mammal species, and competes with otters for fish (De Butléar, 1993; Bang & Dahlstrøm, 2006). Therefore it is not a beneficial addition to the ecology of the site. It is likely that this species visits the area but is not a resident here.
- 2) A single pygmy shrew track was recorded in the 2005 survey in an improved grassland field. This field, along with all privately owned lands was not surveyed during the 2006 survey. Furthermore, this species is difficult to detect due to its tiny size, and concealment of dropping under pieces of wood, stones etc. (Bang & Dahlstrøm, 2006).
- 3) It is not surprising that bats were not sighted during the survey as they are rarely active during daylight hours and are inconspicuous without the aid of a bat detector. It is highly likely that the River Colligan is utilised by a number of bat species as its scrub-lined channel provides excellent feeding habitat for these insectivorous species.

The widespread presence of rabbits in the landfill site is not surprising as this species is known to favour uncultivated areas (D'Arcy, 1988). The large number of latrines present indicates that the site is used by high densities of rabbits, which are likely to feed extensively on maize from the arable fields in autumn as well as on emerging vegetation on the landfill itself. The presence of a warren just west of the landfill site indicates that rabbits are resident in the area, using the site to breed as well as feed. Levels of rabbit activity were similar to the 2005 survey levels indicating that the population is stable here. This species would be prey for foxes.

A very low level of brown rat activity was found within the landfill site itself, however a number of signs were present nearby, particularly along the boundary of the arable fields. Brown or common rats are attracted to arable fields, sometimes in very large numbers, due to the availability of easily accessible, high-quality food (Bang & Dahlstrøm, 2006). This was recorded in the 2005 survey report when the arable fields were surveyed. Once this food source has been removed by harvesting, the rat population may attempt to disperse into the landfill site to scavenge for food (D'Arcy, 1988; MacDonald & Barrett, 1993). Rat control measures are in place (Landfill manager pers. comm.).

High levels of fox activity were recorded throughout the study site, which is not surprising considering the availability of mammal prey (rabbits and rats) here. The fox is a scavenger by nature and this was reflected by the variety of food remains evident in its droppings. These included mammal bones, crabs and berries. The fox is also known to feed on human refuse (D'Arcy, 1988; MacDonald & Barrett, 1993; Hayden & Harrington, 2001) and so may historically have been attracted to this site for this reason. Clearly the variety of habitats available in the study site is beneficial to this species.

The River Colligan is an important habitat for otters which are protected under both Irish and European legislation (see introduction). Numerous sprainting sites, some of which are in long-term use, indicate that otters are resident and successful here. There is evidence of an increase in otter activity since 2005, with new sprainting sites recorded north of the transfer station. Numerous otter couches (resting places) were also present here indicating that otters spend a considerable amount of time at this site. It is possible that the decrease in human activity since the closure of the landfill site has allowed this species to utilise areas of the landfill site which it would normally have avoided. This may pose a hazard to this species due to the proximity of potential toxicants in the landfill site. High levels of toxicants have been found in otters in local areas of Cork City, however this does not generally cause mortality (Sleeman & Moore, 2005). Otters feed predominantly on fish but also take frogs when available (Bang & Dahlstrøm, 2006; Fairley, 2001) and this was evident from spraints found. The high level of otter activity indicates that the River Colligan contains a healthy and reliable population of fish.

The remains of a common frog found at an otter sprainting site also indicate that this protected species occurs in the area – as documented in the 2005 report. Common Frogs are protected by the Wildlife Act of 1976 as amended in 2000 and the European Communities (Natural Habitats) Regulations of 1997. It is also protected under the Annex V of the Habitats Directive, 1992 and Appendix III of the Bern Convention, 1979 and listed as a Red Data Species in Ireland (Whilde, 1993).

The potential risk of contamination by the landfill on animal populations should be considered. While the release of contaminants, such as organochlorines and PCBs, is considered the most serious chemical

threat to water systems from landfills (Giller & Malmqvist, 1998), this threat is considered to be of low concern at the Dungarvan site. This is due firstly, to the nature of the domestic refuse at the landfill site, which is not thought to result in the release of such contaminants, generally associated with industrial waste. Secondly, a study by O'Sullivan *et. al.* (1993) in southern Ireland found low concentrations of such contaminants in otters and concluded that these contaminants were unlikely to result in a significant risk to otter populations in their study. In addition the effects of such contaminants like PCBs are generally sublethal (Giller & Malmqvist, 1998) where thriving otter communities in the UK are known to have high concentrations of heavy metals (Mason & MacDonald 1986). Therefore, the potential risk of contamination by the landfill on the mammal and amphibian community is considered insignificant.

Mammal species not recorded during the current survey but highly likely to utilise habitats in the survey area include stoat (*Mustela erminea hibernicus*), wood mouse (*Apodemus sylvaticus*), badger (*Meles meles*) and possibly house mouse (*Mus (musculus) domesticus*).

Concluding remarks

- Dungarvan landfill and surrounding habitats support and maintain a range of mammal and amphibian species, indicating the importance and suitability of the habitats present for such species.
- The main species found using the landfill site were the rabbit and fox, with the River Colligan supporting a healthy population of otters. The arable fields south of the landfill site are a source of additional food for rabbits and brown rats.
- Both the otter and common frog are protected under National and European Legislation and therefore are important from a conservation viewpoint.
- Risks posed by the landfill to species in the survey area, in particular those associated with wet habitats, are thought to be insignificant.

5.0 AVIAN FAUNA OF DUNGARVAN LANDFILL & ENVIRONS

5.1 Methodology

The avian fauna of Dungarvan Landfill and environs were assessed in the following ways:

- Consultation of relevant literature and local records including consultation with the local NPWS Conservation Ranger and I-WeBS counter.
- A high tide survey of the river corridor adjacent to the landfill and downstream to approximately 500m below Ballyneety Bridge. This survey was carried out at 0830 hours on 28th August 2006.
- A species list was compiled for bird species observed or heard during the ecological surveys of Dungarvan Landfill Site and the immediate surrounding environment.
- A review of annual count data from the Irish Wetland Bird Survey (I-WeBS) (Appendix 5.3) that monitors Dungarvan Harbour including the River Colligan estuary.
- Bird species and conservation importance were assessed with reference to the legislation defined in Appendix 5.1

Latin names are given at first mention in the text. A full list of bird species mentioned in the text with Latin names and conservation status is given in Appendix 5.2.

5.2 Field Survey Results

The high-tide survey recorded birds from the lower reaches of the River Colligan adjacent to Dungarvan landfill and extended below Ballyneety Bridge for about 500m. Twelve bird species were recorded during the survey (Table 5.1), the majority of which were recorded below Ballyneety Bridge. These birds were largely confined to a small grassy spit that extends out into the estuary from the southern boundary. Large numbers of birds were roosting here including c 500 Black-tailed godwits (*Limosa limosa*). Birds were packed tightly together and with poor visibility due to high vegetation growth, many birds may have been undetected. This grassy spit is obviously an important high tide roost.

Very few birds were observed within the water column at high tide; a noticeable absence of gull species during the survey.

A single Common Sandpiper (*Actitis hypoleucos*) was observed along the shoreline just below Ballyneety Bridge.

Table 5.1 Bird Species recorded during the high-tide survey

Species	Peak number	Habitat in which observed
Cormorant	1	Below Ballyneety Bridge
Little Egret	5	Below Ballyneety Bridge
Moorhen	2	River Colligan
Grey Heron	1 2	Above Ballyneety Bridge River Colligan
Shoveler	2	Below Ballyneety Bridge
Lapwing	1	Saltmarsh above Ballyneety Bridge
	1	Below Ballyneety Bridge
Common Sandpiper	1	Below Ballyneety Bridge
Black-tailed godwit	c 500	Below Ballyneety Bridge
Snipe	1	Saltmarsh above Ballyneety Bridge
Greenshank	1	Below Ballyneety Bridge
Curlew	3	Below Ballyneety Bridge
Black-Headed Gull	3	Below Ballyneety Bridge
Common Gull	2	Above Ballyneety Bridge
	2	Below Ballyneety Bridge

Bird species recorded within the landfill site

A total of 27 bird species were recorded during ecological surveys of the landfill and immediate surrounding area (Table 5.2).

Five species were observed in association with the River Colligan including two that are listed on Annex I of the EU Birds Directive: Kingfisher (*Alcedo atthis*) and Little Egret (*Egretta garzetta*). In addition, Swallows (*Hirundo rustica*) and Sand Martins (*Riparia riparia*) were observed foraging for insects over the river.

Three Moorhens (*Gallinula chloropus*) including two juveniles were observed on the leachate pool. This suggests that Moorhens breed within this habitat or close by. A new observation for the leachate pool was the observation of a Little Grebe (*Tachybaptus ruficollis*). This species breeds within the vegetated margins of ponds and may therefore be breeding within this landfill habitat.

As noted in the 2005 survey, the recolonising bare ground habitat and spoil and bare ground habitats within the landfill site provide feeding grounds for species such as Linnet *Carduelis cannabina*) and other finches and resting grounds for Crows (*Corvus corone cornix*) and Rooks (*Corvus frugilegus*).

Table 5.2 Bird species recorded during ecological surveys of Dungarvan landfill and environs

Species	Habitat within which observed
Little Egret	River Corridor
Little Grebe	Leachate Pool
Grey Heron	River Corridor and leachate pool
Moorhen	Leachate Pool
Snipe	Saltmarsh
Kingfisher	River Corridor
Wood Pigeon	Flight, general
Swallow	In flight, general
Sand Martin	In flight, general
Pied Wagtail	Buildings & artificial surfaces
Grey Wagtail	Leachate Pool and Built area
Wren	Treelines
Robin	Treeline
Stonechat	Scrub
Dunnock	Scrub
Blackbird	Treelines/Scrub
Sedge Warbler	Reed & large sedge swamp
Blue Tit	Treelines
Coal tit	Treelines, Scrub
Magpie	Recolonising bare ground
Rook	Recolonising bare ground
Hooded Crow	Recolonising bare ground
Starling	Recolonising bare ground
Chaffinch	Treelines/scrub
Linnet	Recolonising bare ground – foraging flocks
Greenfinch	Treelines, Wet grassland
Goldfinch	Treelines

5.3 Assessment of bird species within the survey area

Dungarvan Landfill and environs support a diversity of birds. The river corridor is particularly species-rich, providing feeding grounds for many passerine species within the trees and scrub along its length, good feeding grounds for aerial insectivores such as Swallows and Sand Martins above the water column and ideal feeding habitats for those species that rely on the water column directly e.g. Kingfisher and Little Egret. As noted in previous reports (Limosa Environmental, 2005) the river corridor also has several areas of riverbank that appear ideal nesting places for Kingfisher. It was interesting that a Kingfisher was observed this year in the same location as in 2005. This suggests that a territory is held along this length of the river. Dippers (*Cinclus cinclus*) were not observed or heard this year but are expected to be present along the river also. Sedge Warblers (*Acrocephalus schoenobaenus*) were again recorded in the reed bed habitat by the leachate pool.

A Common Sandpiper was observed for the second year in a row. This wading bird species breeds within Ireland and migrates to West Africa for the winter (Wernham *et al.*, 2002). Suitable breeding habitat occurs in association with the river and estuary.

Of note is the presence of Little Egret and Kingfisher, Annex I species under the terms of the EU Birds Directive. Little Egrets appeared more abundant this year, a maximum of five being recorded at one

time (during the high tide survey). This may be related to Little Egret numbers in Dungarvan Harbour increasing due to a 'good' breeding season this year (B. Duffy NPWS pers. comm.).

The Kingfisher is considered an indicator species or 'bioindicator' of the health of river ecosystems (Tucker & Heath, 1994), in that it rapidly disappears from polluted waters. Its continued presence in the same area is therefore a positive sign as to the health of the river. Likewise, the presence of both Kingfisher and Little Egret suggest a healthy and adequate fish supply bearing in mind that to successfully rear a brood, Kingfishers need to catch about 100 small fish a day for up to four weeks (NRA, 2001).

5.4 Review of data from the Irish Wetland Bird Survey (I-WeBS)

Dungarvan Harbour is a large, south-east facing bay with extensive mud and sand flats that are sheltered by Helvick Head to the south and Ballnacourty point to the north (Birdlife International, 2005). It is almost entirely enclosed by the linear Cunnigar Spit (Crowe, 2005) which further shelters the mudflats. The River Colligan is the largest of three rivers that enter the harbour.

The large expanses of intertidal mudflats and associated wetland habitats of Dungarvan Harbour are important feeding and roosting areas for migratory wintering wading birds and wildfowl. Consequently Dungarvan Harbour has been designated as a Special Protection Area (SPA) (Site Code 032) and as a Ramsar Site (Ramsar Convention Bureau, 1984). The site qualifies for designation because it is an internationally important wetland site under established criteria of the Ramsar Convention Bureau (1984) in that it regularly supports bird species that are considered to numerically surpass national or international population thresholds. Dungarvan harbour is also recognised as an Important Bird Area (IBA) (Site Code 094) (Birdlife International, 2005).

Waterbirds of Dungarvan Harbour are counted annually during winter as part of the Irish Wetland Bird Survey (I-WeBS) that first commenced in 1994/95. The count area includes the Colligan estuary as far upstream as Ballyneety Bridge.

Crowe (2005) provides a historic review of waterbird data from wetland sites around the country. At Dungarvan Harbour, there appears to have been a slight decline (3%) in the overall waterbird numbers using the harbour since the earlier *Winter Wetlands Surveys* of 1984-1986. This is largely attributed to a significant decline (68%) in waterfowl e.g. Light-bellied Brent Goose and Shelduck. However, there has been an increase in wading birds (12%) since the *Winter Wetlands Surveys* of 1984-1986. More recently, data for Dungarvan Harbour suggests an increase in wintering waterbirds with total waterbird numbers surpassing the 20,000 threshold in recent years (e.g. 23,064 for the winter 2002/03) (Boland & Crowe, 2005).

The average number of total waterbird species found at Dungarvan Harbour (based on the four most recent winter counts) is 18,816 (Boland & Crowe, 2005). Dungarvan Harbour is currently considered the 15th most important wetland site in Ireland and the second most important wetland site in the south-east after Wexford Harbour. Dungarvan Harbour also supports wintering populations of Golden Plover (*Pluvialis apricaria*), Bar-tailed godwit (*Limosa lapponica*), Great Northern Diver (*Gavia immer*) and Little Egret (*Egretta garzetta*), all listed on Annex I of the EU Birds Directive.

The most up-to-date and available I-WeBS data for Dungarvan Harbour (2001/02 – 2004/05) is shown in Appendix 5.3.

Assessment of a species local population size is based on National and International importance thresholds. A site of national importance regularly holds 1% of the estimated national population of a species. A site of international importance is defined as regularly holding 20,000 waterbirds and/or regularly holds 1% of the individuals in a population of a species or subspecies. The same criteria are used to define Ramsar Sites (Ramsar Convention Bureau, 1984). The current I-WeBS data for Dungarvan Harbour were assessed using current national and international population estimates (Delaney & Scott, 2002; Crowe *et al.*, in prep).

The data shows that Dungarvan Harbour supports two species in internationally important numbers: Light Bellied Brent Goose (*Branta bernicla hrota*) and Black-tailed godwit (*Limosa limosa*). The average number of Bar-tailed godwits is close to the international threshold.

A further 13 species are supported in nationally important numbers: Shelduck (*Tadorna tadorna*), Wigeon (*Anas penelope*), Red-Breasted Merganser (*Mergus serrator*), Oystercatcher (*Haematopus ostralegus*), Golden Plover (*Pluvialis apricaria*), Grey Plover (*Pluvialis squatarola*), Lapwing (*Vanellus vanellus*), Knot (*Calidris canutus*), Sanderling (*Calidris alba*), Dunlin (*Calidris alpina*), Curlew (*Numenius*

arquata), Redshank (*Tringa totanus*) and Turnstone (*Arenaria interpres*). Average numbers of Greenshank (*Tringa nebularia*) are close to the national threshold.

A review of the current and previous data suggests relatively stable numbers of wading birds across the winters. Low counts in one season (e.g. Black-tailed godwit 2004/05; Lapwing 2004/05) cannot be viewed as a real decline unless the trend continues over subsequent seasons. Likewise only further data collection in the future will reveal whether apparent increases in species such as Light-bellied Brent Goose, Ringed Plover and Sanderling are sustained.

Appendix 5.1

Conservation Assessment

The conservation importance of bird species largely relates to the population status of each particular bird species, within its breeding and/or wintering range. Bird species of conservation importance may be listed on either or both of the following:

Council Directive of 2 April 1979 on the Conservation of Wild Birds (79/409/EEC) ('Birds Directive')

This directive relates to the conservation of all species of naturally occurring birds in the wild. The directive lays down protection, management and control of these species and lays down rules for their exploitation. The directive applies to the birds, their eggs, nests and habitats.

This legislation is behind the designation of Special Protection Areas (SPAs).

Birds of Conservation Concern in Ireland (Newton *et al.*, 1999).


This document set out by BirdWatch Ireland and RSPB Northern Ireland, presents a priority list of bird species within Ireland. The list is divided into Red List Species of high conservation concern e.g. species that have undergone significant population declines (>50%) since 1900. Amber List Species are defined as having medium conservation concern e.g. species whose breeding population has declined by 25% - 50% in the past 25 years. Green List Species are species whose conservation status is presently considered as favourable.

Appendix 5.2

Bird species recorded during the surveys and mentioned in the text, Conservation status is given with respect to the EU Birds Directive (Annex I species) and birds listed on 'Birds Of Conservation Concern' (Newton *et al.*, 1999).

SPECIES	Listed on Birds Of Conservation Concern (Newton <i>et al.</i> , 1999)	Listed on Annex I of EU Birds Directive (79/409/EEC)
Great Northern Diver <i>Gavia immer</i>		
Little Grebe <i>Tachybaptus ruficollis</i>		
Cormorant <i>Phalacrocorax carbo</i>	Amber List	
Little Egret <i>Egretta garzetta</i>	Amber List	Annex I
Grey Heron <i>Ardea cinerea</i>		
Light-bellied Brent Goose <i>Branta bernicla hrotra</i>	Amber List	Annex I
Moorhen <i>Gallinula chloropus</i>		
Shelduck <i>Tadorna tadorna</i>	Amber List	
Shoveler <i>Anas clypeata</i>		
Wigeon <i>Anas penelope</i>	Amber List	
Red-breasted Merganser <i>Mergus serrator</i>	Amber List	
Oystercatcher <i>Haematopus ostralegus</i>		
Ringed Plover <i>Charadrius hiaticula</i>		
Grey Plover <i>Pluvialis squatarola</i>	Amber List	
Golden Plover <i>Pluvialis apricaria</i>	Amber List	Annex I
Lapwing <i>Vanellus vanellus</i>	Red List	
Sanderling <i>Calidris alba</i>		
Turnstone <i>Arenaria interpres</i>		
Dunlin <i>Calidris alpina</i>	Amber List	
Knot <i>Calidris canutus</i>		
Common Sandpiper <i>Actitis hypoleucos</i>		
Redshank <i>Tringa totanus</i>	Amber List	
Greenshank <i>Tringa nebularia</i>		
Black-tailed godwit <i>Limosa limosa</i>	Amber List	
Bar-tailed godwit <i>Limosa lapponica</i>		Annex I
Curlew <i>Numenius arquata</i>	Red List	
Snipe <i>Gallinago gallinago</i>	Amber List	
Black-headed Gull <i>Larus ridibundus</i>	Amber List	
Common Gull <i>Larus canus</i>	Amber List	
Wood Pigeon <i>Columba palumbus</i>		
Sand Martin <i>Riparia riparia</i>	Amber List	
Swallow <i>Hirundo rustica</i>	Amber List	
Kingfisher <i>Alcedo atthis</i>	Amber List	Annex I
Pied Wagtail <i>Motacilla alba</i>		
Grey Wagtail <i>Motacilla cinerea</i>		
Dunnock <i>Prunella modularis</i>		
Wren <i>Troglodytes troglodytes</i>		
Dipper <i>Cinclus cinclus</i>		
Robin <i>Erithacus rubecula</i>		
Stonechat <i>Saxicola torquata</i>	Amber List	
Blackbird <i>Turdus merula</i>		
Sedge Warbler <i>Acrocephalus schoenobaenus</i>		
Blue Tit <i>Parus caeruleus</i>		
Coal Tit <i>Parus ater</i>		
Magpie <i>Pica pica</i>		
Rook <i>Corvus frugilegus</i>		
Hooded Crow <i>Corvus corone cornix</i>		
Starling <i>Sturnus vulgaris</i>		
Chaffinch <i>Fringilla coelebs</i>		
Linnet <i>Carduelis cannabina</i>		
Greenfinch <i>Carduelis chloris</i>		
Goldfinch <i>Carduelis carduelis</i>		

Appendix 5.3



Dungarvan Harbour

Species name	1% National	1% International	2001/02	2002/03	2004/05	Mean (2000/01-2004/05)	Peak (2000/01-2004/05)
Red-throated Diver	20	10,000		2		1	2
Black-throated Diver		10,000				0	0
Great Northern Diver	20	50		7	6	4	7
Little Grebe	25	3,400	2		2	1	2
Great Crested Grebe	55	4,800	27	51	60	46	60
Cormorant	140	1,200	34	34	53	40	53
Grey Heron	30	2,700	29	10	29	23	29
Little Egret	20	1,300	14	5	17	12	17
Mute Swan	110	110			7	2	7
Light-bellied Brent Goose	220	220	556	531	948	678	948
Shelduck	150	3,000	175	560	371	369	560
Wigeon	820	15,000	112	204	274	197	274
Teal	450	4,000	257	358	343	319	358
Mallard	380	20,000	31	43	30	35	43
Pintail	20	600	1		1	1	1
Long-tailed Duck	20	20,000			1	0	1
Common Scoter	230	16,000			1	0	1
Goldeneye	95	4,000	2	10	17	10	17
Red-breasted Merganser	35	1,700	20	51	33	35	51
Goosander				2	3	2	3
Oystercatcher	680	10,200	994	360	789	714	994
Ringed Plover	150	730	65	116	118	100	118
Golden Plover	1,700	9,300	6,500	5,122	5,800	5,807	6,500
Grey Plover	65	2,500	301	439	326	355	439
Lapwing	2,100	20,000	3,542	4,092	2,702	3,445	4,092
Knot	190	4,500	263	615	446	441	615
Sanderling	65	1,200	40	110	101	84	110
Dunlin	880	13,300	2,737	5,546	5,050	4,444	5,546
Snipe		20,000	1	112	137	83	137
Black-tailed Godwit	140	350	1,129	1,608	559	1,099	1,608
Bar-tailed Godwit	160	1,200	797	1,892	1,083	1,257	1,892
Whimbrel					1	0	1
Curlew	550	4,200	926	507	566	666	926
Spotted Redshank		1,000		1		0	1
Redshank	310	1,900	724	502	951	726	951
Greenshank	20	3,100	16	13	29	19	29
Green Sandpiper			12			4	12
Common Sandpiper			1		1	1	1
Turnstone	120	1,000	67	161	284	171	284
Sandwich Tern			3			1	3
Kingfisher					1	0	1
Sum of wildfowl peaks			1,260	1,868	2,196	1,775	2,196
Sum of wader peaks			18,115	21,196	18,943	19,418	21,196
Sum of wildfowl & wader peaks			19,375	23,064	21,139	21,193	23,064

6.0 GENERAL CONCLUSIONS AND RECOMMENDATION

Landfill habitats exhibited some changes this year in comparison to the 2005 survey, partly through natural vegetation succession with certain plant species starting to dominate (e.g. Gorse) and partly through the clearance of vegetation from the main capped mound of the landfill. A small pond appears to have developed naturally within the site over the past few years and has developed its own wetland vegetation within a landscape of recolonising bare ground. This small habitat should ideally be conserved during site rehabilitation.

Habitats surrounding the landfill are largely the same as previous years but some scrub encroachment is evident as well as reed bed expansion. The report highlighted the dangers of allowing the alien, invasive species Japanese Knotweed to spread. A single stand of this plant was recorded on the northern slopes of the capped mound and we recommend that this is removed using appropriate methods.

The site and its surrounding environs continues to support a diversity of wildlife due to the variety of terrestrial and aquatic habitats present. In particular, the habitats associated with the River Colligan are valuable in terms of the flora and fauna they support. The mammal survey highlighted extensive use of the site by several mammal species. In particular a number of well-established sprainting sites continue to be used by the Annex I species otter and there is a hot-spot of otter activity on a bank behind the transfer station. This indicates the presence of favourable environmental conditions for this species. This species is highly protected and any future works at the site which may impact upon this species will require assessment.

Annex I bird species Little Egret appear to have increased their use of the River Colligan adjacent to the landfill site and numerous other bird species utilise the habitats within and surrounding Dungarvan landfill. In particular the Annex I species Kingfisher continues to hold a territory along this stretch of river.

The biological assessment of the River Colligan suggested a fair to good water quality at the five sampling sites. We raised some concerns with regards the level of macrophyte growth in the river which may have had an impact upon the macroinvertebrate communities and at Site 2 in particular. Macrophyte growth is not however, directly attributable to landfill activities and a variety of nutrient sources and other factors are involved in its abundance. Water quality parameters measured during the survey were found to be within acceptable ranges. Similarly, a review of EPA chemical water quality data (2001-2006) shows acceptable water quality within the River Colligan.

Given the abundance of wildlife associated with the site and the numerous protected species recorded in association with the adjacent River Colligan, future rehabilitation/redevelopment of the site may require some level of ecological impact assessment. The appropriate bodies (e.g. National Parks & Wildlife Service) should be consulted at the relevant time.

7.0 REFERENCES

- Aquatic Services Unit (1998) *Dungarvan Landfill: Marine and Freshwater Ecology*. Report to Waterford County Council.
- Atrill, M. J. & Power, M. (2000) Effects on invertebrate populations of drought-induced changes in estuarine water quality. *Marine Ecology Progress Series* **203**, 133-143.
- Atrill, M. J., Rundle, S. D. & Thomas, R. M. (1996) The influence of drought-induced low freshwater flow on an upper-estuarine macroinvertebrate community. *Water Research* **30**, 261-268.
- Bang P. & Dahlstrøm P (2003) *Animal tracks and signs*. Oxford University Press Inc., New York.
- BirdLife International (2005) *BirdLife's Online World Bird Database: the site for bird conservation*. Version 2.0. Cambridge, UK: BirdLife International. Available: <http://www.birdlife.org> (accessed 21/09/2006).
- Blomster, J., Maggs, C. A. & Stanhope, M. J. (1998) Molecular and morphological analysis of *Enteromorpha intestinalis* and *E. compressa* (Chlorophyta) in the British Isles. *Journal of Phycology* **34**, 319-340.
- Boland, H. & Crowe, O. (2005) Results of Waterbird Monitoring in the Republic of Ireland in 2002/03. *Irish Birds* **7**, 529-538.
- Chapman, D. (Editor) (1996) *Water Quality Assessments. A guide to the use of biota, sediments and water in environmental monitoring*. UNESCO/WHO/UNEP. E & FN Spon, (Chapman & Hall), UK. 625pp.
- Child, L., Wade, M., Wagner, M. (1998) Cost effective control of *Fallopia japonica* using combination treatments. In: Starfinger, U., Edwards, K., Kowarik, I., Williamson, M. (Eds.), *Plant invasions: ecological mechanisms and human responses*. Backhuys Publishers, Leiden, pp. 143-154.
- Connor, D. W., Allen, J. H., Golding, N., Howell, K. L., Lieberknecht, L. M., Northern, K. O. and Reker, J. B. (2004) *The Marine habitat classification for Britain and Ireland. Littoral Sediment Section*. Version 04.05. JNCC. UK. www.jncc.gov.uk/MarineHabitatClassification
- Croft, P. S. (1986) A key to the major groups of British freshwater invertebrates. *Field Studies* **6**, 531-579.
- Crowe, O. (2005) *Ireland's Wetlands and their Waterbirds: Status and Distribution*. BirdWatch Ireland.
- Crowe, O., G. E. Austin, K. Colhoun, P. Cranswick, M. Kershaw and A. J. Musgrove. (in prep). Population estimates and trends for wintering waterbirds in Ireland, 1994/95-2003/04
- Curtis, T. G. F. (2003) Salt marshes. In: *Wetlands of Ireland* (eds: M. L. Otte). University College Dublin Press.
- Curtis, T. G. F. & McGough, H. N. (1988) *The Red Data Book: Vascular Plants*. Stationary Office, Dublin.
- D'Arcy G. (1988) *The Animals of Ireland*. Appletree Press Ltd., Belfast.
- De Butléar, É (1993) *Ireland's Wild Countryside*. Boxtree Ltd, London.
- Dalkin M. & Barnett, B. (2001) Procedural guideline No. 3-6. Quantitative sampling of intertidal sediment species using cores. In: *Marine Monitoring Handbook*. (eds: J. Davies; J. Baxter; M. Bradley; D. Connor; J. Khan; E. Murray; W. Sanderson; C. Turnbull & M. Vincent). Joint Nature Conservation Committee, Peterborough, UK. pp 253-258.
- Davies, A. (2001) The use and limits of various methods of sampling and interpretation of benthic macroinvertebrates. *Journal of Limnology* **60** (Supp. 1) 1-6.
- Davison, I. R. & Pearson, G. A. (1996) Stress tolerance in intertidal seaweeds. *Journal of Phycology* **32**, 197-211.

- Delaney, S. & Scott, D. (2002) *Waterbird Population Estimates*. Wetlands International Global Series No. 12.
- Edington, J. M. & Hildrew, A. G. (1995) *Caseless Caddis Larvae of the British Isles*. Freshwater Biological Association Scientific Publication No. 53.
- Elliott, J. M. & Mann, K. H. (1979) *A key to British Freshwater Leeches*. Freshwater Biological Association Scientific Publication No. 40.
- EPA (2005) *River quality in southeast Ireland*. Environmental Protection Agency, Kilkenny.
- Fairley J. S. (2001) *A Basket of Weasels*. Private Publication, Belfast.
- Fossitt, J.A. (2000) *A Guide to the Habitats of Ireland*. The Heritage Council, Ireland.
- Giller, P. S. (ed) *Studies in Irish Limnology*. Essays on the occasion of the XXVII Congress of Societas Internationalis Limnologiae (SIL) Dublin 1998. Marine Institute.
- Giller P.S. & Malmqvist B. (1998) *The Biology of Streams and Rivers*. Oxford University Press Inc., New York.
- Goodwillie, R. & Assoc. (1998) *Dungarvan Landfill: Terrestrial Ecology*. Report to M.C. O'Sullivan Ltd.
- Hayden T. & Harrington R. 2001. *Exploring Irish Mammals*. Dúchas The Heritage Service. Town House, Dublin.
- Heritage Council (2002) *Habitat Survey Guidelines: a standard methodology for habitat survey and mapping in Ireland (Draft)*. The Heritage Council, Kilkenny, Ireland.
- Hynes, H. B. N. (1977) *A key to the adults and nymphs of British Stoneflies (Plecoptera)*. Freshwater Biological Association Scientific Publication No. 17.
- IEA (1995) *Guidelines for Baseline Ecological Assessment*. Institute of Environmental Assessment. E & FN Spon, UK.
- ISSG, Invasive Species Specialist Group (2001) *100 of the world's worst invasive alien species*. The World Conservation Union (IUCN), Species Survival Commission.
- JNCC (2003) *Handbook for Phase 1 habitat survey: a technique for environmental audit*. Joint Nature Conservation Committee, Peterborough.
- Kiely, G. (1998) *Environmental Engineering*. McGraw Hill International Editions.
- Limosa Environmental (2004) *Ecological survey of Dungarvan Landfill*. Unpublished report for Waterford County Council.
- Limosa Environmental (2005) *Ecological survey of Dungarvan Landfill*. Unpublished report for Waterford County Council.
- Lyons, J. (2003) *Dungarvan Landfill: Ecological Survey*. Report for Waterford County Council.
- Macan, T. T. (1979) *A key to the nymphs of the British Species of Ephemeroptera*. Freshwater Biological Association Scientific Publication No. 20.
- Mason C.F. & MacDonald S.M. (1986) Levels of cadmium, mercury and lead in otter and faeces from the United Kingdom. *The Science of the Total Environment* 53, 139-146.
- MacDonald D. & Barrett P (1993) *Collins Field Guide : Mammals – Britain and Europe*. HarperCollins Publishers.
- McGarrigle, M. L., Bowman, J. J., Clabby, K. J., Lucey, J., Cunningham, P., MacCárthaigh, M., Keegan, M., Cantrell, B., Lehane, M., Clenaghan, C. & Toner, P. F. (2002) *Water Quality in Ireland 1998-2000*. Environmental Protection Agency, Wexford.
- Newton, S., Donaghy, A., Allen, D. & Gibbons, D. (1999) Birds of Conservation Concern in Ireland. *Irish Birds* 6, 333-344.

- NRA (2001) *River Corridor Surveys: Methods and Procedures*. Conservation Technical Handbook No. 1. National Rivers Authority, UK.
- O' Sullivan W.M., MacDonald S.M. & Mason C.F (1993) Organochlorine pesticide residues and PCBs in otter spraints from southern Ireland. *Biology and Environment: Proceedings of the Royal Irish Academy* 93B, 55-57.
- Preston, Pearman & Dines (2002) *New Atlas of the British and Irish Flora*. Oxford University Press, Oxford.
- Ramsar Convention Bureau (1984) Convention on wetlands of international importance especially as waterfowl habitat. *Proceedings of the 2nd conference of Parties: Groningen, Netherlands, 7-12th May, 1984*. Ramsar Convention Bureau, Gland, Switzerland.
- Sleeman, D. P. & Moore, P. G. (2005) Otters *Lutra lutra* in Cork City. *Irish Naturalists Journal* 28, 73-79.
- (SSG) Species Survival Commission (2000) IUCN guidelines for the prevention of biodiversity loss caused by alien invasive species. The World Conservation Union (IUCN), Gland.
- Stace, C. A. (1997) *New Flora of the British Isles*. 2nd Edition. Cambridge University Press, UK.
- Toner, P., Bowman, J., Clabby, K., Lucey, J., McGarrigle, M., Concannon, C., Clenaghan, C., Cunningham, P., Delaney, J., O'Boyle, S., MacCarthaigh, M., Craig, M. & Quinn, R. (2005) *Water Quality in Ireland 2001 – 2003*. Environmental Protection Agency.
- Tucker, G. M. & Heath, M. F. (eds) (1994) *Birds In Europe: Their Conservation Status*. Birdlife International Series No. 3.
- Wallace, I. D., Wallace, B. & Philipson, G. N. (2003) *Keys to the Case-Bearing Caddis Larvae of Britain and Ireland*. Freshwater Biological Association Scientific Publication No. 61.
- Webb, D. A., Parnell, J. & Doogue, D. (1996) *An Irish Flora*. Dundalgon Press Ltd, Dundalk, Ireland.
- Wernham, C. V., Toms, M. P., Marchant, J. H., Clark, J. A., Siriwardena, G. M. & Baillie, S. R. (eds) (2002) *The Migration Atlas: movements of birds of Britain and Ireland*. T & A D Poyser.
- Whilde A. (1993) *Threatened Mammals, Birds, Amphibians and Fish in Ireland - Irish Red Data Book 2: Vertebrates*. HMSO, Belfast.

Appendix B – Closure, Restoration and Aftercare Management Plan



Dungarvan Landfill W0032-02

Closure, Restoration and Aftercare Management Plan

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1 INTRODUCTION

This Closure, Restoration and Aftercare Management Plan (CRAMP) for Dungarvan Landfill, Co. Waterford has been prepared in order for Waterford County Council to comply with Condition 10.6 and 10.7 of their Waste Licence, W0032-02.

1.1 LICENCE COMPLIANCE

It is a requirement under the current waste licence (W0032-02) to prepare a CRAMP report for the facility. The waste licence outlines the requirements of the CRAMP as stated in condition 10.6 and 10.7. The requirements as outlined in the waste licence are as follows:

10.6 Closure, Restoration & Aftercare Management Plan (CRAMP):

- 10.6.1 The Licensee shall prepare for agreement by the Agency, a fully detailed and costed plan for closure, restoration and long-term aftercare of the site or part thereof.
- 10.6.2 The plan shall be maintained and 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 written agreement of the Agency.

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

- 10.7.1 A scope statement for the plan (*see section 1.2*)
- 10.7.2 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. (*see Section 5*)
- 10.7.3 A programme to achieve the stated criteria (*see Section 4*)
- 10.7.4 Where relevant, a test programme to demonstrate the successful implementation of the plan. (*see Section 5*)
- 10.7.5 Details of the long-term supervision, monitoring, control, maintenance and reporting requirements for the restored facility (*see Section 6*)
- 10.7.6 Details of costings for the plan and the financial provisions in place to underwrite these costs. (*see Section 7*)

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

1.2 SCOPE STATEMENT

The scope of this report is to outline to the Agency, for their agreement, the intended closure, restoration and aftercare management proposals for Dungarvan Landfill, Co. Waterford. It is intended that this report meets the requirements of Condition 10.6 and 10.7 of Waste Licence W0032-02.

1.3 FACILITY DESCRIPTION

1.3.1 Site Location and history

Dungarvan Landfill is located in Ballynamuck Middle Co. Waterford approximately 2km north west of Dungarvan, off the N25 road on the Southern Bank of the Colligan River. The existing landfill covers an area of approximately 6.5 hectares. The location is indicated in Figure 1. It is thought that filling on the site commenced in the late 1960's. Ownership of the landfill was passed to Waterford County Council in 1985.

Since then, it is estimated that 365,000 tonnes of waste had been accepted. A temporary layer of cover material was placed across the site in early 2003 in accordance with licence condition 5.2.3. This intermediate cover was placed at a minimum depth of 500mm of inert material. This was carried out so that no waste, other than inert waste suitable for underlying the specified engineering works, was exposed. Acceptance of waste at the facility ceased in 2003.

1.3.2 Surrounding Environment

The existing landfill site at Ballynamuck Middle is located on a meander of the Colligan River, immediately to the west of Ballyneety Bridge. Adjacent to the site the Colligan River becomes tidal, with an extensive area of mudflats located further to the east of Ballyneety Bridge extending into Dungarvan Harbour. Dungarvan Harbour itself is designated as a Special Protection area (SPA) which extends from Helvic Head to Ballyneety Bridge. A National Heritage Area (NHA) covers most of the bay and touches the western boundary of the landfill site. The location of the landfill in relation to the river Colligan can be seen in Figure 1.

The topography of the area is a gentle south facing slope and is bounded by a low ridge running east-west to the north of the Waterford-Cappoquin Road. The general character of the landscape is one of good quality agriculture with a relatively high level of visual amenity. Land use in the vicinity of the site is primarily agricultural pastureland with some isolated patches of cropland. There is urbanisation in the form of ribbon development on the county roads around the site. There is also an "angler's path" running along the boundary of the site adjacent to the river on which there is a public right of way.

1.3.3 Waste Licence

A Proposed Decision Waste Licence (PD) was granted to Waterford County Council for the restoration of Dungarvan Landfill Facility at Ballynamuck Middle, Dungarvan, Co. Waterford, in April 2005. An objection to the PD was lodged by the council and a final licence was granted for the site in May 2005.

Condition 10 of the waste licence set out the requirements for the restoration and aftercare of the facility.

1.3.4 Proposed After Use Development

It is intended that the site is to be capped completely at which time it will progress to a non-clean closure status as defined in the EPA Guidance Document. This process will be discussed in more detail in Section 2.

It is intended to develop a series of Integrated Constructed Wetlands (ICW) at the site to treat the leachate and provide a public local amenity area.

While the primary objective of the constructed wetlands is for leachate treatment, the development and conservation of wildlife habitats is compatible as an afteruse. The layout, structure and composition of the wetlands will be entirely compatible with the surrounding ecology and will greatly increase the restored landfill's visual and wildlife amenity. Wetlands are important as habitats for invertebrates, marginal and aquatic vegetation, amphibians, fish and a range of breeding and wintering wildfowl as an area for nesting and feeding. The restored site will play an important role as a wildlife corridor in the area.

Development of the site as a nature conservation area will involve careful consideration of the following key principles:

- Ongoing consultation with relevant nature consideration bodies, i.e. the National Parks and Wildlife Service (NPWS) and local groups.
- Views of the local community.
- Incorporation of existing ecological interests and use of native species.
- Integration of other uses such as public pathways and signboards explaining local ecology or an interpretive centre.
- Ongoing maintenance/management of pollution control systems throughout the afteruse of the site.
- Ongoing monitoring to determine whether nature conservation objectives are being achieved.

1.4 FACILITY PROCESS AND ACTIVITIES

Dungarvan Landfill is licenced for the following Waste Disposal Activities in accordance with the Third Schedule of the Waste Management Acts 1996 to 2005.

- **Class 4.** Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons
- **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.

Dungarvan Landfill is licenced for the following Waste Recovery Activities in accordance with the Fourth Schedule of the Waste Management Acts 1996 to 2005.

- **Class 2.** Recycling or reclamation of organic substances which are not used as solvents (including composting and other biological processes).
- **Class 3.** Recycling or reclamation of metals and metal compounds.
- **Class 4.** Recycling or reclamation of other inorganic materials.
- **Class 9.** Use of any waste principally as a fuel or other means to generate energy.
- **Class 11.** Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule.
- **Class 13.** Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced.

2 RESTORATION DESIGN

2.1 CAPPING DESIGN

Capping of the landfill will be completed in early 2008. The final capping system comprises of a gas collection layer, LLDPE liner, drainage layer, subsoil layer and topsoil layer as follows:

- 150-300mm layer of topsoil; underlain by
- Subsoil such that thickness of topsoil and subsoil is at least 1m thick; underlain by
- A surface water geocomposite layer; underlain by
- 1mm LLDPE liner (a low permeability geomembrane material).
- Geocomposite gas collection layer.

The capping layers will provide protection from the ingress of rain into the site and thus minimise leachate generation. In addition to the capping detail as required by the licence it is proposed that wetland ponds be constructed for the purpose of treating leachate. The drainage geocomposite layer will be placed on the side slopes only as the constructed wetlands will effectively control surface water drainage; in addition the depth of subsoil/topsoil will be decreased from 1m to 0.3m in areas where the ponds are located.

Approximately 5,500m² of the side slopes on the Southern side of Dungarvan landfill were capped in 2002 using a GCL as the low permeability layer.

2.1.1 Landscaping

In visual terms the existing landscape is contained within strong physiographic barriers – the Colligan River to the north, east and west, with its associated level changes and plant communities. The main views from the public domain to the site are from Ballyneety Bridge to the east, and from the road joining Ballyneety Bridge to the Waterford-Cappoquin Road to the north-east. There are also views to the site from individual properties to the west and from the farm on the Cappoquin road to the north. Overall the landfill has a minor negative visual impact on the surrounding landscape and approach roads.

Since the closure of the landfill in December 2003 reprofiling of the landfill has been undertaken to facilitate preparation for the capping of the landfill and formation of the Integrated Constructed Wetlands.

2.1.2 Inventory of Infrastructure

There is currently a civic amenity facility, an administration building and a composting area at the entrance to the landfill site. The civic amenity is a facility where the public can come to recycle their household waste. The administration building which incorporates a staff office, a canteen, and a toilet is located adjacent to the weighbridge. There is a secure compound formed by palisade fencing

around the civic amenity, administration building and composting areas. The following infrastructure is also in place:

- Composting slab;
- Anaerobic digesters;
- CCTV.

3 POLLUTION CONTROL SYSTEMS

3.1 INTRODUCTION

The following subsections outline the pollution control systems that will be managed and maintained throughout the restoration and aftercare phase in accordance with Condition 10 of Waste Licence W0032-02. These controls shall be maintained on-site until the EPA approves of their decommissioning.

3.2 CAPPING

Geosynthetics were used for the drainage layer, barrier layer and gas collection layer. Geogrid will also be placed on the side slopes, if required, for slope stability. The drainage geocomposite layer will be placed on the side slopes only as the constructed wetlands effectively control surface water drainage on the flat areas. Leachate extraction wells are to be located strategically across the site in order to maximise collection efficiency. Furthermore, rainwater will assist in the dilution of leachate within the constructed wetlands. The surface water drainage from the side slopes will run-off towards the proposed surface water carrier drain, which will run along the northern boundary.

3.3 LANDFILL GAS/LEACHATE MANAGEMENT

It is proposed to install a combined landfill gas and leachate extraction system, where gas and leachate are collected from a common set of collection points and transported via pipes laid within common trenches. Wellheads are adapted to accept both gas control valves and leachate pump. One of the advantages of the combined system is that it uses the same set of extraction boreholes, which given the limited space available at Dungarvan Landfill is particularly relevant as the constructed wetlands will occupy much of the surface area (see Figure 2).

The number of boreholes and the spacing between the boreholes was based on a number of factors including:

- Geological nature of underlying ground (site can be divided into three types – boulder clay, sand/gravel and limestone)
- Permeability of waste and boulder clay, sand/gravel and limestone)
- Head of leachate leachate over various areas of site.
- Diameter and construction of borehole
- Lowest attainable water table in borehole during abstraction (level outside borehole)

The current proposed layout of the combined gas and leachate extraction system is outlined in Figure 2. All wells are located on the berms surrounding the ponds to ensure access for installation and maintenance. Additional banks have been included in Pond 1 which is the largest of the ponds (10,479m²) to facilitate the layout of wells. The pipework network will be buried in the berms or subsoil layer and will allow for leachate to drain by gravity to the leachate collection tank as shown on Figure 2. Gas will be directed to the proposed flare location also shown on Figure 2.

A leachate interceptor drain will also be laid along the northern boundary. The drain will comprise of slotted HDPE pipes laid in a gravel surround and any leachate collected in the drain will be directed

towards the proposed leachate collection tank, where it will be pumped to the constructed wetlands for treatment.

A Supervisory Control and Data Acquisition (SCADA) system responsible for collecting all of the leachate information from the landfill site (e.g. pumps on/off/alarms, flow rates, leachate quality and flow trends) and displaying/storing information will be installed at the landfill. The flow will be regulated by a flow meter, which will ensure that the flow does not exceed the design capacity of the leachate collection tank and in turn the capacity of the wetlands ponds.

Waterford Co. Co consulted the National Parks and Wildlife Service as part of the preparation of the Restoration & Aftercare Plan on their proposals to construct integrated wetlands on the landfill for the purpose of treating leachate. Based on existing leachate concentrations at Dungarvan Landfill, the National Parks and Wildlife Service recommended a 1:5 to 1:8 dilution of the untreated leachate prior to treatment. The integrated constructed wetlands will consist of four ponds of varying size as shown on Figure 2. The ponds will be constructed by creating 1m x 3-4m wide perimeter bunds which will also be lined to effectively contain the leachate and allow for vehicular access, pathways and the integration of pollution control systems i.e. leachate and gas collection.

As outlined in the 'Water Treatment Performance and Environmental Impact of Integrated Constructed Wetlands (ICWs) in the Anne Valley Watershed' (see Appendix A), as waters pass through the wetlands, suspended organic matter is typically deposited onto wetland soil surfaces, which help impede infiltration from wetlands. Therefore, the creation of wetlands is similar to a barrier layer as it restricts the infiltration of water. It is proposed that lisimeters be placed on top of the barrier layer in the other ponds to assess the infiltration, if any, of water through wetland soil surface.

Vegetation plays a variety of essential roles in the performance of ICWs by providing:

1. Hydraulic resistance and increased residence time.
2. Large surface-area skeletal structure to support microbial bio-films.
3. Oxygen transport to the soil substrate to aid the breakdown of organic pollutants.
4. Necromass/detritus that facilitates the long-term storage of phosphorus, and ensures the source of carbon for anaerobic metabolism, including the denitrification of ammonium and nitrate.
5. Long-term storage of sequestered carbon.
6. Reinforcement of the banded structure through reducing infiltration and providing enhanced integrity to the wetland base structure.
7. Increased landscape-fit opportunities due to plant varieties

The primary vegetation types used in ICWs are emergent plant species (helophytes). These species have evolved to enable them to root in soils with no available or limited oxygen, growing vertically through the water column with most of their leaves in the air. They have specially adapted tissues that facilitate oxygen storage and its transportation from the leaves through the stem to the roots. Soil and water characteristics influence the type and performance of plant species for each wetland segment of an ICW. While more than a hundred native species can be used, in general about 12 species are most commonly used. These generally are:

- Carex Typha Phragmites
- Sparganium Glyceria Juncus Eleocharis
- Iris Myriophyllum Veronica Ranunculus

Species selection depends upon; water depth, turbidity, pH, ammonium concentration and ionic strength for each wetland segment/cell. Various mixes of species will be used throughout the ICW, related to the physical appearance of the plants, but also related to survival at different water depths.

With time the wetland environment changes as its constituent species interact. Inter-specific competition and other biotic factors, especially waterfowl, influence long term vegetation development. Initial plant establishment exerts the dominant influence on the vegetation structure of an ICW.

3.4 SURFACE WATER MANAGEMENT

As the landfill is located on the banks of the river Colligan, it is proposed that the surface water drainage from the side slopes will run-off towards the proposed surface water carrier drain, which will run along the northern boundary. The carrier drain will then discharge into the River Colligan.

3.5 STABILITY ASSESSMENT

Restoration of the landfill will take account of the risk of instability of the side slopes both in the short-term prior to, and during, restoration works, and in the long-term after capping and when restoration is completed. Particular attention will be paid to the stability of the individual capping layers on the side slopes especially where geosynthetics are used.

4 RESTORATION PROPOSALS

Restoration of the landfill will provide for an integrated approach to pollution control. As part of the restoration programme the following pollution control measures are vital to the successful restoration of the landfill in order to protect the environment:

- The landfill capping system acts as a barrier layer and restricts moisture ingress and migration of landfill gas.
- The landfill gas management system controls the landfill gas generated within the waste body.
- The leachate management system abstracts and controls the leachate generated within the waste body.
- The surface water management system ensures that the surface water generated on the restored landfill does not erode the landfill capping.
- Fixed monitoring points provide an outlet for monitoring for potential environmental impacts which may be caused by the landfill.

The potential impacts of pollution control systems on the proposed afteruse and access requirements for monitoring purposes are being continually considered.

4.1 STEPS OF RESTORATION

The stages of restoration which have been carried out or which are intended to be carried out are listed below:

4.1.1 Surface preparation

This stage involved the preparation of the side slopes and top of the landfill for final capping and the formation of the ponds for ICW's. This involves the removal of existing vegetation and any protruding objects within the temporary cap. It is imperative that any protruding objects on the side slopes are removed as geosynthetics are to be used and any protruding objects could potentially damage these materials.

Preparation of the landfill surface involves re-profiling the landfill and the removal of the temporary capping in places. Extreme care was taken to maintain an adequate cover over the waste at all times.

4.1.2 Installation of final cell capping layers

The final capping layer is to be constructed using the materials as described in Section 2.1.

4.1.3 Installation of gas/leachate extraction wells

After capping to subsoil level, it is proposed to install the extraction wells. The extraction wells are to be positioned strategically across the site in order to maximise the collection efficiency. There is to be 12 combined gas/leachate wells, the remainder will be exclusively gas wells.

4.1.4 Installation of collection pipework

The collection pipework for both leachate and gas collection systems will consist of a network of pipes connected to the extraction wells. Pumps for leachate abstraction will be installed in the 12 combined gas/leachate wells. Leachate will be pumped through a network of collection pipework to a leachate storage tank. The treated effluent will be tested for a number of agreed parameters. There will be no discharge to the River Colligan unless these performance parameters of the effluent are below the agreed threshold. This proposal is subject to approval of the agency and will be considered in a future submission. Gas will be extracted under a negative pressure and will flow through a gas collection pipe network to the flare plant.

4.1.5 Distribution of leachate into wetland ponds

The wetlands are to be constructed by creating perimeter bunds around each pond. The shape of the ponds, the bunds and the topography of the pond floor can be seen in Figure 2.

Leachate will be extracted from the landfill body through a series of leachate extraction wells outlined in Section 4. The collection pipework will carry the leachate to a collection tank where dilution will take place. From there it will be pumped up to Pond 1 where treatment will begin. The leachate will flow through Ponds 2, 3 and 4. In the event that high levels of contamination are shown at the outlet of Pond 4, the leachate will be directed back into the dilution tank for further treatment in the constructed wetlands.

4.1.6 Landscaping and ecological proposals

The landfill side slopes and a small area of the surface will be grassed thus improving the surface stability and visual impact. Grass is a suitable crop for landfill restoration as it is tolerant of poor soil conditions, provides all year round soil cover and promotes the development of soil structure. Suitable grass seeds will be based upon the type of grass in the surrounding area. Suitable grass seeds for poor soil conditions that would be experienced in landfill restoration conditions would include ryegrasses, meadow fescues, timothy and clover. Choice of grass seeds also depends on consultation with the Agency Manual on Restoration and Aftercare.

Mitigation of the visual impact of the landfill will be achieved in the following ways:

- Through grading the site and establishment of wetlands.
- Reinstatement of the old hedgerow along the southern boundary of the site creating an enclosure against the cropland adjacent to the site.
- Through planting the surrounding embankments to the north, east and west with woodland planting. Trees will be planted at the bottom of the slopes so that they will not block views of the Comeragh Mountains to the north.

The screening and grassing of the capped areas has been so designed to minimise the visual impact of the landfill and ensure continuity with the surrounding landscape. It is intended that, after the establishment of the wetlands, the landfill be restored to its final afteruse as a nature conservation and public amenity area.

The establishment of the wetlands on the landfill will bring the landfill to the afteruse stage. The landfill will be closely monitored (in accordance with Condition 6 of Waste Licence W0032-02) in order to maintain and encourage the use of the wetlands for the purpose of the development of wildlife in the area.

4.1.7 Pollution control systems

As the wetlands are also intended to be used for ecological and landscape purposes, it will remain a permanent feature of the restoration. As gas production decreases overtime the flare on site will be decommissioned and removed from site. Monitoring of all parameters will continue after restoration and closure of the landfill.

5 CRITERIA FOR SUCCESSFUL CLOSURE

5.1 CRITERIA FOR SUCCESSFUL CLOSURE

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.

Table 5.1 – Criteria for Successful non–clean closure of Area

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.	Leachate pumps to be disconnected. Removal of all leachate from the collection chambers, the cleaning of these chambers and then backfilling them with inert material for health and safety reasons. Upkeep of wetlands to be continued with the aid of rainwater collection. Leachate concentrations must be continually monitored.
Amounts of landfill gas produced are no longer sufficient to operate a 100m ³ /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.

5.2 TEST PROGRAMME

Monitoring will continue for the parameters identified in Schedule C of the waste licence W0032-02. 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.

5.2.1 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.

5.2.2 Non Clean Closure Declaration

The area will be subject to 'non-clean' closure and a restoration and aftercare plan will have to be maintained. This Closure Plan will be reviewed and updated annually as part of the Annual Environmental Report Submission to the EPA.

6 AFTERCARE MANAGEMENT PROPOSALS

6.1 INTRODUCTION

Waterford County Council will be responsible for the aftercare of Dungarvan Landfill up until the date when the EPA accepts the surrender of the Licence as specified under Section 48 of the Waste Management Act of 1996. According to Section 48(7): “if the Agency is satisfied that the condition of the relevant facility is not causing or likely to cause environmental pollution, then it shall accept the surrender of the Waste Licence, but otherwise shall refuse to accept the surrender of the Waste Licence”.

According to the EPA Manual ‘Landfill Restoration and Aftercare’ (1999) the aftercare plan ‘details the operations required after the replacement of the soil to bring the land up to the required standard for afteruse’. Such works will include:

1. Development of the site to its proposed afteruse, through completion of the restoration phase.
2. Environmental monitoring.
3. Site maintenance.

Section 4 discussed the requirements of the first point while the following sections discuss the necessary operations for points 2 and 3.

6.2 ENVIRONMENTAL MONITORING

The EPA Manual on Landfill Monitoring, 2nd edition (2003) identifies that monitoring shall continue into the aftercare phase in compliance with the Waste Licence. This will be continued until it can be shown that the landfill is no longer posing a risk to the environment.

A topographical survey will be undertaken on an annual basis over the capped area, this is particularly important in the first 2-3 years after final restoration, in order to assess the settling behaviour of the landfill body. In addition, a stability assessment will be completed to evaluate the structural integrity of the landfill body.

Waterford County Council will have regard to the conditions of the Waste Licence, the EPA Manual on Landfill Monitoring, 2nd edition (2003) and Annex III of the EU Landfill Directive, which outlines control and monitoring procedures in the aftercare phase to check, “that environmental protection systems are functioning fully as intended”.

During the aftercare phase the site operator will examine all monitoring equipment on a monthly basis to identify areas where maintenance works are required. The site operator will ensure that all works undertaken have minimal impact on the afteruse of the restored site.

Monitoring requirements set out in the EPA Waste Licence W0032-02 for Dungarvan Landfill will be continued up to a stage where the EPA instruct that the frequency of monitoring can be reduced.

6.3 SITE MAINTENANCE

6.3.1 Introduction

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

- 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 no longer required, redundant equipment and ancillary structures shall be removed.

6.3.2 Surface Profile & Capping System

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.

6.3.3 Surface Water Control

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.

6.3.4 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.

6.3.5 Maintenance of Pollution Control Systems

The above ground components of the pollution control systems will not be sited in vulnerable locations and appropriate security and preventative measures will be taken against vandalism. Should maintenance or remedial works be required on the pollution control systems, the following measures will be implemented to ensure minimal impact on the proposed afteruse:

- Account to be taken of the public usage of the site after closure and the need for the pollution control systems to operate safely in a public environment. Timing of works – Nature conservation aspects, such as breeding seasons and suitable sowing times, will be taken into account.
- All operations will be closely supervised to minimise damage to the restored land.
- Disturbance will be reduced by using the minimal practical working area and suitable access.
- Work will progress only when soil conditions are suitable.
- Machinery and plant which will cause minimum soil compaction to be used.

6.3.6 Leachate Management System

Leachate monitoring will include regular checks of the leachate monitoring points, the leachate pumps and the leachate storage tank. 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.

Once leachate abstraction is no longer required, decommissioning and removing of redundant structures shall take place. This will include the removal of all leachate from the collection chambers, the cleaning of these chambers and then backfilling them with inert material for health and safety reasons. All work in relation to leachate management shall be carried out in an environmentally safe manner and shall not adversely impact the afteruse or users of the restored site.

6.3.7 Gas Management System

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

- Regular monitoring of boreholes and 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.

Other work that may be required during the aftercare period may include changing the system from active to passive to extraction or relocating the gas flare system.

Once gas extraction is exhausted, decommissioning and removal of redundant structures shall take place. All work in relation to gas management shall be carried out in an environmentally safe manner and shall not adversely impact the afteruse or users of the restored site.

6.3.8 Landscape & Ecology

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.

Ecological monitoring will continue at the site after closure and the local ecology of the site will be maintained at the site. Any recommendations relating to the management of ecology from these assessments will be considered and implemented if required.

6.3.9 Infrastructure

All pathways, access points, buildings and equipment associated with the afteruse of the site will be checked regularly to ensure their integrity. Maintenance works will be carried out if required.

6.3.10 Security

To protect against vandalism the site operator will ensure that the security fencing and gates are maintained adequately given the afteruse at the site.

6.4 CONSULTATION

It is proposed at this stage that meetings shall be held with landscape architects/local community representatives and any other interested parties to discuss the progress of the restoration of the site. Any proposed changes to the restoration and aftercare plan shall be agreed with the Agency prior to implementation. The site operator will notify the Agency of any significant adverse environmental effects revealed by the monitoring procedures in the aftercare phase.

7 COSTS

7.1 FINANCIAL PROVISIONS

In accordance with Condition 12.1 of the Waste Licence, Waterford County Council have established and are maintaining a fund that is adequate to assure the financial capability of implementing the Restoration and Aftercare Plan as agreed with the Agency. The Council will revise the cost of the plan annually.

7.2 COSTS OF RESTORATION

The predicted costs for the restoration and aftercare of each area of the landfill are supplied in Table 7.2. These costs are based on previous amounts paid and tendered for similar works at other landfills around the country.

Both short and long-term “known” environmental liabilities exist at the landfill. Environmental liabilities are the costs associated with the restoration and aftercare works. The short-term liabilities are those which are expected to arise within the next 2 years and include the capping of the landfill area and the construction of a gas and leachate management system.

The long-term “known” environmental liabilities are those that will occur between 3 and 30 years from now. This includes the general upkeep of the area and landscape including the establishment of the wetlands as a habitat area for local flora and fauna. Long-term liabilities which apply to the landfill 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.

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*.

All costs estimates have been based on current 2007 rates and prices.

Table 7.2 - Costs of Restoration Proposal

Task No.	Title	Elements	Estimated Cost (Ex VAT)	Task Total
1	Preparatory Works	Site Clearance and preparation of site for placement of liners	€ 15,300.00	€ 117,650.00
		Construction of anchor trenches	€ 5,950.00	
		Connection of ESB to site	€ 25,000.00	
		Screening subsoil	€ 71,400.00	
2	Leachate Management	Supply and Installation of Leachate Collection Tank	€ 80,000.00	€ 160,000.00
		Preparation of ground for tank placement	€ 60,000.00	
		Tankering of Leachate for 1 year period	€ 20,000.00	
3	Leachate and Gas System	General Items	€ 42,850.50	€ 576,022.44
		Drilling of Boreholes	€ 53,592.84	
		Gas and Leachate collection system	€ 262,500.00	
		Gas Flare	€ 217,079.10	
4	Landfill Capping	Import Subsoil material	€ 119,250.00	€1,304,389.17
		General Items	€ 125,468.00	
		Lining Works	€ 590,839.62	
		Place Subsoil material	€ 427,160.00	
		Construction Quality Assurance for capping layers	€ 41,671.55	
5	Landscaping	Miscellaneous landscaping, grass seeding etc	€ 29,400.00	€ 63,828.80
		Materials for surface water drains post lining	€ 7,696.30	
		Construction of Surface water drains and ponds post lining	€ 26,732.50	
6	Project Management	WCC - Wages, Salaries and Expenses	€ 83,000.00	€ 357,796.00
		Consulting Engineer - Fees (Design, PSDS, Contract Administration and Supervision)	€ 266,860.00	
		PSCS	€ 7,936.00	
7	Flare Slab	Supply of materials	€ 16,000.00	€ 21,000.00
		Construction costs	€ 5,000.00	
			Total	€2,600,686.41

7.3 COSTS OF AFTERCARE MANAGEMENT PROPOSALS

Table 7.3 – Costs of aftercare management proposals

Environmental Liability	Description	Cost Estimate
General Management and maintenance of site during aftercare phase (30 yrs – includes for 20 years of aftercare).	€ 80,000 per annum– monitoring contract with Laboratory, small maintenance works.	€ 2,400,000
Management and maintenance of Leachate Abstraction & Treatment Process and pumping system during aftercare phase (30 yrs – includes for 20 years of aftercare)	€ 70,000 per annum- maintain Leachate Abstraction & treatment Process and SCADA system and replace pumps, lines etc. where required; Power supply; Testing	€ 2,100,000
Management and maintenance of Gas Management System during aftercare phase (30 yrs – includes for 20 years of aftercare)	€ 20,000 per annum – Maintain & operate landfill gas extraction system	€ 600,000
	Total for 30 year period	€ 5,100,000
	Contingency set at 15% for increased scope on last three items.	€ 765,000
	Total for 30 years with contingency	€ 5,865,000

7.4 FINANCIAL PROVISIONS IN PLACE

Waterford County Council allocates funding on an annual basis. The fund will be maintained in an amount always sufficient to underwrite current operations and future Restoration and Aftercare in accordance with Condition 12 of the waste licence.

8 CLOSURE PLAN UPDATE, REVIEW, IMPLEMENTATION AND VALIDATION

8.1 PROPOSED SCOPE AND FREQUENCY OF REVIEW

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.

This report will be reviewed on an annual basis and updated as required by the licence. 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.

8.2 EPA NOTIFICATIONS

The Plan will be maintained and reviewed annually and proposed amendments thereto will be notified to the Agency for agreement as part of the AER. No amendments will be implemented without the prior written agreement of the Agency. This will be in accordance with Condition 10.6.2 of the Waste Licence.

8.3 CLOSURE VALIDATION AUDIT

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.

8.4 CLOSURE VALIDATION AUDIT REPORT

A final validation report, which will include a certificate of completion for the CRAMP for each area of the site, will be submitted to the Agency within three months of execution of the plan. Monitoring results and necessary investigations and tests will be carried out to confirm that there is no continuing risk to the environment. This will be in accordance with Condition 10.8 of the Waste Licence.

9 CONCLUSION

This Closure Restoration and Aftercare Management Plan for Dungarvan Landfill, Co. Waterford, has been prepared in compliance with Condition 10.6 of Waste Licence W0032-02, 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 is held on site at Dungarvan Landfill for continual review and comment.

Appendix A

Water treatment performance and environmental impact of integrated constructed wetlands in the Anne valley watershed, Ireland

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Abstract

Integrated constructed wetlands (ICWs) can provide a management option for the collection and treatment of farmyard dirty water. An integrated constructed wetland is a surface flow wetland, which mimics the role and structure of natural wetlands. It also encompasses elements of landscape fit, biodiversity and habitat enhancement into its design. As part of the Annestown stream restoration project, ICWs were installed to treat dirty water from 12 farmyards. A detailed monitoring programme was conducted between 2001 and 2004. A significant reduction in organic matter, nutrients and faecal indicator bacteria between influent and effluent samples was recorded. There was no summer discharge from any of the farm wetland systems. An improvement in the quality of the receiving water (Annestown stream) was observed. A site-specific study suggested that P exported from an ICW system was similar to background levels of P export rates from land to water. In general, the ICWs monitored during this study indicate that they are capable of treating farmyard dirty water to a satisfactory quality, thereby provide a means of reducing nutrient and contaminant loss from agriculture.

Keywords: integrated constructed wetlands, farmyard dirty water, phosphorus, nitrogen surface water, and groundwater.

Introduction

Water quality status of the Annestown stream, Co. Waterford, Ireland was classified by the Irish Environmental Protection Agency (EPA) as heavily polluted during the 1990s. Dirty water runoff from farmyards within the watershed was considered to be a significant contributing factor to this. To help improve the water quality of the Annestown stream, 12 Integrated Constructed Wetlands (ICWs) were designed and built to treat farmyard dirty water from farms within the 25 km² Anne valley watershed. An ICW is a surface flow wetland, which mimics the role and structure of natural wetlands. The wetland is designed to have landscape fit, and by its addition to the landscape, it provides an additional ecological habitat (Harrington and Ryder, 2002). The design and structure of these systems are described in more detail by Harrington et al. (2005). The initiative to adopt an ICW approach within the watershed began in 1996. Most ICWs were built and commenced operation between 1999 and 2000.

This paper presents an overview of a monitoring study of 12 farm ICWs during the last three years, and their impact on receiving waters (both surface and groundwaters) within the watershed.

Materials and methods

Study area

Wetlands were constructed on various farm enterprises within the watershed (Table 1). In general, wetland size ranged from 3,621 m² to 22,025 m². Components of farmyard dirty water discharged to the wetlands were variable; waters typically consisted of yard and dairy washings, rainfall on open yard and farmyard roofed areas along with silage and manure effluents. On average, total ICW size was about 1.4 times the size of the open farmyard areas. All ICWs are in operation for at least four years.

Water sampling and flow monitoring

An extensive water quality monitoring programme was undertaken on the 12 ICW systems. This comprised of sampling wetland influents, effluents, receiving surface waters and groundwaters between August 2001 and July 2004. Grab samples were taken on a monthly basis from each wetland influent and effluent during the monitoring period. Wetland influents were generally taken from the first cell of each ICW, while effluent samples were taken from either the outlet pipe of the last wetland cell, or in the absence of effluent discharge, from the surface waters of the last wetland cell of each ICW system.

At one farm, ICW number 11 – a 4-celled system - (Table 1) flow meters were installed. Flows into (influent), between wetland cells (inflow into cell 2) and out of the ICW (effluent) were continuously recorded, using a flow meter and recording device. Flows were measured between March 2003 and July 2004.

Monthly grab water samples were taken since August 2001 along the main channel of the Annestown stream. This stream is the receiving waterbody for all ICW discharges. Macroinvertebrate surveys of the stream were also taken every three years by the EPA, which is an independent public body that was set up to protect the environment.

A total of eleven piezometric groundwater-monitoring wells were placed both up gradient and down gradient at various depths (2-5 meters) at three of the farm ICW sites. These wells were sampled approximately monthly between January 2004 and July 2004. The day before sample extraction, wells were purged. To assess the status of ambient groundwater quality, water samples were also taken from the farmers' water-supply wells. Testing of the participating farmers' water-supply wells was conducted once during March 2004.

Laboratory analysis

Water analysis for chemical oxygen demand (COD), five day biological oxygen demand (BOD₅), ammonium, nitrate, molybdate reactive phosphate (MRP), total suspended solids (TSS), chloride and *E. Coli* bacteria was conducted at the Waterford County Council water laboratory using American Public Health Association (APHA) standard methods 1992. The analysing laboratory participates in the EPA's laboratory proficiency scheme and is registered as an approved laboratory for these water analyses.

Table 1. Site characteristics of farms and integrated constructed wetland systems in the Anne valley, Co. Waterford.

ICW number	Farm enterprise	Farmyard area	Effective ICW area	ICW to yard area ratio	Aspect ratio of wetland cells	Dairy washings† (number of cows)	Yard water	Silage effluent	Roof water	Extraneous surface water or spring
		-----m ² -----								
1	Dairy	4,500	6,081	1.4	3	Yes (60)	Yes	No	Yes	Yes
2	Dairy	14,750	22,025	1.5	4	Yes (60)	Yes	Yes	Yes	Yes
3	Dairy, Beef	5,400	10,290	1.9	9	Yes (50)	Yes	Yes	Yes	No
4	Dairy	8,700	10,340	1.2	5	Yes (100)	Yes	No	Yes	No
5	Dairy and Tillage	4,000	3,950	1.0	2	Yes (35)	Yes	Yes	Yes	Yes
6	Dairy	9,800	12,710	1.3	2	Yes (80)	Yes	Yes	No	Yes
8	Beef	2,300	3,942	1.7	2	No	Yes	No	Yes	Yes
9	Mixed	4,800	7,958	1.7	2	Yes (55)	Yes	Yes	Yes	No
10	Mixed	2,100	4,380	2.1	2	Yes (50)	Yes	Yes	Yes	No
11	Dairy	5,000	7,690	1.5	5	Yes (77)	Yes	Yes	Yes	No
12	Mixed	10,500	10,726	1.0	2	Yes (85)	Yes	No	Yes	No
13	Sheep and tillage	5,000	3,621	0.7	2	No	Yes	No	Yes	Yes

† Dairy washings: A “Yes” indicates discharges to the wetland, a “no” indicates that there were none.

Results

Wetland influents and effluent water quality

Water quality data for all wetland influents and effluents for the monitoring period August 2001 until July 2004 are summarised in Table 2. Concentrations of the various water quality parameters measured reduced between wetland inlets and outlets. Concentration reductions were generally greater than 96% independent of water quality parameter. On average, COD was $2200 \pm 8000 \text{ mg L}^{-1}$, BOD₅ was $1040 \pm 4800 \text{ mg L}^{-1}$, TSS was $677 \pm 22 \text{ mg L}^{-1}$, ammonia was $83 \pm 0.7 \text{ mg L}^{-1}$, MRP was $24 \pm 0.5 \text{ mg L}^{-1}$ and *E. Coli* was $216000 \pm 381000 \text{ cfu per 100 mls}$ at wetland influents. This suggests that farmyard dirty water that was discharged to the 12 wetlands was variable in water quality. Average effluent water quality being discharged from the wetlands was $51 \pm 34 \text{ mg COD L}^{-1}$, $19 \pm 20 \text{ mg BOD}_5 \text{ L}^{-1}$, $22 \pm 26 \text{ mg TSS L}^{-1}$, $0.7 \pm 2.0 \text{ mg ammonia L}^{-1}$, $0.5 \pm 0.8 \text{ mg MRP L}^{-1}$, and *E. Coli* was $368 \pm 1320 \text{ cfu per 100 mls}$ during monitoring period.

In terms of BOD₅, if the two farm sites without dairy washings are excluded, ICWs 8 and 13 (Table 1) then the BOD₅ concentration of water entering the other ICW systems was approximately $1200 \pm 5200 \text{ mg l}^{-1}$. This value is consistent with soiled water, such as dairy washings diluted with “cleaner” water such as yard and roof runoff (EPA, 2002).

The ICW systems seem particularly proficient at reducing nitrogen concentrations in farmyard dirty water. Although not all fractions of nitrogen, such as organic nitrogen, were measured in this study, it is reasonable to assume that the sum of ammonium and nitrate in ICW system effluent are the major components of nitrogen in the treated water, given the low particulate and organic matter content in wetland effluents (Table 2). All phosphorus analyses were on the unfiltered reactive fractions, which are represented as MRP. During the monitoring a subset of wetland effluent samples were analysed for total phosphorus (TP). Results indicate that the effluent MRP concentrations ranged between 60 and 80% of TP concentrations.

There was a marked reduction in *E. Coli* counts between influents and effluents (Table 2). In fact, *E. Coli* counts in the ICW effluents being discharged to surface waters were lower than background counts in other south-eastern river waters, which had an average of 1446 cfu per 100 mls for the years 2002 and 2003 (Neill, 2002; 2003). This suggests that the ICWs had a high capacity to remove faecal indicator organisms associated with farmyard dirty water.

Factors influencing wetland performance

While a full discussion of ICW design in relation to farmyard management practices is beyond the scope of this paper, we will discuss the relative sizing of ICWs to farmyard areas, and also wetland aspect ratios, in conjunction with phosphorus performance data of the wetland. The average MRP concentration in the ICW effluents is used as the key indicator of water treatment performance. Effluent MRP concentration is considered an appropriate indicator, as phosphorus is recognised as one of the most difficult nutrients to remove from water, and it is the limiting nutrient in most Irish freshwater systems. To do this determination of performance six ICW systems (3, 4, 9, 10, 11 and 12; Table 1) were considered. These sites were chosen as on-site observations of all wetlands suggested that the other sites (1, 2, 5, 6, 8, and 13) were being influenced by the entry of extraneous waters from surface and/or subsurface origins. Due to these confounding effects, these sites were excluded.

Table 2. Summary data of water quality parameter concentrations of ICWs influents and effluents. Water quality parameters include chemical oxygen demand (COD), five day biochemical oxygen demand (BOD₅), total suspended solids (TSS), ammonium (NH₄⁺-N), molybdate reactive phosphorus (PO₄³⁻-P), nitrate (NO₃⁻-N), chloride (Cl⁻) and *E. Coli*.

	ICW number	COD		BOD ₅		TSS		NH ₄ ⁺ -N		PO ₄ ³⁻ -P		NO ₃ ⁻ -N		Cl ⁻		<i>E. Coli</i> cfu per 100 mls	
		Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Effluent	Influent	Effluent	Influent	Effluent	
Mean	1	10167	29	7194	12	1141	13	184	0.3	92.4	0.2	2.1	1687	54	39000	37	
SD		23261	11	16304	9	3113	12	258	0.4	220	0.4	2			61000	34	
n		21	24	19	23	21	22	21	22	20	23	23	1	1	3	6	
Mean	2	789	38	510	31	532	24	64	0.5	15.3	0.3	5.7	187	51	122000	46	
SD		759	14	643	2	1639	33	63	0.8	7.7	0.2	3.7			187000	46	
n		19	24	14	23	18	22	18	20	18	24	18	1	1	4	3	
Mean	3	1209	78	447	26	136	20	56	0.8	19.1	1.8	2	154	60	153000	87	
SD		1692	19	681	19	144	16	38	2.6	9.9	1.8	2	12	6	154000	20	
n		25	28	20	21	22	25	28	25	28	31	24	6	6	3	3	
Mean	4	1897	96	521	34	1119	52	119	3.1	25.4	1.5	3.3	197	75	513000	373	
SD		1981	39	365	25	3180	40	63	4.6	11.2	1.1	3.5	32	7	600000	173	
n		33	32	27	26	31	29	34	31	35	34	23	7	7	3	3	
Mean	5	922	43	313	19	136	14	51	0.6	13.6	0.3	3.8	178	27	190000	249	
SD		1505	34	382	22	131	9	68	1.1	22	0.7	2.1			41000	300	
n		21	20	21	20	21	18	19	20	20	21	14	1	1	3	3	
Mean	6	594	55	213	19	210	22	39	0.3	10.5	0.1	1.8		35	23000	13	
SD		670	29	289	16	493	25	45	0.3	9.8	0.2	1.3			30000	6	
n		21	23	21	21	19	21	21	21	22	23	10	0	1	3	3	
Mean	8	137	33	59	3	43	9	22	0.2	1.5	0.04	0.8		45	1000	79	
SD		87	9	62	14	60	7	85	0.3	1.3	0.07	0.6			1000	48	
n		22	22	20	19	21	20	21	21	22	22	4	0	1	3	3	
Mean	9	828	44	494	12	459	15	41	0.6	11	0.5	1.2	259	41	94000	65	
SD		1522	14	1040	11	1025	11	46	1.1	22.2	0.3	1.1	136	4	110000	71	
n		25	24	25	24	25	21	31	31	31	32	22	7	7	3	3	
Mean	10	834	43	171	14	165	20	40	0.4	14.7	0.1	1.7	48	23	24000	53	
SD		2171	35	398	11	267	10	108	0.8	36.8	0.1	1.5	19	3	20000	61	
n		26	27	22	23	23	23	28	31	27	31	21	5	7	2	2	
Mean	11	1502	60	694	21	693	18	40	0.4	12.8	1	3.2	134	40	293000	10	
SD		2401	24	1066	21	2354	17	48	0.6	17.2	0.6	3.6	81	5	166000		
n		40	41	32	28	37	39	43	46	43	47	36	10	12	3	2	

Mean	12	6494	45	2245	17	3089	24	266	0.7	60.4	0.3	2.7	96	41	79000	1056
SD		11995	56	2537	36	8340	28	407	1.8	80.2	0.5	2.3	101	1	95000	1374
n		28	26	22	22	22	21	28	28	28	29	21	4	4	3	2
Mean	13	139	35	50	16	200	20	13	0.1	0.9	0.05	1.8		39	2000	816
SD		186	18	70	15	370	22	26	0.1	1.3	0.08	1.3				1320
n		18	19	17	17	18	17	18	19	17	19	9	0	1	1	3

For the purpose of analysing the influence of ICW size on performance, the intercepted area from which water was observed to flow to the wetland was measured. Based on this, the ICW to intercepted area ratios ranged from 1.3 to 3.8. There was an inverse correlation ($r^2=0.66$; $p < 0.05$) between these ratios and wetland effluent MRP concentration (Table 2). These findings suggest that interception area such as farmyard open areas were important for adequate sizing of ICWs to attain wetland effluent MRP concentrations of sufficient quality.

Aspect ratio is defined as the average length of the wetland system divided by the average width. In this study, aspect ratios ranged from 2 to 9. There was a strong correlation ($r^2=0.86$; $p < 0.05$) between aspect ratio and wetland effluent MRP concentration.

There was no relationship between average wetland influent and effluent MRP concentrations. Nor was there a relationship between cow numbers and wetland effluent MRP concentrations. This may suggest that the amount of dairy wash water generated per cow has little effect on the overall performance of the ICW. Silage effluents contributed to farmyard dirty water on some sites. We found that there was no significant difference in effluent MRP concentration between systems receiving silage effluent, and those ICW systems that were not.

All the ICWs have been operating for a minimum of four years, and their performance with time is illustrated in figure 1. Effluent MRP concentrations were variable between and within sites during the monitoring period. Molybdate reactive phosphorus concentrations ranged from $10 \mu\text{g L}^{-1}$ to 4.7 mg L^{-1} depending on site and time of year. ICW sites 3 and 4 had relatively high and variable effluent MRP concentrations, with mean effluent MRP concentrations of 1.8 and 1.5 mg L^{-1} respectively. The remaining sites displayed less variability and relatively lower (less than 1 mg L^{-1}) mean effluent MRP concentrations. Average MRP concentration for all wetland effluents was low (mean \pm standard deviation; $0.41 \pm 0.7 \text{ mg L}^{-1}$) in comparison to influent concentrations. There was no discernable disimprovement in effluent quality over the monitoring period.

Site specific hydraulic flows

Hydraulic influences from extraneous sources were minimal at site 11; thus flow meters were installed. Wetland inflows, inflows to wetland cell 2 and wetland outflows were continuously recorded and results are shown in Figure 2. Average daily inflows, inflow to cell 2 and outflows from the ICW system during the monitoring period (April 2003 to August 2004) were $8.02 \pm 4.54 \text{ m}^3 \text{ d}^{-1}$, $10.25 \pm 14.69 \text{ m}^3 \text{ d}^{-1}$, and $0.62 \pm 1.72 \text{ m}^3 \text{ d}^{-1}$, respectively. Although there was inflow to the ICW between August 2003 and December 2003, and May 2004 and August 2004 there was no outflow from the system during these periods. The result being that there is a short discharge period to surface receiving waters. At this particular site discharge was during late winter and early spring. In general, all flows increased during early winter to early spring periods, which were from November to February 2004, whereas flows generally decreased during summer periods (Figure 2). During spring and early summer periods (February to May) inflows to wetland cell number two were larger than outflows, which suggest that rainfall on the previous wetland cell was an important contributor to within system flows. We can assume this, as the effect of other waters such as surface and subsurface runoff from the surrounding landscape was minimal at this particular site.

The pattern of flows seen at site 11 was repeated at other ICW sites, where instantaneous flows were measured. During February 2004 an average increase in flow through the wetland ponds of 250% was recorded at sites 4, 9 and 11. Decreases in flow through the wetlands

were recorded in the summer periods, and none of the twelve farm ICWs were discharging to receiving waters during the period June to October 2004.

During dry periods the loss of water from wetland due to evaporation and infiltration creates increased water storage capacity or freeboard within wetland cells. This provides a buffering capacity of the wetland during wetter weather such that waters are stored within the wetland system prior discharge during wet weather.

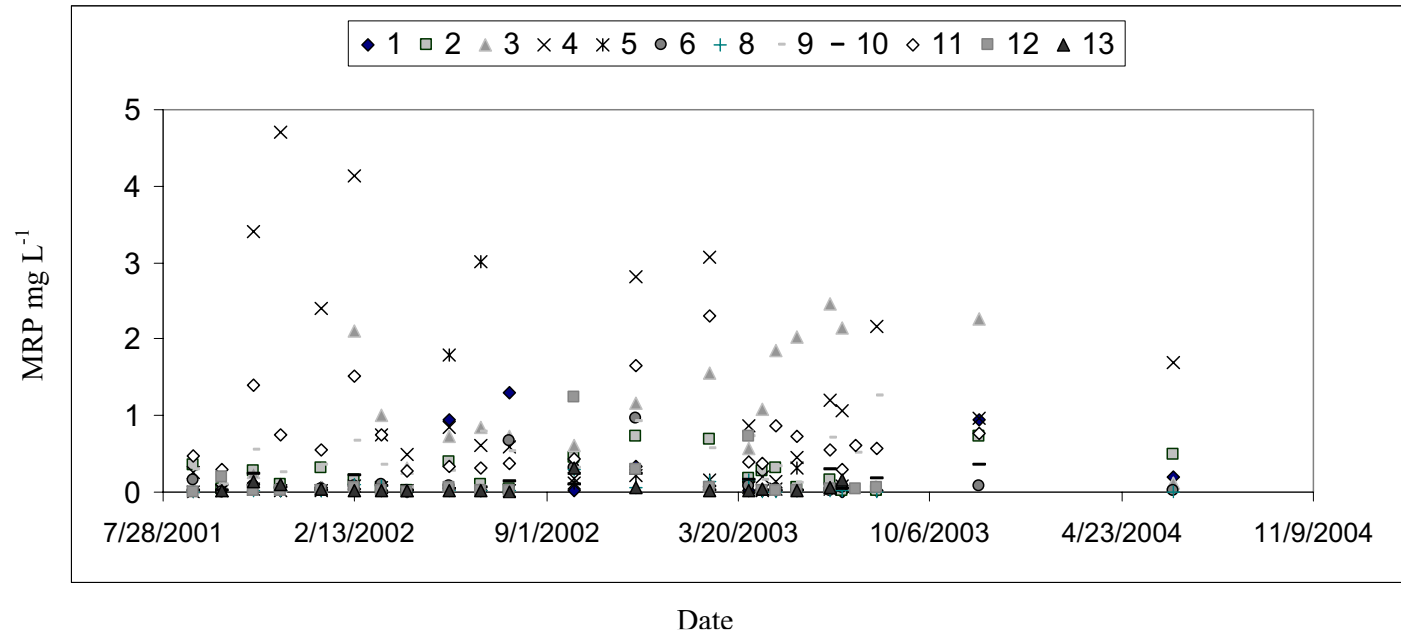


Figure 1. Molybdate reactive phosphorus (MRP) concentrations in effluents of the 12 ICWs between August 2001 and June 2004. Total number of observations during this period was 260.

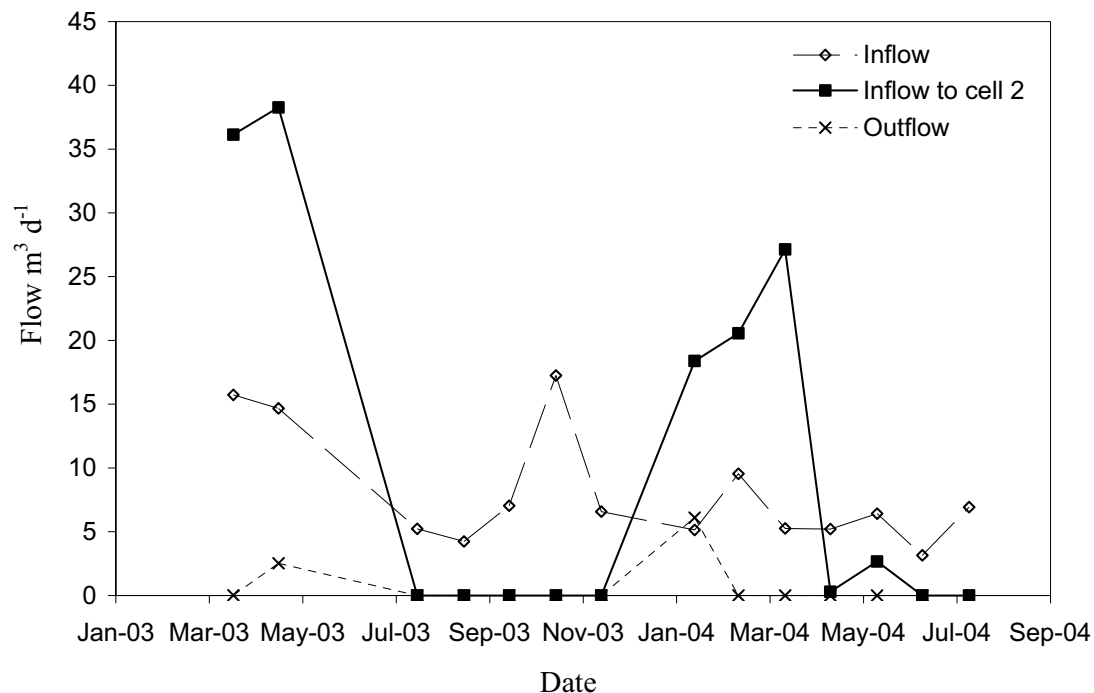


Figure 2. Hydraulic inflows, inflows to cell number 2 and outflows from the wetland (ICW, site number 11) during the monitoring period (April 2003 to August 2004).

Phosphorus export

We made comparisons between the export of P from the ICW site (site number 11) during the monitoring period and some other P export rates reported from other studies in Ireland that investigated P loss from agricultural practices to water. Exports of P from the ICW site were similar to background levels of P export from land to water and lower than P loads in runoff from agricultural grassland. Morgan et al. (2000) outlines that where farmyard dirty waters were not managed, leakage of P from farmyards can be high (Table 3). Thus, the appropriate management of these waters are important and our study indicates that the use of ICWs may be an appropriate management option.

Receiving surface waters

Since the construction of the 12 farm-scale ICWs, the Annewstown stream has had good chemical water quality status (Table 3). All four sites that we monitored along the stream complied with the target phosphorus concentration of a median annual concentration of 0.03 mg MRP L⁻¹ as required by the Irish Phosphorus Regulations (1998). Biological water quality status was also good. Since 1998, the biological water quality status of the stream has improved from an overall water quality rating of Q2 (seriously polluted) to a water quality rating of Q 3/4 (slightly polluted) in 2001 and 2004.

Table 3. Comparison of phosphorus (P) exports from the ICW site number 11 and other land losses of P in Ireland.

Source	Phosphorus export rates -----kg P ha ⁻¹ yr ⁻¹ -----	Study
ICW site number 11, Anne valley, Waterford.	0.27 MRP	This study.
Farmyard leakage, Dripsey watershed study, Cork	7.95 as dissolved MRP	Morgan et al., 2000
Background/natural land export	0.1 – 0.2 as TP	McGarrigle et al., 1993
Agricultural grassland export	1 – 2 as TP	Tunney et al., 1998

Table 4. Annestown stream water quality monitored between 2001 and 2004. Values represent median, mean, standard deviation (SD) and number of observations (n) at each site.

Sampling station (distance from sea)	BOD ₅	Ammonia	MRP	Nitrate
	-----mg L ⁻¹ -----			
Median (Mean) Ballyphilip upstream of village (4 km)	1.3	0.05	0.02 (0.03)	4.3
SD	0.04	0.025	0.015	0.85
n	4	7	12	11
Median (Mean) Ballyphilip downstream of village (3.5 km)	2	0.05	0.03 (0.03)	4.4
SD	1.6	0.03	0.02	0.81
n	18	13	22	28
Median (Mean) Dunhill Castle (2 km)	1.9	0.04	0.02 (0.02)	5
SD	1.26	0.025	0.02	1.1
n	16	19	27	25
Median (Mean) Monument (0.5 km)	2	0.06	0.03 (0.03)	4.2
SD	1.39	0.04	0.02	1.4
n	17	20	28	26

Groundwater quality

All ICWs were constructed using *in situ* soils. Site subsoil was used and reworked to line wetland bed and bank surfaces and topsoil was redistributed for plant establishment. This helps to impede infiltration from wetland surfaces. In addition, incoming waters (farmyard dirty water) to the ICWs are high in BOD₅ and TSS loads. As these waters pass through the wetland, suspended organic material is typically deposited onto wetland soil surfaces, which helps impede infiltration from wetland cells (Kadlec and Knight, 1996).

Nitrate levels were elevated (> 10 mg L⁻¹) in most of the participating farmers' water-supply wells (Table 5), which were monitored to assess background nitrate concentrations in groundwaters. These high concentrations suggest that the farmers drinking water supply was impaired during the time of sampling. Nitrate concentrations of groundwaters in wells located upgradient, downgradient or beside ICW treatment wetland cells was generally lower (< 0.6

mg L⁻¹) than farm wells; however at ICW site one, concentrations were 11.7 mg L⁻¹, similar to ambient levels. Ammonium concentrations for all wells upgradient, downgradient or beside ICW treatment wetland cells other than those present at site three were 2.44 ± 2.12 mg NH₄⁺ L⁻¹. At site three concentrations were much higher than all other wells. Ammonium concentrations of well waters at this ICW site averaged 18.67 ± 15.07 mg L⁻¹. A possible explanation for these high concentrations is that these wells are within the floodplain of the Annestown stream, which may have naturally high ammonium levels due to the waterlogged conditions. The MRP and *E. Coli* levels of well waters (farm wells and wells associated with ICW systems) were generally low (Table 5). One borehole at ICW site 3 had elevated *E coli* levels.

A major component of ICW design and operation is to eliminate the need for conventional land spreading of dirty water as several studies in Ireland (Richards et al., 1999; Bartley, 2003; Rodgers et al., 2003) have reported that land spreading of dirty water can lead to (either directly or indirectly) high nitrate levels in soil pore water and groundwater. Given this evidence and the evidence we have outlined in our monitoring, it seems that ICWs can provide an appropriate alternative management option for such waters.

Conclusions

Significant concentration reductions in organic material, suspended material, nutrients and faecal bacteria, between ICW influent and effluents of the 12 sites was observed during the monitoring study. Surface discharges from the ICW sites were seasonal. None of the 12 farm ICWs had surface discharges during summer months. The export of phosphorus from the intensively monitored site to surface waters was similar to background levels of P export rates.

Piezometer well water quality data suggest that ICWs had negligible effects on receiving groundwaters. This is important as present landspreading practices of farmyard dirty water can lead to the degradation of groundwater quality.

In conclusion, our findings suggest that ICWs are capable of treating farmyard dirty water to a satisfactory quality and that these systems can provide a suitable management option to reduce nutrient and contaminant loss from agriculture to water resources.

Acknowledgements

The authors wish to thank the participating farmers for their kind cooperation, Ann Gannon for providing rainfall data, and Sinead Fox and Declan Halpin, Waterford County Council, for their contribution to this study.

Table 5. ICW groundwater monitoring results between January and July of 2004.

Site number	Location	Depth	Ammonium	Nitrate	MRP	<i>E. Coli</i> Per 100 mls
		--m--	-----mg L ⁻¹ -----			
1	Farm well		0.02	13.4	< 0.02	0
	Well down gradient of ICW 3 treatment cell 3		5.8	0.7	< 0.03	< 50
Mean						
SD			5.4	2.4	0.03	
n			16	14	15	2
Mean	Well down gradient of ICW 5 treatment cell 5		0.96	11.7	<0.02	< 50
SD			0.44	6.1	< 0.02	
n			5	5	5	1
3	Farm well		0.01	10.4	< 0.02	0
	Farm well		0.004	11.9	< 0.02	0
Mean	Adjacent farmyard well	5	0.29	11	0.05	
SD			0.38	6.3	0.06	
n			6	6	6	
Mean	Well up gradient of ICW treatment cell 2	5	36	< 0.03	0.09	100
SD			25.6	0.13	0.09	
n			6	6	6	2
Mean	Well beside ICW treatment cell 3	5	11.3	1.6	< 0.03	>5000
SD			7.6	3	0.06	
n			14	12	14	2
Mean	Well down gradient of ICW 3 treatment cell 4		8.7	1.3	0.17	75
SD			6.8	2.6	0.49	
n			5	5	5	0
11	Farm well		0.01	12.6	< 0.02	6
	Farm well		0.01	9.9	< 0.02	1
Mean	Well up gradient of treatment cell 1	5	0.4	0.1	0.02	< 50
SD			0.17	0.11	0.006	
n			4	4	4	1
Mean	Well down gradient of treatment cell 3	5	0.77	< 0.02	0.01	< 50
SD			0.29	0.23	0.006	
n			7	7	7	2
Mean	Well down gradient of treatment cell 3	3	3.8	< 0.03	< 0.03	< 50
SD			1.6	0.18	0.018	
n			7	7	7	2
Mean	Well down gradient of treatment cell 4	5	2.9	< 0.03	< 0.02	< 50
SD			1.98	0.13	0.076	
n			7	7	7	2
Mean	Well down gradient of treatment cell 5	5	0.3	< 0.03	< 0.02	< 50
SD			0.2	0.18	0.008	
n			7	7	7	2

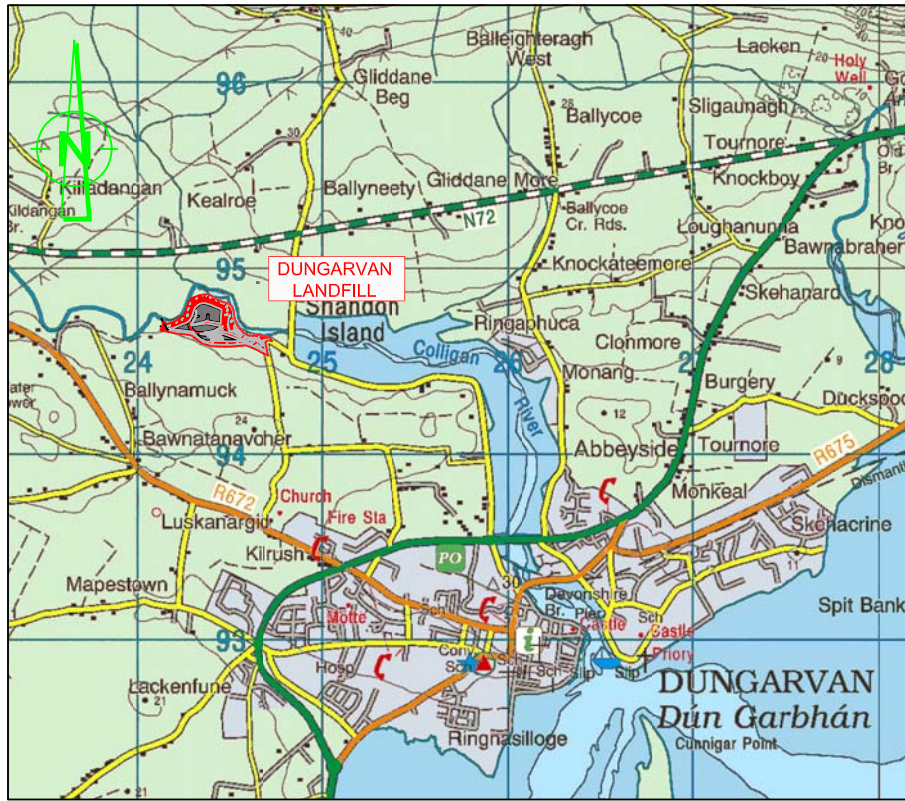
References

- Bartley, P., 2003. Nitrate responses in groundwaters under grassland dairy agriculture. Unpublished Ph.D. thesis, Trinity College Dublin, Ireland.
- EPA, 2002. Interim report: The biological survey of river quality 2001. Environmental Protection Agency, Johnston Castle, Wexford, Ireland.
- American Public Health Association, 1992. Standard Methods for the Examination of Water and Wastewater, 17th edition, APHA AWWA WEF, Washington, D.C.
- Harrington, R., and C. Ryder. 2002. The use of integrated constructed wetlands in the management of farmyard runoff and waste water. *In* Proceedings of the National Hydrology Seminar on Water Resource Management: Sustainable Supply and Demand. Tullamore, Offaly. 19th Nov. 2002. The Irish National Committees of the IHP and ICID, Ireland.
- Kadlec, R.L., Knight, R.H., 1996. Treatment Wetlands. CRC Press, Boca Raton, 893 pp.
- McGarrigle, M., T. Champ, R. Norton, P. Larkin, and M. Moore, 1993. The trophic status of Lough Conn, County Mayo, Ireland. Mayo County Council.
- Morgan, G., Q. Xie, and M. Devins, 2000. Phosphorus export from farm in Dripsey catchment, Co. Cork, Ireland. EPA Research and Development Report, Series No. 6, pp. 17-25.
- Neill, M., 2002. River water quality in the South East, 2002, Environmental Protection Agency, Johnston Castle, Wexford, Ireland.
- Neill, M., 2003. River water quality in the South East, 2003, Environmental Protection Agency, Johnston Castle, Wexford, Ireland.
- Tunney, H., O. Carton, T. O'Donnell, and A. Fanning, 1998. Phosphorus loss from soil to water. End of Project Report. Teagasc, Ireland, ARMIS 4022.
- Richards, K. 1999. Sources of nitrate leaching to groundwater in grasslands of Fermoy, Co. Cork. Unpublished Ph.D. thesis, Trinity College Dublin, Ireland.
- Rodgers, M., P. Gibbons, and J. Mulqueen, 2003. Nitrate leaching on a sandy loam soil under different dairy wastewater applications *In* IWA Proc. 7th International Specialised Conference on Diffuse Pollution and Basin Management, UCD, Dublin, Ireland. Aug. 2003.

Appendix B

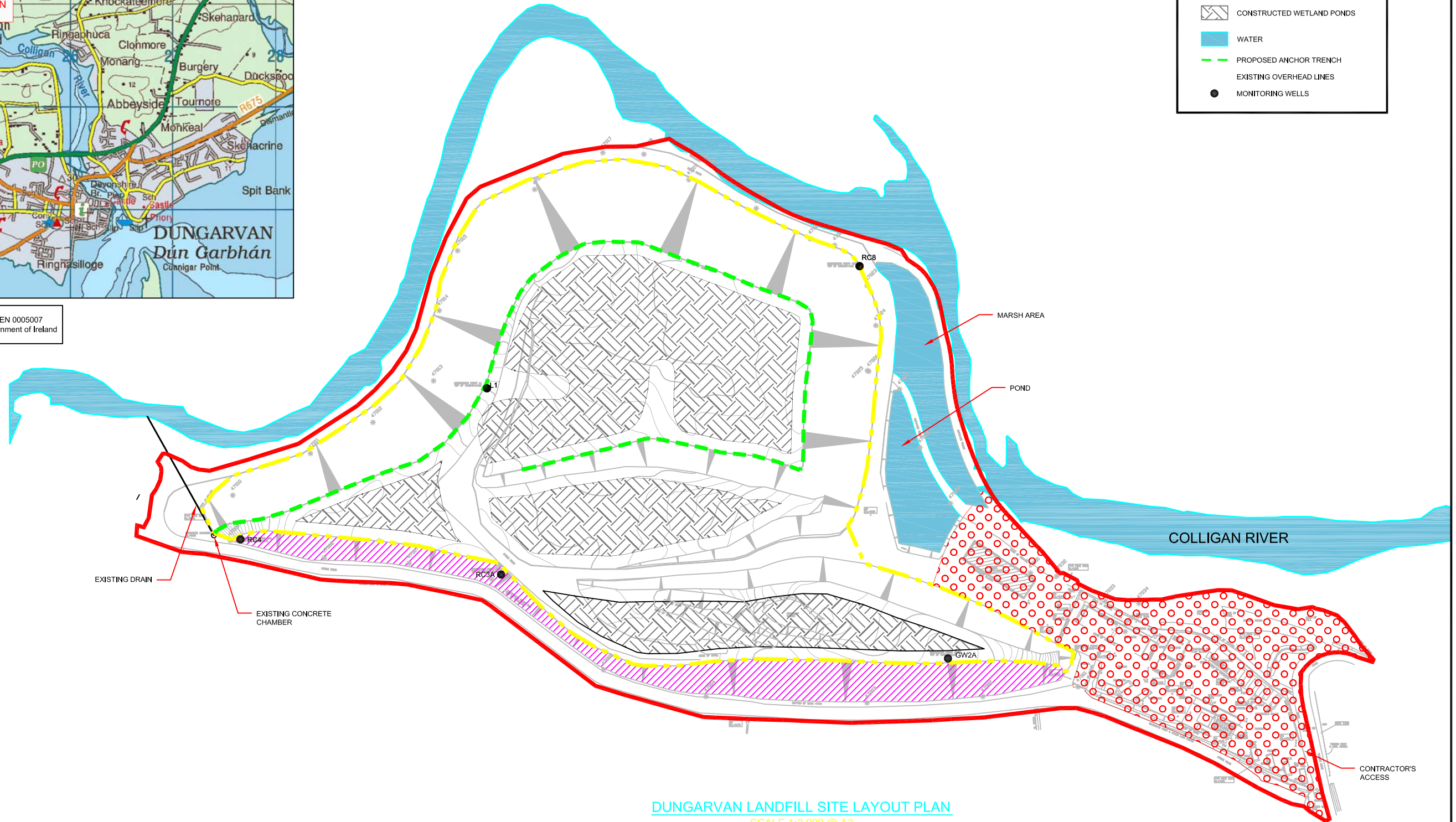
DUNGARVAN LANDFILL LOCATION PLAN

SCALE 1:40,000 @ A3



LEGEND:	
	EXTENT OF SITE
	EXISTING CAPPED AREA
	EXTENT OF CIVIC WASTE FACILITY
	EXTENT OF WORKS
	CONSTRUCTED WETLAND PONDS
	WATER
	PROPOSED ANCHOR TRENCH
	EXISTING OVERHEAD LINES
	MONITORING WELLS

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DUNGARVAN LANDFILL SITE LAYOUT PLAN

SCALE 1:2,000 @ A3

Client:



WATERFORD COUNTY COUNCIL
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No.	Date	By	Amendment / Issue	App.

Project:

DUNGARVAN LANDFILL

Title:

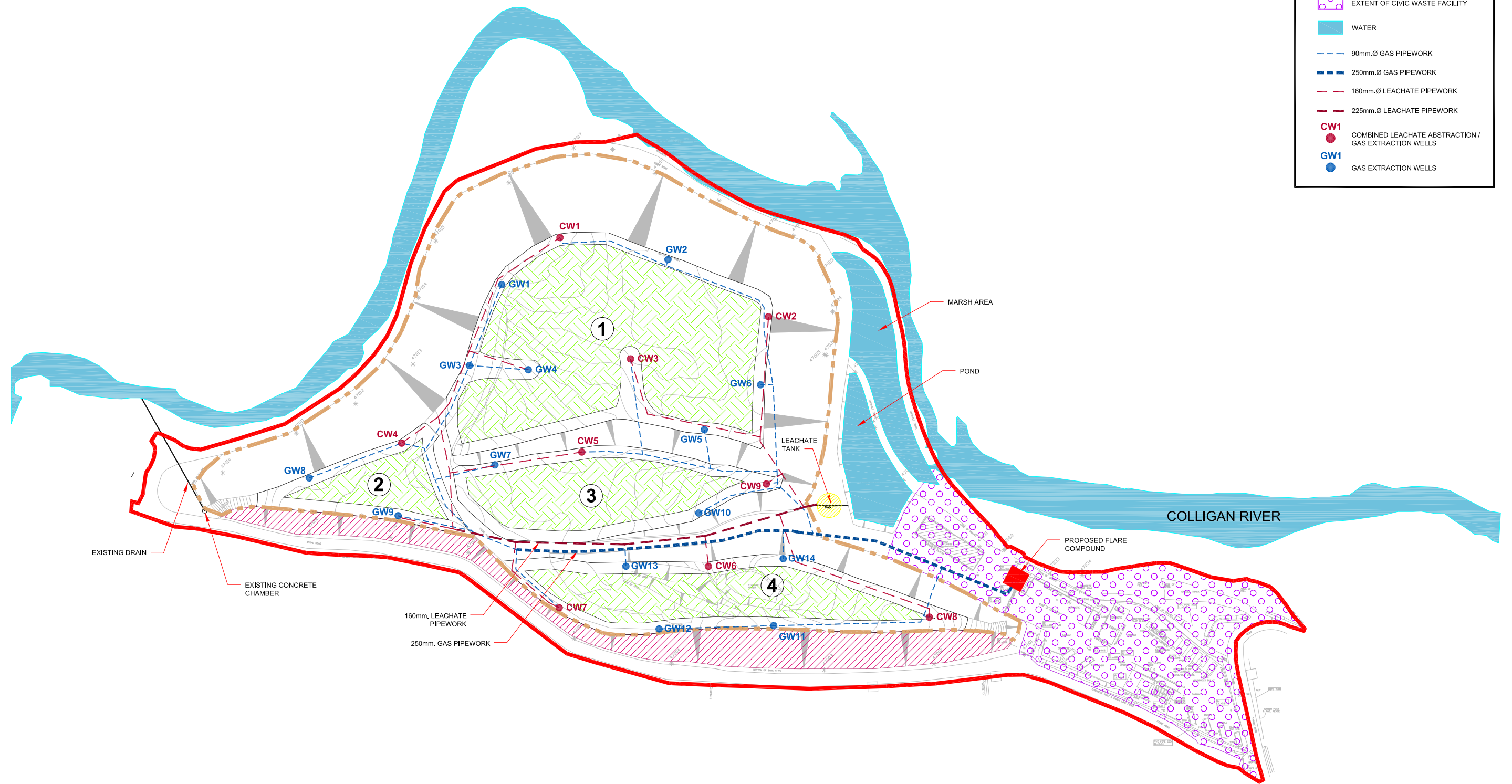
SITE LAYOUT

Drawn by:	RH	Job No:	mdr0350
Checked by:	MS	File No:	mdr0350FG0001D01
Approved by:	EB	Drg. No:	Figure 1
Scale:	As shown@A3	Rev:	-
Date:	Nov. 07		



LEGEND:

	EXTENT OF SITE
	EXTENT OF CAPPING
	EXISTING CAPPED AREA
	CONSTRUCTED WETLAND PONDS
	EXTENT OF CIVIC WASTE FACILITY
	WATER
	90mm.Ø GAS PIPEWORK
	250mm.Ø GAS PIPEWORK
	160mm.Ø LEACHATE PIPEWORK
	225mm.Ø LEACHATE PIPEWORK
	CW1 COMBINED LEACHATE ABSTRACTION / GAS EXTRACTION WELLS
	GW1 GAS EXTRACTION WELLS



Client:



WATERFORD COUNTY COUNCIL
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No.	Date	By	Amendment / Issue	App.

Project:

DUNGARVAN LANDFILL

Title:

SITE LAYOUT
(CRAMP)

Drawn by:	RH	Job No:	mdr0350
Checked by:	MS	File No:	mdr0350FG0002D01
Approved by:	EB	Drg. No:	Figure 2
Scale:	1:2,000@A3	Rev:	-
Date:	Nov. '07		

Appendix C – Annual Environmental Report 2007

WATERFORD COUNTY COUNCIL

COMHAIRLE CHONTAE PHORTLAIRGE



ANNUAL ENVIRONMENTAL REPORT 2007

BALLYNAMUCK WASTE DISPOSAL SITE

BALLYNAMUCK MIDDLE

DUNGARVAN CO. WATERFORD

Waste Licence Register No. W0032-2

Report Compiled by;
Mr Paul Carroll, Executive Scientific Officer, Adamstown Laboratory
Mr Tom Longan, Facility Manager Tramore Landfill

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Introduction

Waterford County Council was granted a Waste Licence (Ref 32-1) by the Environmental Protection Agency on the 29th November 2002 for the continued acceptance of municipal waste within the existing footprint of the Dungarvan Landfill Facility at Ballynamuck Middle, Dungarvan Co. Waterford. The landfill ceased to accept waste on the 30th June 2003. This licence was updated by Waste Licence (Ref 32-2) which included permission for a Transfer Station and Composting facilities. This is the fifth Annual Environmental Report for the Facility and includes the monitoring period 1st January 2007 – 31st December 2007. The report has been prepared in accordance with Condition 11.7 and Schedule G of the Waste Licence.

1. Reporting Period

This is the Fifth Annual Environmental Report for the Dungarvan Waste Disposal Site, which covers the period 1st January 2007 to 31st December 2007.

2. Waste Activities carried out at the Facility

Part 1 of the Waste Licence details the activities authorised by the licence:

Waste Management Act 1996: Third Schedule

Class 4. Surface impoundment, including placement of liquid or sludge discards in to pits, ponds or lagoons:

This activity is limited to the storage of leachate generated within the facility in a lined leachate lagoon and the storage of surface water run off in surface water retention (s) ponds

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 was produced:

This activity is limited to the storage of rejected waste in the waste Inspection and Quarantine area and the Construction and Demolition Recovery Area prior to the removal of such waste off site for the disposal at an appropriate facility

Waste Management Act, 1996, Fourth Schedule

Class 2. Recycling or reclamation of organic substances, which are not used as solvents (including composting and other biological transformation processes):

This activity is limited to recycling of organic waste including cardboard and paper at the civic waste facility only and the acceptance and storage of waste oils in appropriate containers at the civic waste facility prior to removal offsite.

Class 3. Recycling or reclamation of metals and metal compounds:

This activity is limited to the acceptance of white goods within a designated Metal Recovery Area, the acceptance and storage of beverage cans in the appropriate containers at the civic waste facility prior to removal offsite.

Class 4. Recycling or reclamation of other inorganic materials:

This activity is limited to the acceptance and storage in appropriate containers of glass bottles, batteries and fluorescent tubes and the recovery of inert waste at the facility for use in site development and restoration works.

Class 9. Use of any waste principally as a fuel or other means to generate energy

Class 11. Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule:

This activity is limited to the use of suitable inert waste in site development and restoration works.

Class 13. Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than the temporary storage, pending collection, on the premises where such waste is produced:

This activity is limited to the storage of wastes within designated areas and receptacles prior to recovery offsite and the storage of inert waste prior to restoration of the facility.

3. Quantity and Composition of Waste received, disposed of and removed during the reporting period and each year previous

The quantity and composition of waste received, disposed of and removed for the reporting period 1st January 2007 – 31st December 2007 is attached in Appendix A.

4. Methods of deposition of inert waste for restoration

Inert waste is brought on site in dumper trucks where it is tipped in the relevant areas that needed temporary capping. Acceptance criteria are as outlined in Schedule F of the Waste Licence. An excavator then levels the inert waste. Due to capping works started in 2007, a large quantity of clay was required on-site. 48990 tonnes of clay was accepted in 2007. This material was stocked piled and then spread on the liner as required.

5.0 Environmental Monitoring

Introduction

Dungarvan landfill is located in County Waterford approximately 2km north west of Dungarvan off the N25 road on the southern edge of the Colligan River. The total area of the landfill site is approximately 6.5 hectares, and has been in operation since 1968. The landfill closed on 30th June 2003, but still acts as a transfer station for recyclable material.

Monitoring of surface waters, groundwater's and leachate and landfill gas was carried out in accordance with the waste licence, conditions 8. EPA and Waterford County Council staff carried out sampling and field measurements. Analysis was carried out at EPA Laboratories, Waterford County Council Laboratory and Euro environmental Laboratory. Toxicity tests were conducted at Enterprise Ireland. The ecological survey was carried out by Limosa Scientific.

Sampling sites are as set out in Table 1 and attached Drawing, DUN-EIS-003.

Surface water stations	Groundwater station	Leachate station	Gas monitoring station	Noise	Dust
SW1*, SW2*, EPA station 280, EPA station 300 Also - Annual biological survey	GW1*, GW2a, RC3a, RC4*, RC6a, RC7*, RC8*	L1, L2a, L3*, L4*, L5a, L6*, Leachate tank	L1*, L2a, L3*, L4*, L5a, L6, RC1*, RC3, RC4*, RC6, RC7, RC8, GW1*, GW2a	B1*, B2*, B3*, B4*, NSL1*	B1, B2, B3, B4, D1

Table 1: Monitoring locations, Dungarvan Landfill

*Baseline results available for these sites

Baseline Monitoring

One of the purposes of compliance monitoring is to determine if there has been a release of contaminants to the environmental media, and to demonstrate compliance with landfill licence conditions. ***Baseline monitoring*** is monitoring which serves as a reference point to which later monitoring results are compared. While there is no data available preceding the landfill, for the purpose of this report, water quality results obtained during 2001 will be used as baseline monitoring data. Two new groundwater monitoring boreholes (RC7 and RC8) were installed since 2001, and results of tests carried out in 2002 at these sites are used as baseline. Noise measurements taken during the 1998 survey will also be used as comparison with this 2006 study.

5.1 SURFACE WATER.

5.1.1 Introduction

Sampling was carried out by EPA and Waterford County Council personnel at sites SW1, SW2, EPA site 300 and EPA Site 280 as per attached map.

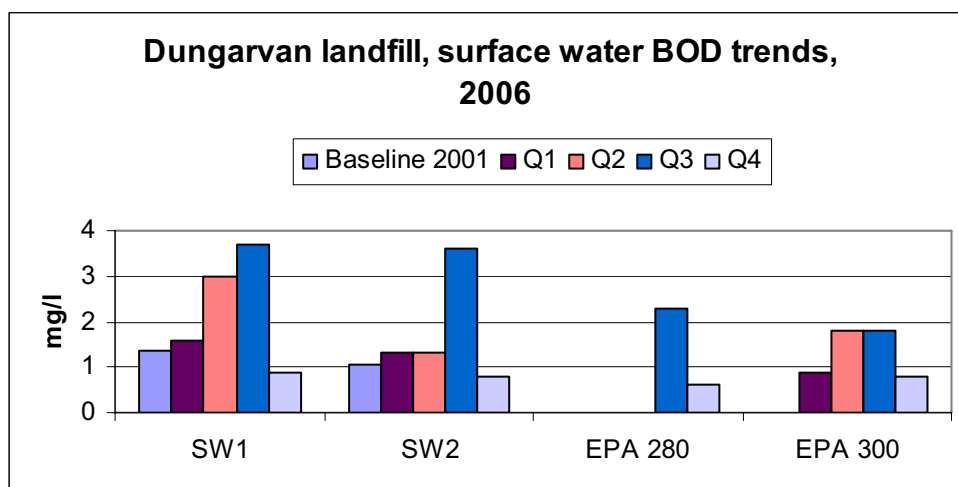
Sampling site EPA 300, at Ballyneety Bridge downstream of the landfill site, is subject to saline intrusion from Dungarvan Estuary. There are difficulties involved in monitoring surface water pollution from landfills adjacent to estuaries, as the salinity of the samples can interfere with many of the tests, (*ammonia, COD, arsenic, copper*). Additionally, many of the ions, which are considered indicators of leachate contamination, are also major components of sea/brackish water, (*chloride, sulphate, sodium, magnesium, calcium, boron*).

5.1.2 Results

Results for 2006 are presented in tables 1.1 to 1.4 and appendices. Ammonia was elevated at SW1 on 14/3/06 and 27/6/06. High conductivity and ammonia recorded at EPA 280 (upstream station) on 5/9/06 was unusual and may be due to a mix-up with site EPA 300 which is downstream of the landfill in a tidal zone.

Key Parameter – BOD

The BOD test is a measure of the amount of oxygen consumed by microorganisms in breaking down organic matter in water. Respiration by phytoplankton or their decay, can also lead to oxygen depletion during the BOD test resulting in a high BOD value. Surface waters supporting fish life should have a BOD value < 4 mg/l BOD.



Discussion BOD levels were somewhat elevated at sites SW1, SW2 and 280 on 5/9/06, otherwise results for 2006 were satisfactory and in line with baseline monitoring. Water quality was generally satisfactory at all the surface water sites throughout the year.

Table 1.1 Dungarvan landfill surface water monitoring 14/3/06

Test	SW 1	SW 2	SW 300	Drinking Water Standards (SI 439 2000)	Bathing Water Standards (SI 155 1992)	Estuarine Water Standards (DOELG 2001)
Ammonia mg/l N	0.26	0.04	0.032	0.23		
BOD mg/l O ₂	1.6	1.3	0.9			
Dissolved Oxygen % Sat	116.1	116.1	116.8	-	70-120 95% compliance	70-130 (Brackish) 80-120 (Saline)
COD	<8	<8	<8			
Conductivity µS/cm	129	129	121	1500		
pH	7.9	7.8	7.7	6.5-9.5		
Suspended Solids mg/l	<9.68	<6.82	<6.82			
Temperature °C	9.6	9.4	8.7	25		
Chloride mg/l Cl	12	13	12	250		

SW 280 - No Sample as tide was out

Surface water was in flood when sample was taken

Table 1.2 Dungarvan landfill surface water monitoring 27/6/06

Test	SW 1	SW 2	SW280	SW 300	Drinking Water Standards (SI 81 1988)	Bathing Water Standards (SI 155 1992)	Estuarine Water Standards (DOELG 2001)
Ammonia mg/l N	0.25	0.088	-	0.049	0.23		
BOD mg/l O ₂	3	1.3	-	1.8			
Dissolved Oxygen % Sat	127.2	131.4	-	120.2	-	70-120	70-130 (Brackish) 80-120 (Saline)
			-				
COD	<8	nm	-	<8			
Conductivity µS/cm	257	239	-	174	1500		
pH	8.8	9	-	8.7	7-9		
Suspended Solids mg/l	<6	<6	-	<6			
Temperature °C	16.6	16.4	-	16.6	25		
Chloride mg/l Cl	33	29	-	15	1000		

SW280 No Sample-Tide Out

Table 1.3 Dungarvan landfill surface water monitoring 5/9/2006

Test	SW 1	SW 2	SW280	SW 300	Drinking Water Standards (SI 81 1988)	Bathing Water Standards (SI 155 1992)	Estuarine Water Standards (DOELG 2001)	Comments
Ammonia mg/l N	0.031	0.04	0.34	0.017	0.23			elevated ammonia result most likely due to interference by high chloride level
BOD mg/l O ₂	3.7	3.6	2.3	1.8				
Dissolved Oxygen % Sat					-	70-120	70-130 (Brackish)	
						95% compliance	80-120 (Saline)	
COD	<8	12	nr	<8				
Conductivity µS/cm	175	200	31900	274	1500			high chloride result at this site 280 unusual and suggests mix-up with sample from site 300
pH	8	8	8	7.9	7-9			
Suspended Solids mg/l	<10	<10	14.6	<10				
Temperature °C	21.6	21.5	23.2	21.5	25			
Chloride mg/l Cl	18	34	nr	46	1000			

Table 1.4 Dungarvan landfill surface water monitoring 28/11/06

Test	SW 1	SW 2	SW 280	SW 300	Drinking Water Standards (SI 81 1988)	Bathing Water Standards (SI 155 1992)	Estuarine Water Standards (DOELG 2001)
Ammonia mg/l N	0.099	0.06	0.067	0.1	0.23		
BOD mg/l O ₂	0.9	0.8	0.6	0.8			
Dissolved Oxygen % Sat	97.8	97.6	98.3	96.8	-	70-120 95% compliance	70-130 (Brackish) 80-120 (Saline)
COD	<8	<8	<8	29			
Conductivity μS/cm	169	167	156	1551	1500		
pH	7.3	7.5	7.6	7.5	7-9		
Suspended Solids mg/l	<18.2	<6	<6	<12			
Temperature °C	9.3	9.3	9.3	9.2	25		
Chloride mg/l Cl	17	17	17	nr	1000		

5.2 Groundwater

5.2.1 INTRODUCTION

Sites GW1, GW2a, RC3a, RC4, RC6a, RC7 and RC8 were sampled quarterly during 2006. RC1 is no longer in place.

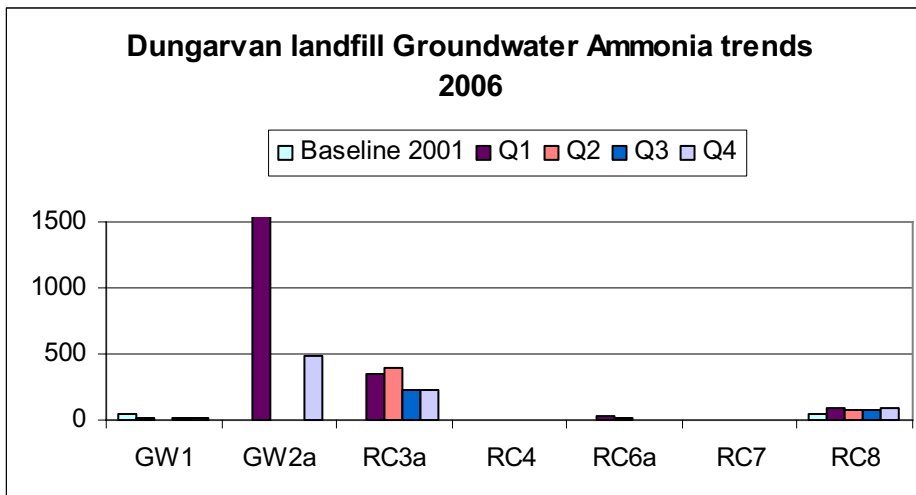
RC4 (south west of site) and RC7 (east of site) are outside the waste deposit area.

All the other ground water stations are within the site boundary, either within or immediately adjacent to waste deposit areas. Ground-water flow through the site has previously been described as south to north.

5.2.2 RESULTS

Results for 2006 are presented on tables 2.1 to 2.4 below, and appendices. High ammonia levels were detected at sites GW2a, RC3a, RC6a and RC8, within the landfill site. Metals levels were generally low, although high iron levels were detected at GW1 and RC3a. Trace organics were not detected in groundwaters. Intermittently high conductivity levels detected at site RC7, outside the landfill boundary, and at RC8 indicate likely saline intrusion from the estuary.

Key Parameter – Ammonia

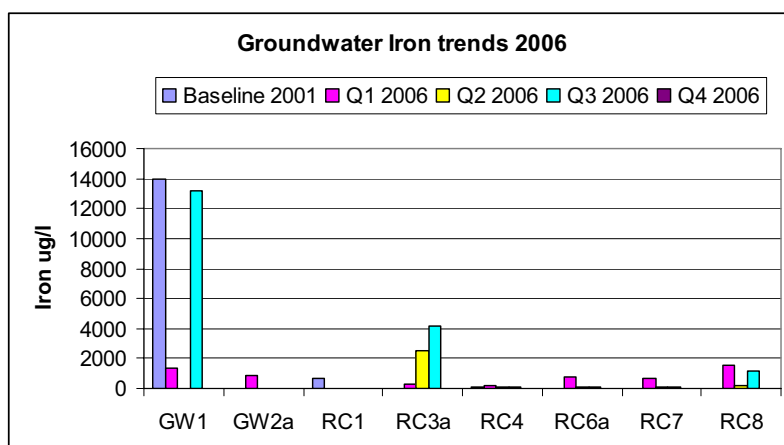


Results for 2006 were similar to baseline monitoring.

Key Parameter - Iron

Iron is present in significant amounts in soils and rocks, principally in insoluble forms. However, many complex reactions, which occur naturally in ground formations can give rise to more soluble forms of iron, which will therefore be present in water passing through such formations.

Appreciable amounts of iron may therefore be present in groundwaters. Landfill leachate also contains significant amounts of iron. Leachate from Irish/UK landfills accepting mainly domestic waste, have been found to contain between 0.4 to 664 mg/l Fe, with a median value of 12 mg/l Fe. (Source: Department of the Environment, 1995).



5.2.3 DISCUSSION

Ammonia was elevated at sites GW2a, RC3a, RC6a, RC8. The trends in values for *iron* broadly mirrored the *ammonia* level. In general, RC4 and RC7, had relatively low *ammonia*, just above drinking water standards. RC7 had a high ionic content at times, possibly indicating brackish water intrusion.

Heavy metals and organics were not detected or else present in low concentrations.

The results of groundwater monitoring are in line with results from previous rounds of testing carried out between 1999 and 2002. The sites within and closely adjacent to the working area appear to be impacted by landfill leachate. Site RC4 at the south-western boundary had relatively good water quality. Site RC7, 200 metres east of the facility, and outside the landfill area, had generally satisfactory water quality and appeared to be unaffected by the landfill, though saline intrusion is evident.

Table 2.1 Dungarvan landfill groundwater monitoring 14/3/06

Test	GW 1	GW 2a	RC 3a	RC4	RC 6a	RC 7	RC 8	Drinking Water Standards (SI 106, 2007)
Ammonia mg/l N	8.8	2000	350	0.27	27	0.078	93	0.23
Nitrite mg/l N	<.001	1.8	0.084	0.01	0.01	<.001	<.001	0.03
Chloride mg/l Cl	52	2024	489	28	137	>700	>850	250
Conductivity μ S/cm	1041	20100	59300	674	1321	5220	8610	2500
Dissolved Oxygen % Sat	19.7	74.9	15.4	51.4	14.8	33.3	16.1	
pH	6.6	8.1	7.3	7.5	7.2	7.5	7.2	6.5 to 9.5
Temperature °C	11.7	13.3	12.8	11.4	12.2	11.7	13.2	
Orthophosphate mg/l P	<.006	5.6	0.055	0.041	<0.006	<0.006	<0.006	
Total Oxidised Nitrogen mg/l N	nr	nr	nr	12	15	0.9	<0.1	11.3 N
Faecal Coliforms /100mls	<10	-	<10	0	<10	670	<10	0
Total Coliforms /100 mls	<10	-	10	2	<10	1935	<10	0

Insufficient sample acquired from GW2 to carry out all analysis.

Alkalinity was not carried out on the ground water due to laboratory error

TON not reported where high Chloride values cause interference with the test method

Table 2.2 Dungarvan landfill groundwater monitoring 28/6/06

Test	GW 1	GW 2a	RC 3a	RC4	RC 6a	RC 7	RC 8	Drinking Water Standards (SI 106, 2007)
Ammonia mg/l N	5.6	-	400	0.6	8.2	0.03	69	0.23
Nitrite mg/l N	<0.001	-	<0.001	0.01	0.003	0.001	0.001	0.03
Chloride mg/l Cl	46	-	570	28	161	1441	1968	250
Conductivity μ S/cm	961	-	5800	672	1190	5100	8530	2500
Dissolved Oxygen % Sat	28.1	-	18.8	51.1	47.2	25.3	25.1	
pH	6.7	-	7.4	7.4	7.3	7.7	7.4	6.5 to 9.5
Temperature °C	14.9	-	14.3	12.5	13.1	11.3	13.5	
Orthophosphate mg/l P						0.094	0.013	
Total Oxidised Nitrogen mg/l N	<0.1	-	nr	nr	nr	1.3	<0.1	11.3 N
Faecal Coliforms /100mls	0	-	0	1	0	68	<1	0
Total Coliforms /100 mls	14	-	2	411	16	1046	11	0

Total Organic Carbon (TOC) analysis was not carried out on the sample due to instrumental problems in the laboratory.

Table 2.3 Dungarvan landfill groundwater monitoring 5/9/06

Test	GW 1	GW 2a	RC 3a	RC4	RC 6a	RC 7	RC 8	Drinking Water Standards (SI 106, 2007)
Ammonia mg/l N	8.5		230	0.006	3.5	0.05	83	0.23
Nitrite mg/l N	<0.001		0.008	0.02	0.002	<0.001	<0.001	0.03
Chloride mg/l Cl	51		304	27	171	nr	2068	250
Conductivity $\mu\text{S/cm}$	875		3770	657	1349	13120	8520	2500
Dissolved Oxygen % Sat								
pH	6.5		7.3	7.4	7.2	7.4	7.3	6.5 to 9.5
Temperature °C	19.5		19	18.9	18.8	18.5	19.6	
Orthophosphate mg/l P	0.027		<0.006	<0.006	<0.006	0.072	<0.006	
Total Oxidised Nitrogen mg/l N	<0.1		0.9	11	14	0.1	<0.1	11.3 N
Faecal Coliforms /100mls	<1		1	1	<1	30	<1	0
Total Coliforms /100 mls	>2419		13	1	<1	30	2	0

GW2a-No sample-would not pump

Table 2.4 Dungarvan landfill groundwater monitoring 28/11/06

Test	GW 1	GW 2a	RC 3a	RC4	RC 6a	RC 7	RC 8	Drinking Water Standards (SI 106, 2007)
Ammonia mg/l N	9.6	490	220	0.015	4.6	0.51	90	0.23
Nitrite mg/l N	<0.001	0.33	<0.001	0.006	0.002	0.006	<0.001	0.03
Chloride mg/l Cl	51	584	278	33	115	334	nr	250
Conductivity μ S/cm	1169	8220	3060	702	1144	1268	8810	2500
Dissolved Oxygen % Sat	16.8	65	14.2	50.4	11.9	56.9	22.9	
pH	6.7	8	7.3	7.4	7.2	7.9	7.3	6.5 to 9.5
Temperature °C	13.6	13.3	12.7	11.4	12	10.3	12.8	
Orthophosphate mg/l P	<0.006	1.2	<0.006	<0.006	0.01	0.037	<0.006	
Total Oxidised Nitrogen mg/l N	<0.1	5.6	<0.1	15	17	2.1	<0.1	11.3 N
Faecal Coliforms /100mls	<10	nm	<10	0	20	119	<10	0
Total Coliforms /100 mls	>24192	nm	10	9	331	3255	<10	0

5.3 LEACHATE

5.3.1 INTRODUCTION

Boreholes L1, L2a, L4, L5a, lagoon L6, and the leachate holding tank were sampled during 2006.

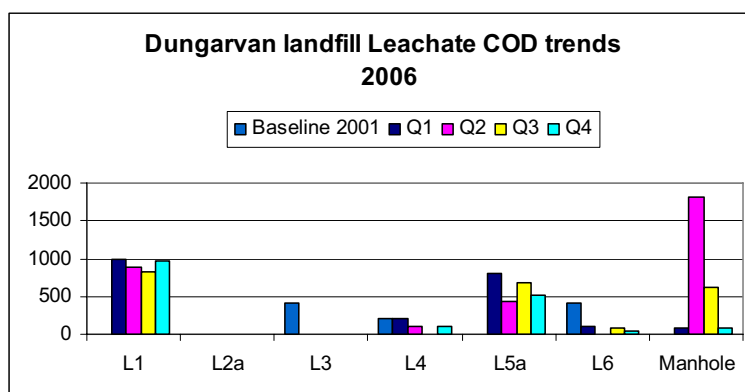
Results of analysis are presented in table 3.1 to 3.4, below, and laboratory results appendices. Values are compared with the median of typical landfill leachate, as published in the EPA document “*Landfill Operational Practices*” 1998.

5.3.2 RESULTS

COD was high in L1, L5a and occasionally in the leachate interception tank. Heavy metals and organic concentrations were low at all sites.

Key Parameter – COD

The COD test measures the organic matter in a sample that is amenable to chemical oxidation. The COD test is usually applied to polluted waters and waste-waters.



COD levels were typical of landfill leachate, and similar to baseline levels. An increase in COD occurred in the leachate manhole sample in the 2ND quarter of 2006, possibly as a result of increased run-off to this tank during wet weather. The contents of this tank are removed and treated off-site, as required. Continued monitoring will indicate any trends.

The high ammonia and COD levels found during 2006 were typical of leachates from landfills receiving mainly domestic waste.

DISCUSSION

High ammonia and COD concentrations, combined with low metals levels and trace organics, indicate leachate typical of domestic landfills

Table 3.1 Dungarvan landfill leachate monitoring 14/3/06

Test	L1	L2A	L3	L4	L5a	L6 Lagoon	Leachate Tank Inteceptor	Typical Leachate Analysis (EPA, 1997)
Ammonia mg/l N	690	-	-	190	810	53	30	453
Chloride mg/l Cl	1516	-	-	422	786	92	72	
Conductivity μ S/cm	12450	-	-	4730	9450	1197	1264	7180
pH	7.4	-	-	7.3	7.3	7.7	8.4	7.1
BOD mg/l O ₂	85	-	-	8.9	70	>8.2	15.4	270
COD mg/l O ₂	980	-	-	201	802	93	89	954
Temperature °C	10	-	-	14	13	11.1	9	
Orthophosphate mg/l P	0.93	-	-	0.025	4.9	<.006	0.16	1.1

L2&L3 damaged

Very little sample was obtained for L6. Insufficient sample was present to carry out bacteriological testing

Table 3.2 Dungarvan landfill leachate monitoring 28/6/06

Test	L1	L2A	L3	L4	L5a	Leachate Tank Inteceptor	L6 Lagoon	Typical Leachate Analysis (EPA, 1997)
Ammonia mg/l N	730	-	-	110	520	230	1.5	453
Chloride mg/l Cl	1809	-	-	378	730	351	69	
Conductivity μ S/cm	13030	-	-	4320	8750	5000	790	7180
pH	7.8	-	-	7	7.2	6.9	7.9	7.1
BOD mg/l O ₂	45	-	-	3.8	98	>740	5.1	270
COD mg/l O ₂	887	-	-	106	426	1810	<8	954
Temperature °C	15	-	-	11	12	17	20.3	
Orthophosphate mg/l P	0.84	-	-	0.13	5.5	11	0.082	1.1

L2&L3 damaged

Table 3.3 Dungarvan landfill leachate monitoring 5/9/06

Test	L1	L2A	L3	L4	L5a	Leachate Tank Inteceptor	L6 Lagoon	Typical Leachate Analysis (EPA, 1997)
Ammonia mg/l N	580	-	-	-	960	76	1.2	453
Chloride mg/l Cl	1552	-	-	-	1225	170	72	
Conductivity μ S/cm	11240	-	-	-	11950	2310	748	7180
pH	8	-	-	-	7.3	6.9	8	7.1
BOD mg/l O ₂	25	-	-	-	80	255	nr	270
COD mg/l O ₂	831	-	-	-	674	614	74	954
Temperature °C	20	-	-	-	14	19	23.6	
Orthophosphate mg/l P	0.44	-	-	-	6.1	4.7	0.086	1.1

L3 damaged

L2a & L4 Borehole dry-No sample

Table 3.4 Dungarvan landfill leachate monitoring 28/11/06

Test	L1	L2a	L3	L4	L5a	Leachate Tank Inteceptor	L6 Lagoon	Typical Leachate Analysis (EPA, 1997)
Ammonia mg/l N	>555	-	-	91	540	42	11	453
Chloride mg/l Cl	1556	-	-	330	651	75	39	
Conductivity μ S/cm	12470	-	-	2330	8540	1373	684	7180
pH	7.5	-	-	7.2	7.1	6.9	7.7	7.1
BOD mg/l O ₂	nr	-	-	2	nr	13	4.4	270
COD mg/l O ₂	963	-	-	111	513	78	33	954
Temperature °C	15	-	-	12	14	9	8.8	
Orthophosphate mg/l P	2.7	-	-	0.02	5.4	0.21	0.058	1.1

L2 damaged

L3 Insufficient leachate for sample

5.4. Groundwater and Leachate Levels

5.4.1 Introduction

Groundwater and leachate levels are determined monthly, by dip meter, at boreholes GW1, GW2a, RC3a, RC4, RC6a, RC7, RC8, L1,L2a, L3, L4, and L5a.

5.4.2 Results

Results of monitoring are presented in table 4.1. LT2a and LT3 were dry most of the time.

Table 4.1 Dungarvan landfill leachate levels 2006

Date	Operator	GW 1	GW 2A	RC 3A	RC 4	RC 6A	L1	LT 2A	L3	L4	L5A	RC 7	RC 8
27/01/2006	TL/DH	3	1.4	12.5	15.9	8	1.3	Foam	D	1.4	4.8	D	12.4
14/02/2006	TL/DH	2.5	1.5	12.3	15.6	7.9	1.1	Foam	D	1.4	4.2	D	12
14/03/2006	DH/JMcG	2.6	2.2	12.6	15.1	7.8	0.9	0.4	D	1.5	4.2	10.4	12.2
21/04/2006	TL/DH	3.1	1.4	12.6	16.1	7.9	1	Foam	D	1.4	4.9	10.5	12.1
26/05/2006	TL/DH	3.1	1.4	12.7	16.2	7.8	1	Foam	D	1.4	4.8	10.5	12.4
28/29/06/06	DH/JMcG	2.6	1.4	12.5	16.2	8.3	0.8	Foam	D	1.5	4.8	10.3	11.9
18/07/2006	TL/DH	2.4	1.6	12.5	16	8.3	0.7	Foam	D	1.5	4.8	10.2	12
06/08/2006	DH/JMcG	2.6	1.4	12.5	16.2	8.3	0.8	Foam	D	1.5	4.8	10.3	12
29/09/2006	TL	2.5	1.6	12.6	16	8.1	1	Foam	D	1.3	4.8	10.5	12.2
31/10/2006	TL	3.4	1.8	13	15.7	8.2	1	Foam	D	1.3	5	10.5	12.2
30/11/2006	TL	4	2.3	13.6	16.3	8.8	1	Foam	D	1.7	5	10.1	12.2
04/12/2006	TL	4	2.4	13.4	16.3	8.8	0.9	Foam	D	1.7	5	10.2	12.2

D=Damaged

5.4.3 Discussion

The variation in groundwater and leachate levels may be due to air pressure, changes in landfill water balance or tidal effects.

5.5 LANDFILL GASES

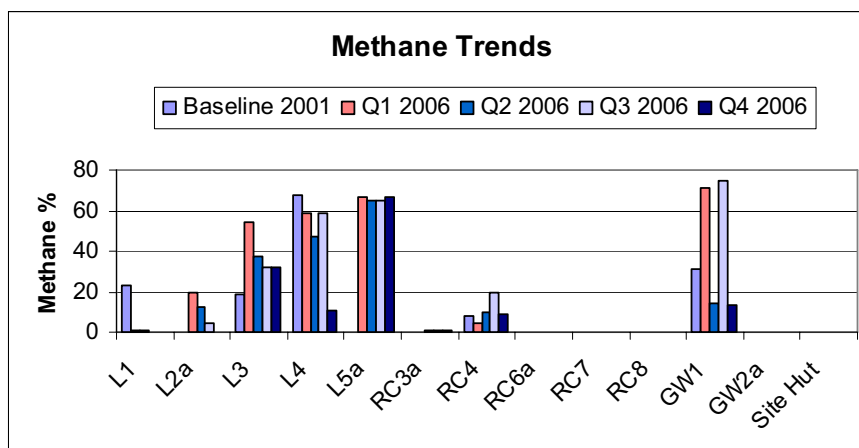
5.5.1 Introduction

Gases (mainly methane –65% and carbon dioxide – 35%) are given off by the biodegradation of organic matter within the landfill waste. The rate of gas generation is dependent on waste type, moisture content and age of waste. Gas is monitored weekly at the site building, and monthly at the groundwater and leachate boreholes. Results of gas monitoring are presented in tables 5.1 to 5.4 below.

5.5.2 Results

KEY PARAMETER –METHANE

Methane is a colourless, odourless gas generated by the biodegradation of organic matter. Landfill gas contains about 65% methane.



Relatively high levels of methane were detected at most boreholes within the waste deposit area, indicating active decomposition of waste, in line with previous monitoring results. Methane levels detected at L3, L4, L5a, RC4 and GW1 were quite constant over the year and compared to baseline levels in 2001. There appeared to be a reducing trend at site L2a over 2006.

No methane was detected in the site buildings or at monitoring points outside the landfill area.

Table 5.1 Dungarvan landfill gas monitoring Q1 2006

Week No	Date	Operator	Gas	Site Hut	GW 1	GW 2A	RC 3A	RC 4	RC 6A	LT 1	LT 2A	LT 3	LT 4	LT 5A	RC 7	RC 8
1	06/01/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 21.0 1024												
2	13/01/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.9 1006												
3	20/01/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.8 1015												
4	27/01/2006	TL/DH	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.7 1032	54.3 19.2 4.5 1031	0 0 21.1 1031	5.4 3.0 15.4 1031	8.3 4.3 15.3 1031	0 0 21.1 1033	0.9 0.8 20.2 1031	FOAM DRY		59.6 23.6 4.8 1031	67.3 33.3 0.6 1031	DAMA GED	0 0 21.1 1033
5	03/02/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.8 1020												
6	10/02/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.5 1022												
7	14/02/2006	TL/DH	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.8 1004	71.1 23.6 0.8 1003	0 0 20.8 1003	3.6 2.2 19 1003	3.7 2.1 18 1004	0 0 20.8 1004	0.6 0.4 20.4 1003	FOAM DRY		60.1 24.2 2.5 1003	63.5 30.5 0.2 1003	DAMA GED	0 0 20.8 1004
8	23/02/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.8 1020												
9	27/02/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 21.2 1027												
10	10/03/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.7 1016												
11	14/03/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.9 1020	70.7 21.8 1.3 1021	0 0 20.8 1021	0.8 1.2 20.0 1021	4.3 1.8 18.3 1021	0 0 21.1 1018	0.9 0.3 20.4 1021	68.2 25.8 0.3 1020	69.2 29.5 0 1020	64.3 24.3 2.2 1022	65.2 28.2 1.5 1021	0 0 20.8 1016	0 0 20.9 1017
12	20/03/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.6 1015												
13	31/03/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.7 998												

Table 5.2 Dungarvan landfill gas monitoring Q2 2006

Week No	Date	Operator	Gas	Site Hut	GW 1	GW 2A	RC 3A	RC 4	RC 6A	LT 1	L2A	L3	LT 4	LT 5A	RC 7	RC 8
14	06/04/2006	TL	CH ₄ , CO ₂ , O ₂ Air Pressure	0 0 20.6 1015												
15	10/04/2006	TL	CH ₄ , CO ₂ , O ₂ Air Pressure	0 0 20.7 1012												
16	21/04/2006	TL	CH ₄ , CO ₂ , O ₂ Air Pressure	0 0 20.8 1019	0 0 20.8 1018	0 0 20.8 1019	0.4 0.3 20.2 1018	4.5 3.3 14.6 1018	0 0 20.8 1019	0.8 0.3 20.5 1017	19.6 8.0 14.7 1017	54.3 24.7 4.3 1019	58.5 26.9 2.0 1018	66.8 30.0 1.1 1019	0 0 20.8 1019	0 0 20.8 1019
17	28/04/2006	TL	CH ₄ , CO ₂ , O ₂ Air Pressure	0 0 20.7 1032												
18	05/05/2006	TL	CH ₄ , CO ₂ , O ₂ Air Pressure	0 0 20.8 1018												
19	10/05/2006	TL	CH ₄ , CO ₂ , O ₂ Air Pressure	0 0 20.7 1032												
20	18/05/2006	TL	CH ₄ , CO ₂ , O ₂ Air Pressure	0 0 20.7 1018												
Week No	Date	Operator	Gas	Site Hut	GW 1	GW 2A	RC 3A	RC 4	RC 6A	LT 1	L2A	L3	LT 4	LT 5A	RC 7	RC 8
21	26/05/2006	TL	CH ₄ , CO ₂ , O ₂ Air Pressure	0 0 20.7 1014	14 8.7 10.3 1014	0 0 20.7 1014	0.5 0.2 20.3 1014	3.4 1.1 18.8 1014	0 0 20.7 1014	0.3 0 20.4 1014	64.4 3.0 0.5 1013	66.5 29.3 0.3 1013	66 26.7 1.5 1014	67 30.7 0.5 1014	0 0 20.7 1014	0 0 20.5 1014
22	01/06/2005	TL	CH ₄ , CO ₂ , O ₂ Air Pressure	0 0 20.6 1029												
23			CH ₄ , CO ₂ , O ₂ Air Pressure	Monitor being calibrated												
24	14/06/2005	TL	CH ₄ , CO ₂ , O ₂ Air Pressure	0 0 21 1024												
25	23/06/2006	TL	CH ₄ , CO ₂ , O ₂ Air Pressure	0 0 20.7 1018												
26	28/06/2006	TL	CH ₄ , CO ₂ , O ₂ Air Pressure	0 0 20.7 1030	14.0 8.7 10.3 1028	0 0 21.0 1029	0.5 0.2 20.3 1028	10 4.7 15.3 1029	0 0 20.7 1030	0.8 0.4 20.7 1028	12.6 7.3 16.2 1028	37.6 21.4 9.4 1028	46.8 22.3 5.7 1029	65.3 33.2 1.5 1029	0 0 20.7 1030	0 0 21.2 1030

Table 5.3 Dungarvan landfill gas monitoring Q3 2006

Week No	Date	Operator	Gas	Site Hut	GW 1	GW 2A	RC 3A	RC 4	RC 6A	LT 1	LT 2A	LT 3	LT 4	LT 5A	RC 7	RC 8
27	06/07/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.9 1019												
28	12/07/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.9 1022												
29	18/07/2006	TL/DH	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.8 1021	20.3 10.6 9.7 1021	0 0 20.9 1022	0.3 0.3 20.0 1022	12.3 6.9 14.7 1021	0 0 20.8 1021	0.5 0.4 20.7 1021	10.6 5.3 17.6 1022	35.6 19.9 9.9 1022	44.6 23.3 5.5 1021	63.5 32.1 1.8 1021	0 0 20.8 1021	0 0 20.8 1021
30	25/07/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.8 1019												
31	04/08/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.8 1026	42 16.5 2.7 1027	0.1 0 20.5 1027	1 2.3 18.1 1027	20.6 9.5 6.1 1026	0 0 20.8 1026	0.1 0.4 20.4 1027	12.6 7.3 16.2 1026	37.6 21.4 9.4 1027	49.5 15.5 5.5 1026	27.7 13.8 11.8 1026	0.5 0.2 19.9 1026	0 0 20.7 1027
32	11/08/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.8 1019												
33	17/08/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.8 999												
34	23/08/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.9 1009												
35	31/08/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.8 1023												
36	04/09/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.9 1022												
37	11/09/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.8 1013												
38	19/09/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.9 997												
39	28/09/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.8 1002	75.1 23 0.4 1001	0 0 20.8 1001	1.1 0.5 20.4 1001	19.3 7.4 3.1 1001	0 0 20.8 1001	0.2 0 20.8 1000	4.4 1.7 19.6 1001	31.7 17.4 10.8 1000	58.4 27.0 3.0 1000	65.1 34.7 1.0 1001	0 0 20.8 1002	0 0 20.8 1002

Table 5.4 Dungarvan landfill gas monitoring Q4 2006

Week No	Date	Operator	Gas	Site Hut	GW 1	GW 2A	RC 3A	RC 4	RC 6A	LT 1	LT 2A	LT 3	LT 4	LT 5A	RC 7	RC 8
40	04/10/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.9 1013												
41	10/10/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.9 1014												
42	20/10/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.9 1016												
43	24/10/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.9 999												
44	31/10/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.9 1022	0 0 20.9 1022	0 0 20.9 1021	0.1 0.1 20.9 1022	0.1 0 20.9 1022	0 0 20.9 1021	0.4 0.2 20.8 1022	0 0 20.9 1021	35.5 17.7 11.0 1021	40.8 20.2 7.0 1021	68.3 33.1 1.2 1021	0 0 20.9 1021	0 0 20.9 1022
45	10/11/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.9 1023												
46	15/11/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.9 1013												
47	23/11/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.9 999												
48	30/11/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 21.0 1004	13.6 4.5 17.3 1004	0 0 21.0 1004	0.6 0.5 20.7 1004	9.0 3.5 15.9 1004	0 0 21.0 1005	0 0 20.9 1004	0 0 20.9 1004	31.7 14.6 11.9 1003	10.4 3.3 18.3 1003	66.5 32.0 2.5 1004	0 0 21.0 1005	0 0 20.9 1004
49		TL	CH ₄ CO ₂ O ₂ Air Pressure	No test Monitor being calibrated												
50		TL	CH ₄ CO ₂ O ₂ Air Pressure	No test Monitor being calibrated												
51		TL	CH ₄ CO ₂ O ₂ Air Pressure	No test Monitor being calibrated												
52	29/12/2006	TL	CH ₄ CO ₂ O ₂ Air Pressure	0 0 20.9 998												

5.6 NOISE

5.6.1 Introduction

Daytime noise levels were recorded in November 2006 at five locations at Dungarvan Landfill Site, B1-4 and NSL1, as specified in the licence monitoring schedule D. These locations are shown in fig. DUN-EIS-003, attached. There are limits of 55 dB Leq(30) daytime, and 45 dB Leq(30) night-time imposed as a condition of the licence. Night-time measurements were not considered necessary as the landfill does not operate at night.

A Cirrus 800A Sound Level Meter was used. The meter was calibrated and checked with a 94 dB calibrator before and after each measurement. Broadband and Frequency Band analysis measurements were conducted at each location. A summary of results is presented in the table below. Octave band analysis for 5 monitoring locations are presented in figures 6.1 to 6.5 below.

5.6.2 Noise levels

2006 Noise levels

1998 “Baseline” noise levels

Site	Date of Monitoring	$L(A)_{eq}[30mins]$ dB	$L(A)_{10}[30mins]$	$L(A)_{90}[30mins]$	Frequency Analysis “A” weighting (Max Sound level frequency)	Comments
B1	1/11/06 Baseline 1998	50.8 56	50.5 68	43.2 58	50 dB @ 250 Hz	
B2	1/11/06 Baseline 1998	48.9 50	51.7 51	42.3 46	44 dB @ 1 kHz	
B3	1/11/06 Baseline 1998	47.8 46	51.1 47	43.0 43	50 dB @ 2.5 KHz	
B4	2/11/06 Baseline 1998	45.7 47	47.4 50	41.7 45	47 dB @ 6.3 KHz	
NSL1	3/11/06 Baseline 1998	46.7 54	48.4 55	43.3 34	42 @ 1.6 kHz	

5.6.3 Discussion

Noise levels were compliant with the noise emission requirement of 55 dB(A) L_{Aeq} (30 mins).

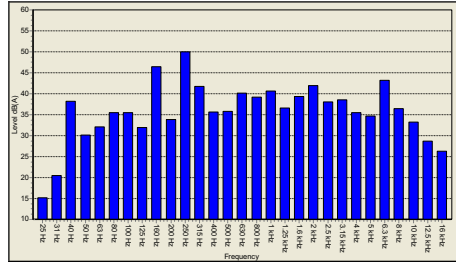


Fig 6.1 Dungarvan landfill noise monitoring 1/11/06, location B1, octave band analysis, A weighting

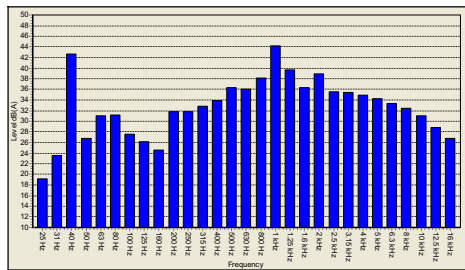


Fig 6.2 Dungarvan landfill noise monitoring 1/11/06, location B2, octave band analysis, A weighting

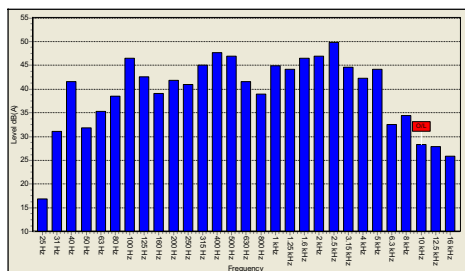


Fig 6.3 Dungarvan landfill noise monitoring 1/11/06, location B3, octave band analysis, A weighting

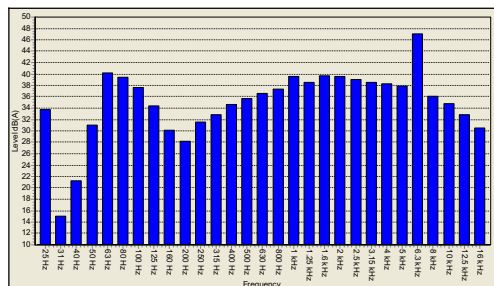


Fig 6.4 Dungarvan landfill noise monitoring 2/11/06, location B4, octave band analysis, A weighting

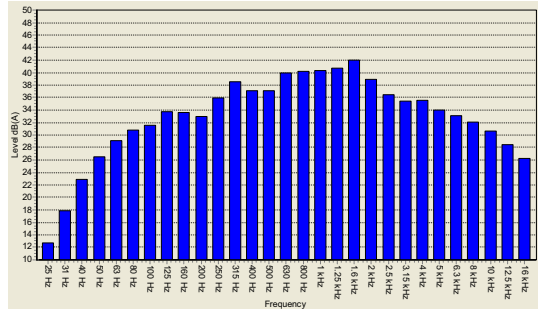


Fig 6.5 Dungarvan landfill noise monitoring 3/11/06, location NSL1, octave band analysis, A weighting

5.7 DUST

5.7.1 Introduction / Methodology

Dust deposition rates were measured at five locations (B1, B2, B3, B4, and D1), over 40 days, at Dungarvan Landfill during 2006, using Bergerhoff instruments.

5.7.2 Results

Dungarvan Landfill - Dust Deposition Rates mg/m²/day

Dust Monitoring Dungarvan Landfill

Monitoring 01/11/2006 to 11/12/2006

No Of Day 40

Location	No of Days	Deposition Rate mg/sq. m/day
B1	40	19.3
B2	40	21.6
B3	40	23.9
B4	40	34.1
D1	40	17

5.7.3 Discussion

Dust deposition rates were very low, at background levels.

5.8 LEACHATE TOXICITY

5.8.1 Introduction / Methodology

The tests described in this section were conducted to comply with condition 8.11.1(ii) of the landfill licence, which requires "an assessment of the toxicity of leachate using appropriate organisms which reflect the habitats... in the vicinity of the site."

The toxicity tests were carried out at the Aquatic Toxicity Laboratory, Enterprise Ireland, Shannon.

A representative sample of leachate was obtained by compositing four grab samples, taken on 14/11/05, from leachate boreholes, L1, L2a, L4, L5a, lagoon L6 and the leachate tank.

Three test species were used, namely *Daphnia magna* (freshwater copepod), *Pseudokirchneriella subcapitata* (freshwater alga), and *Vibrio fischeri* (bacterium).

The tests consisted of exposing populations of the tests species to various concentrations of the leachate sample, and noting the concentration at which the species exhibited a response (usually mortality or growth inhibition) for 50% of the population thus exposed. This concentration is termed the EC50 (Effective concentration for 50% of the exposed population). The EC50 can also be expressed as *Toxic Units*, which are calculated by dividing 100 by the EC50.

5.8.2 Results

A full report was prepared by Enterprise Ireland and results are summarized below.

SPECIES	<i>D.magna</i>	<i>P. subcapitata</i>	V. fischeri	
EC50	37.2% vol/vol	14.0% vol/vol	23.6% vol/vol	19.3% vol/vol
	48 hr EC50	72 hr IC50	5 min EC50	15 min EC50
TOXIC UNITS	2.7	7.1	4.2	5.2

5.8.3 Discussion

All toxicity results were low (less than 10 Toxic units) indicating that the leachate exhibits no significant toxic characteristics to the representative organisms.

5.9 CHEMICAL ANALYSIS OF ESTUARINE SEDIMENT AND BENTHIC MACROFAUNA

5.9.1 Introduction

Small concentrations of metals exist naturally in the environment and living organisms require trace amounts in order to exist. However some metals can be hazardous to the environment if concentrations exceed certain thresholds. An evaluation of the heavy metal content of riverine / estuarine sediment and invertebrate (mussel) tissue is required by condition 8.11 of the landfill licence. It was not possible to sample river sediments due to high water levels at the time of sampling in December 2006. The results of monitoring of sediments in 2005 are presented below. Mussel samples were obtained however on 11/12/06, at the usual sampling point at the N25 Bridge approximately 2.5 km downstream of the landfill, see fig 9.1.

Based on field investigations and literature data, Jeffrey et al (1995) established baseline and threshold values for organic matter and heavy metals in estuarine sediments.

* The baseline concentration is defined as “that of the natural unpolluted estuary and corresponds to the authors views of the pre-industrial situation for sediments”.

** The threshold is “the pollutant concentration beyond which deleterious environmental change is observable”.

*** The National Oceanic and Atmospheric administration in USA (Long and Man, 1995) also established sediment quality guidelines. The guidelines are based on a review of numerous studies of the correlation between the toxicity of sediments and the content of pollutants. The ERL limits shown represent the concentration above which there may be a risk of deleterious impacts on fauna.

Background trace metals in estuarine sediments generally reflect the occurrence and abundance of metals in the geological formations in the catchment area of the estuary, and any metals discharged to the environment due to human activities.

Prior to their closure, Dungarvan Crystal and Dungarvan Tannery were licenced to discharge lead and chromium to Dungarvan Harbour.

Sediment

Samples of sediment (approx 2 kg) were taken on 18/8/05 at five sampling points, shown on fig 9.1.

- S1 – just upstream of disused railway bridge upstream of landfill (EPA stn 280)
- S2 – immediately upstream of the landfill site
- S3 – opposite most downstream drain from the landfill

- S4 – 150 m downstream of landfill
- S5 – Ballyneety Bridge, downstream of landfill (EPA stn 300)

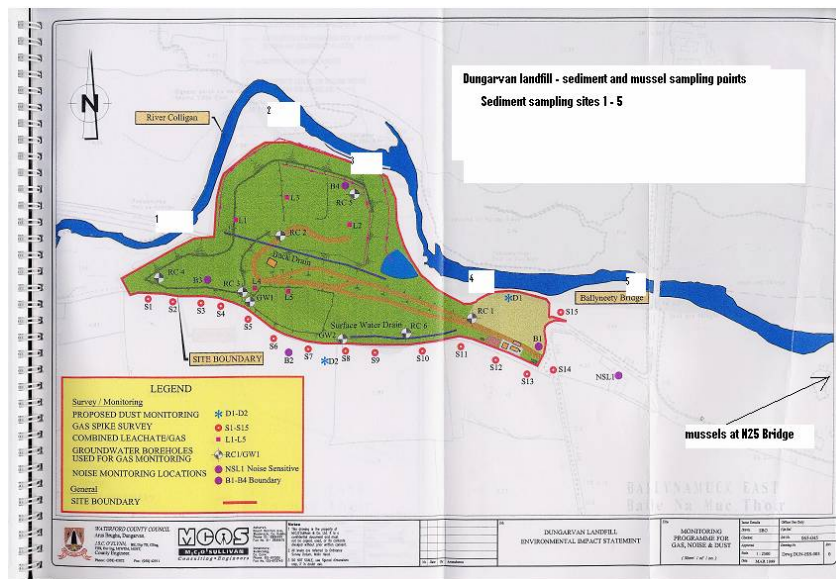


Figure 9.1 Dungarvan landfill, sediment and mussel sampling sites

The samples were hand mixed on-site, and a portion (approx 200g) taken for analysis. The samples were dried at 105 deg for two days, and pulverized with mortar and pestle in Adamstown laboratory. Portions of the powdered samples were analysed for metals at Euro Environmental Services Laboratory, Drogheda. QC and reference materials were processed with the samples.

5.9.2 Results and discussion

a) Sediment

Dungarvan Sediments 2005 Results [2004] and (2003) Results in brackets)							Waterford Harbour EPA Survey, 2003, average of 5 samples	Wexford Harbour EPA Survey, 2002, average of 4 samples	Dungarvan Harbour EPA Survey, 2004 ¹ Average of 4 samples	Sediment Quality Standards (Jeffrey et al)
Parameter	units	S1	S2	S3	S4	S5				
Arsenic	mg/kg	1.6 [2.5] (5.2)	1.4 [2.7] (6.5)	1.9 [2.1] (3.7)	1.3 [3.5] (3.5)	1.5 [3.7] (4.6)	8	8.6	6.7	
Chromium	mg/kg	5.5	5.9	9.6	5.9	6.0	20	31	22.8	
Copper	mg/kg	5.9 [6.1] (7.4)	6.2 [5.7] (9.3)	9.5 [6.6] (7.2)	5.1 [8.7] (6.4)	4.7 [204] (13.6)	9.8	11.4	23.4	50

Lead	mg/kg	4.5 [17.1] (13)	5.7 [5.7] (23)	8.2 [6.9] (10)	7.2 [35.2] (10)	5.4 [72] (14)	26	15	93	
Zinc	mg/kg	23.3 [38.6] (43)	48.8 [40.8] (49)	35.7 [31.5] (88)	27.9 [38.8] (450)	21.8 [1526] (41)	141	70	102	100

Discussion

Metals levels in sediment in 2005 were broadly in line with other years, and compared favourably with results from other part of the coast. The apparent elevated values detected in 2004 at sampling point S5 were not present in 2005.

Shellfish

Mussels samples (*Mytilis edulis*) were taken at a location downstream of the landfill, at the N25 Bridge at Dungarvan bypass road, on 11/12/06, as shown on fig 9.1. Twelve individual mussels, of 6 cm average length, yielding approximately 30 grammes wet weight of flesh were sampled.

Mussels were depurated overnight in clean aerated estuarine water before de-shelling. The flesh was blotted dry and dried at 60deg for 3 days. The dried flesh was ground to powder and portions were analysed for metals at Euro Environmental Services Laboratory, Drogheda. QC and reference materials were processed with the samples.

b) Mussel Samples

Metals Content

Parameter	units	Dungarvan Mussels 2006 results {2005} [2004] and (2003) results in brackets	Waterford Harbour EPA Survey, 2001, average of 4 samples	Wexford Harbour EPA Survey, 2004, average of 4 samples	Dungarvan Harbour EPA Survey, 2004, Average of 4 samples	SHELLFISH QUALITY STANDARDS (Glynn et al)	Marine Institute Study Maximum Values (Glynn et al)
Arsenic	mg/kg WET WEIGHT	1.9 {2.2} [9.8] (2.6)	3.7	1.6			
Cadmium	mg/kg WET WEIGHT	0.07 {0.1} [0.34] (0.03)	0.4	0.1	0.2	1	0.44
Chromium	mg/kg WET WEIGHT	0.15 {0.5}	1.1	0.9	0.9		0.86
Iron	mg/kg WET WEIGHT	15.8 {66.4} [212] (49)	115	62	140		
Lead	mg/kg WET WEIGHT	0.72 {2.1} [15.4] (3.8)	1.5	<0.4	7.5	1.5	0.77
Manganese	mg/kg WET WEIGHT	0.65 {2.4} [18] (1.4)	5.7	3.4	2.5		
Zinc	mg/kg WET WEIGHT	8.3 {11.6} [51] (13.2)	39	22.4	26		28.5

*Ref: Trace Metals and chlorinated Hydrocarbon Concentrations in Shellfish from Irish Waters, 1997-1999, E McGovern et al, Marine Institute, 2001.

Discussion

Metals levels in mussels at the N25 bridge downstream of the landfill were satisfactory relative to quality standards and other sites around the coast.

5.10 ECOLOGICAL SURVEY OF BACKSTRAND AND DUNES

10.1 INTRODUCTION

An ecological survey of Dungarvan Municipal Landfill and environs was carried out by Limosa Environmental and Ecological consultants in August 2006, on behalf of Waterford County Council. A full report was issued and a summary is presented below.

The scope and objectives of the survey were.

1. Habitat quality at landfill and environs. Mapping of main habitat types, and identification of main flora and fauna present. Interpretation of findings with regard to previous studies.
2. Flora (macroalgae) and fauna (including macroinvertebrates) at five River Colligan sites, map attached. Application of appropriate rating systems, such as the EPA Q-rating system, and estuarine evaluation systems. Interpretation of results in light of previous studies.
3. Interpretation and comment on bird count data –to be obtained from annual IWeBs counts, by Birdwatch Ireland, and the landfill bird control contractor

5.10.2 METHODOLOGIES

5.10.2.1 Habitat and botanical survey

A habitat survey was carried out on the 28th August 2006. The survey area encompassed the landfill site and adjacent habitats including the corridor of the River Colligan to the north of the site.

The survey followed Phase 1 methodology (JNCC, 2003) as laid out in ‘*Draft Habitat Survey Guidelines*’ (Heritage Council, 2002). Habitats within the study area were classified using habitat descriptions and codes set out in the Heritage Council’s “*A Guide to Habitats in Ireland*” (Fossitt, 2000).

5.10.2.2 Biological survey of the River Colligan

Sampling of the River Colligan was undertaken at five sites along its length adjacent to the landfill site, and at one site (Ballyneety Bridge) just downstream of the site. The sampling sites were the same as those used in previous annual surveys and were set out by Waterford County Council.

The macroinvertebrate community was sampled using the standard method of kick-sampling (IEA, 1995) using a D-net of 0.3-m diameter and 1-mm mesh. Each kick-sample lasted 2 minutes

(McGarrigle *et al.*, 2002). Three replicate samples were taken at each sampling site and later pooled to give one collective sample per site.

After collection, each sample was sieved in the field over a 0.5mm mesh sieve and any large stones and debris removed. The samples were then transported back to the laboratory. Each sample was then sorted and the macroinvertebrate fauna retained preserved in 70% alcohol.

Macroinvertebrate identification was carried out using identification keys developed by the Freshwater Biological Association (e.g. Hynes, 1977; Croft, 1986; Wallace *et al.*, 2003).

5.10.2.3 Mammal survey

A dedicated mammal survey of Dungarvan Landfill site was undertaken on 24th August 2006. All areas within the boundary of the landfill site itself were thoroughly surveyed as were the adjoining lands south of, and including, the River Colligan - east as far as Ballyneety Bridge. The privately owned arable lands south of the landfill site were not surveyed but their neighbouring boundaries were checked for mammal access routes. The salt marsh and mud shores north of the River Colligan were also surveyed.

The survey consisted of walking the survey area, paying particular attention to boundaries, and recording signs of mammal activity (*i.e.* tracks, droppings, burrows, feeding signs *etc.*) and/or direct observations of mammal species. The locations of all mammal signs were recorded in the field using detailed survey maps and signs of particular note such as otter spraints were recorded using a Handheld GPS (Global Positioning System - Garmin GPS 12 Channel receiver). The survey commenced at 0930hrs and ended at 1630hrs with low tide occurring at 1330 hrs. Weather conditions on the day were good with no rain, low cloud cover, light wind and high visibility.

5.10.2.4 Avian fauna

The avian fauna of Dungarvan Landfill and environs were assessed in the following ways:

- Consultation of relevant literature and local records including consultation with the local NPWS Conservation Ranger and I-WeBS counter.
- A high tide survey of the river corridor adjacent to the landfill and downstream to approximately 500m below Ballyneety Bridge. This survey was carried out at 0830 hours on 28th August 2006.
- A species list was compiled for bird species observed or heard during the ecological surveys of Dungarvan Landfill Site and the immediate surrounding environment.

- A review of annual count data from the Irish Wetland Bird Survey (I-WeBS) (Appendix 5.3) that monitors Dungarvan Harbour including the River Colligan estuary.
- Bird species and conservation importance were assessed with reference to the relevant legislation

5.10.2. GENERAL CONCLUSIONS of ECOLOGICAL SURVEYS

Landfill habitats exhibited some changes this year in comparison to the 2005 survey, partly through natural vegetation succession with certain plant species starting to dominate (e.g. Gorse) and partly through the clearance of vegetation from the main capped mound of the landfill. A small pond appears to have developed naturally within the site over the past few years and has developed its own wetland vegetation within a landscape of recolonising bare ground. This small habitat should ideally be conserved during site rehabilitation.

Habitats surrounding the landfill are largely the same as previous years but some scrub encroachment is evident as well as reed bed expansion. The report highlighted the dangers of allowing the alien, invasive species Japanese Knotweed to spread. A single stand of this plant was recorded on the northern slopes of the capped mound and we recommend that this is removed using appropriate methods.

The site and its surrounding environs continues to support a diversity of wildlife due to the variety of terrestrial and aquatic habitats present. In particular, the habitats associated with the River Colligan are valuable in terms of the flora and fauna they support. The mammal survey highlighted extensive use of the site by several mammal species. In particular a number of well-established sprainting sites continue to be used by the Annex I species otter and there is a hot-spot of otter activity on a bank behind the transfer station. This indicates the presence of favourable environmental conditions for this species. This species is highly protected and any future works at the site which may impact upon this species will require assessment.

Annex I bird species Little Egret appear to have increased their use of the River Colligan adjacent to the landfill site and numerous other bird species utilise the habitats within and surrounding Dungarvan landfill. In particular the Annex I species Kingfisher continues to hold a territory along this stretch of river.

The biological assessment of the River Colligan suggested a fair to good water quality at the five sampling sites. We raised some concerns with regards the level of macrophyte growth in the river which may have had an impact upon the macroinvertebrate communities and at Site 2 in particular. Macrophyte growth is not however, directly attributable to landfill activities and a variety of nutrient sources and other factors are involved in its abundance. Water quality parameters measured during

the survey were found to be within acceptable ranges. Similarly, a review of EPA chemical water quality data (2001-2006) shows acceptable water quality within the River Colligan.

Given the abundance of wildlife associated with the site and the numerous protected species recorded in association with the adjacent River Colligan, future rehabilitation/redevelopment of the site may require some level of ecological impact assessment. The appropriate bodies (e.g. National Parks & Wildlife Service) should be consulted at the relevant time.

5.11 CONCLUSIONS

The occasionally elevated ammonia at SW1 will require investigation if it recurs during 2007, though there is no evidence heretofore of a landfill cause, and downstream sites were satisfactory. In general, water quality at the River Colligan surface water sites in the vicinity of the landfill were satisfactory throughout 2006.

The results of groundwater monitoring are in line with results from previous rounds of testing carried out since 1999. As indicated in previous reports, water in boreholes within the current working area appears to be impacted by leachate from the landfill, however groundwater outside the landfill site was generally satisfactory.

Leachate quality was as expected for a landfill accepting mainly domestic and inert waste. Metal and trace organics concentrations were low. Based on toxicity tests carried out, no toxic effect from landfill leachate is expected.

No noise nuisance was indicated during the annual noise survey.

Dust deposition levels were at background levels.

Metals levels in mussels were satisfactory compared to standards and other coastal and estuarine sites.

The ecological survey of the landfill and estuarine area carried out during 2006 recorded a diversity of habitats and wildlife. There was a high level of bird and mammal activity recorded and the biological assessment of the River Colligan suggested a fair to good water quality at the five sampling sites.

Overall, water and ecological quality in the vicinity of the landfill were satisfactory and there was no indication that the landfill was having a detrimental impact on the surrounding environment.

5.12 Meteorological Data.

Monthly meteorological data is attached in Appendix F.

6. Sequence and timescale for development and restoration of the facility

a) Landfill Capping and Restoration

A Restoration and Aftercare Plan has been approved by the EPA and capping will commence in 2007. Contractors have been appointed and works will be completed in 2007.

b) Landfill Gas & Leachate Management

The gas collection & leachate system will be installed in tandem with the final capping of the landfill. Tenders have been accepted and this work will be carried out in conjunction with the Restoration and Aftercare Plan. The EPA and Waterford County Council have reached agreement on the proposed treatment of leachate by use of a series of reed beds.

7. Topographical survey

A Topographical survey is attached in Appendix G.

8. Schedule of Environmental Objectives and Targets for the forthcoming year

Objective 1 – To maintain site infrastructure to the standards outlined in Condition 3 of the Waste Licence

Target 1.1 - Any defect to the existing infrastructure will be repaired / replaced as quickly as possible on an on going basis.

Objective 2 – That no specified emissions from the facility, shall exceed the limit values, set out in Condition 6 and Schedule C of the Waste Licence.

Objective 3 – To maintain the Monitoring Programme as outlined in Condition 8 and Schedule D of the Waste Licence.

Target 3.1 – To carry out the monitoring programme as outlined in Condition 8 and Schedule D of the Waste Licence.

Target 3.2 – To submit Monitoring Reports to the Agency within the timescale as outlined in Schedule E of the Waste Licence.

Objective 4 – To establish good record keeping and that all records are held at the facility office to comply with Condition 10 of the Waste Licence.

Objective 5 – That no emergency situation occurs on the site.

Target 5.1 – Ensure the contingency arrangements as outlined in Condition 9 of the Waste Licence are implemented throughout the year. A document entitled ‘Emergency Response Procedures’ forms the nucleus of the contingency arrangements and is currently with the Agency.

Objective 6 – To restore the landfill on an on going basis in such a way that final works have a minimal impact on the surrounding environment.

All works regarding the restoration of the facility are agreed beforehand with the Agency and to date no negative feedback has been issued on restoration work proposed. Work will begin in 2006 and be completed in 2007.

Objective 7 – To implement a Gas Management System.

Objective 8 – To implement a Leachate Management System

9. Full title and a written summary of any procedures continued during the reporting period

The European Council Directive 90/313/EEC on the *Freedom of Access to Information on the Environment* recognises the significance of the public's access to information relating to the environment. At present, copies of all documents and correspondence relating to Waste Licence 32-2 are on display at the Civic Offices, Dungarvan.

A communications programme will be put in place as required under condition 2.4.1 of the Waste Licence to ensure that members of the public can obtain information concerning the environmental performance of Ballynamuck Landfill. This in turn will address any local community concerns and allow the public the opportunity to provide feedback on the facility.

The Facility Manager will be responsible for the implementation of this programme, which shall form part of the routine operation and management of the facility. Further support will be provided from the Environment Section of Waterford County Council if required.

Programme

Information to be provided at the Facility

1. The following information will be available for inspection at the Site Office, and will be maintained by the Facility Manager.
 - Map of the Facility showing all environmental monitoring points
 - Current Waste Licence for the Facility
 - All records relating to the Facility
 - Civic Waste Records
 - Nuisance Inspection
 - Integrity Tests of Bunds
 - Complaints Register
 - Incidents Register

- Environmental Monitoring Records (Groundwater, Surface water, Leachate, Landfill Gas, Noise and Meteorological Data).
 - Emergency Response Procedure
 - Programme for the control and Eradication of Vermin and Flies
 - The current EMS for the Facility
 - Annual Environmental Report
 - Visitors Book
2. The Waste Acceptance hours under condition 1.7.1.2 of the Waste Licence are
Monday – Friday 9.00am – 1.00pm and 1.30pm – 5.00pm,
Saturday's 9.00am – 1.00pm.
 3. All visitors are required to sign a Visitors Book at the site office outlining their reason for visiting. Unauthorised personnel are not allowed access to the site.
 4. Members of the public may arrange a site visit by contacting the Facility Manager prior to their visit. For Health and Safety reasons all visitors must have appropriate clothing (High Vis-jacket, Walking boots/Wellingtons). The Facility Manager or Caretaker shall accompany all visitors on site visits.
 5. If information is requested that is not available at the site, the interested party will be directed to the Environment Section of Waterford County Council at the Civic Offices in Dungarvan.
 6. Written Requests for Information
All requests concerning the environmental performance of the facility should be made in writing to:
Facility Manager
Ballynamuck Waste Disposal Site
Dungarvan
Co. Waterford.

7. The Facility Manager shall copy all requests to:
Senior Engineer
Environment Section
Waterford County Council
Civic Offices
Dungarvan
Co. Waterford
8. Each request should indicate the name, address and contact telephone number of the concerned party, an outline of the required information and the manner in which they require the information i.e. copy of record, e-mail etc.
9. Waterford County Council shall make replies in writing within twenty working days of receiving the written request.
10. The information required shall be issued in paper format unless otherwise requested by the concerned party. Requests that require information in digital format may require more time than the twenty working days as outlined previously.
11. If requested Waterford County Council will provide a clear explanation of the information provided.
12. If the concerned party requests the examination of a particular report/document relating to the facility, then it will be made available for viewing at the Landfill site office.
13. ***Media Requests***
The Director of Services within the Environment Section of Waterford County Council shall nominate a liaison person to respond to requests made by the media for information relating to the environmental performance of the facility.
14. ***Feedback from the public***
The Facility Manager will record any comments or suggestions made by the public during their visits and the opportunity will also be available to submit a written comment to the landfill site office. Copies of such minutes or submissions will be kept in a register by the Facility Manager and will also be copied to the Environment Section, for the attention of the Senior Engineer. If requested a reply will be provided by the Council within twenty working days.

Emergency Response Procedures

Scope

The Emergency Response Procedures apply but is not limited to the following incidents occurring:

- Fire / Explosions
- Spillages
- Migration of Landfill Gas
- Environmental Pollution
- Injury or serious accident to persons
- Any other incident, which may pose a significant threat to persons or the environment.

Responsibility

1. The Facility Manager is responsible for the implementation of the Emergency Response Procedure and for the training of all landfill personnel and contractors in effective emergency response procedures.
2. In the event of a major fire or an explosion the Senior Rostered Fire Officer will be notified immediately via the Regional Fire
3. In the event of a serious accident or injury to a person the Ambulance service should be contacted
4. In the event of other incidents e.g. spillages or environmental pollution the Senior Environment Engineer will be notified and will assume responsibility along with the Facility Manager.

Procedure

In the event of an accident occurring the following procedure will be adopted:

- Evacuate the immediate area within the site if necessary
- Inform other site users
- Remain upwind of any hazard area
- Contact site office and advise in detail of the emergency
- Ensure entrance/exit gate is not obstructed
- Contact fire Brigade, Ambulance, Gardaí, and / or Senior Engineer, Waterford County Council as required by dialing 999 or 112

- If incident occurs outside office hours an emergency telephone contact number will be provided on the site notice board
- Personnel shall report to the designated assembly point at the site office
- All areas affected by the incident shall remain closed until given the all-clear by an authorised person

In the event of landfill gas being detected in the site office the following procedure will be followed:

- Raise the alarm
- Evacuate the site office
- Notify relevant senior personnel in Waterford County Council or emergency services if necessary
- Immediately conduct gas survey to identify source
- Remedy cause of problem
- Document incident properly

In the event of a spillage, the Facility Manager shall apply a suitable absorbent material to contain and absorb any spillage at the facility. Once contained the Facility Manager shall have regard to the Corrective Action Procedure.

In the event of a serious threat to the environment, the Facility Manager shall take all necessary short-term action to minimise any further impact and allow the Corrective Action Procedure.

Records

Details of any incident will be recorded in a written register, which will be maintained at the site office

Waste Characterisation & Acceptance Procedures for the Acceptance, Storage and Segregation of Waste

The Civic Waste Facility at Dungarvan Landfill accepts waste from Domestic Householders only.

The following items are accepted:

Waste Electronic and Electrical Equipment – Cages are provided for the collection and storage of small electrical goods. Members of the public are instructed to place all items into these cages by Waterford County Council Employees.

Paint – A 20ft container allows for the collection and storage of paint cans. Members of the public are instructed to place all items on the floor of the container where they are later packed in to steel drums by Waterford County Council Employees.

White Goods (Cookers, washing machines, driers, fridges, freezers) - A 20 ft container allows for the collection and storage of all White goods. Members of the public are instructed to leave all items near the door of the container where they are later double stacked by Waterford County Council Employees.

Glass – Bottle banks are in place to facilitate the disposal of green, brown and clear glass bottles. There is also a small skip in place for the collection of flat glass where it is removed off site for recovery at a later stage.

Hazardous Materials (These are collected and stored in a 40ft container)

Cooking Oil – Waterford County Council employees place all cooking oil in steel drums.

Car oil – Members of the public are instructed to leave all cans beside the oil collection unit where it is later emptied in to the unit by Waterford County Council employees.

Fluorescent tubes – Are collected and stored in a specifically made timber coffin.

Domestic Batteries – These are collected and stored in plastic barrels.

Car Batteries – These are collected are stored in specifically designed battery receptacles.

Obsolete medicines - These are collected and stored in plastic barrels.

Aerosols – These are collected and stored in plastic barrels (all aerosols are separated in to flammable, non – flammable, toxic prior to packing. The aerosols are stacked in layers and covered with vermiculite which is a fire proofing material)

Pesticides - These are collected and stored in plastic barrels.

Scrap metal – Members of the public are instructed to place all metal items in to an open skip where it is later removed off site for recovery

Bulky Items (Beds, Carpets, Mattresses, etc) - Members of the public dispose of these items in to a 20ft container where they are later disposed of to the tip head.

Household Waste – Members of the Public place domestic waste in to a closed skip where it is later disposed of to the tip head.

Rubble - Members of the Public place rubble waste in to an open skip. This is kept on site for use in the haul roads

Clay & Top soil - Members of the Public place clay & topsoil in to an open skip. This is kept on site for use in restoration works.

Household Dry Recyclables – Members of the public dispose of recycling material in to a closed skip where it is later removed off site for recovery.

Timber - Members of the Public place timber products in to an open skip where it is later removed off site for recovery.

10. Reported Incidents and Complaints

There were no reported incidents or complaints for the reported period.

11. Management and Staffing of the Facility

Management and staffing of the facility is attached in Appendix H.

12. Programme for Public Information

All files are held at the site office and at the Civic Offices Dungarvan Co. Waterford

13. Report on training of staff

Both the Facility Manager and Deputy Manager have attended the Fás Waste Management Training Course. Site personnel have attended the Fás Safe Pass program, Waste Facility Operative Course and site operatives attended a course in the handling, storage and removal of Waste from the Civic Amenity Site. Training Courses for 2007 will include manual handling training, Waste Facility Operative Course, Fire Fighting and fire extinguisher training and a refresher First Aid Course.

APPENDIX A

Quantity & Composition of Waste Received, Disposed of & Recovered
during the reporting period.

Waste Disposed	Type	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Total
Domestic	Domestic Bulky CoCo	22.78	10.64	10.48	16	13.7	9.88	11.76	14.34	15.42	13.84	12.32	11.42	162.58
	Bulky CoCo	0	0.54	58.48	5.74	0.14	0	10.18	0	1.56	0	0	0	76.64
	Domestic Bulky UDC	24.82	1.96	18.66	16.66	2.8	11.3	11.8	15.64	8.18	32.96	50.3	35.44	230.52
	Civic Skip	13.56	9.46	5.76	7.04	7.16	8.52	6.8	6.72	7.74	5.12	7.06	7.28	92.22
	Transferred from Lismore	41.2	18.42	37.36	33.92	33.82	26.74	35.44	34.98	16.12	32.92	23.26	34.32	368.5
	WCC Housing	0	0	0.08	0.58	0.26	0	0.18	0.16	0	0	0	0	1.26
	Spring Clean Up	0	0	0	14.44	0.12	0	0.2	0.42	0.58	0	0	0	15.76
	Domestic CoCo	236.32	113.9	227.18	123.84	170.6	151.06	157.6	186.64	108.9	215.36	100.78	186.52	1978.7
	UDC Domestic	103.1	45.76	108.16	51.92	87.2	53.56	61.66	72.94	48.12	83.56	44.5	77.16	837.64
MRF Plant	MRF Plant	9.14	10.02	0	5.18	3.18	3.7	4.16	0	0	2.66	0	0	38.04
Litter	Roadsweeper	0	0	0	0	0	0	0	0	0	0	0	0	0
	RoadsweeperUDC	42.6	36.74	48.28	46.6	36.94	36.48	39.06	41.08	28.9	50.08	45.22	38.48	490.46
	Litterbins	20.36	12.54	8.96	10.04	12.2	13.88	11.42	12.44	8.1	9.48	9.92	7.74	137.08
	LitterbinsUDC	18.56	21.38	23.32	19.04	20.6	22.78	26.2	24.7	26.96	25	21.84	16.88	267.26
Total Disposed		532.44	281.36	546.72	351	388.72	337.9	376.46	410.06	270.58	470.98	315.2	415.24	4696.66

0

Recycling	Dry Material	13.58	9.58	6.36	8.06	6.32	8.16	8.38	11	8	7.44	7.14	9.68	103.7
	Textiles	0.56	0.38	0.32	0.08	0	0.68	0	1.1	0	0	0.74	0	3.86
	Fridges	1.9	4.08	1.62	3.92	0.74	3	3.4	0.4	5.48	1.104	3.1	2.78	31.524
	Large Household	8.98	13.36	10.76	5.72	9.68	12.4	12.1	14.14	9.82	6.044	6.58	6.98	116.564
	Small Household	4.54	1.52	0.98	3.6	3.66	1.46	5.28	7.92	3.28	5.448	2.48	0	40.168
	Polluted Appliances	0	0	0	0	0	0	0	0	0	0	0	0	0
	TV's Monitors	2.92	1.7	1.36	3.08	0.9	1.24	4.21	3.25	0	2.504	0	0	21.164
Scrapmetal	Scrap metal	3.78	7.16	2.98	4.92	5.08	3.14	3.88	3.24	5.54	2.9	2.92	2.16	47.7
Recovery	Clay	0	0	0	0	0	0	0	0	0	0	0	0	0
	Clay on Purchase	2313.8	3938.16	11530.94	218.76	2183.38	4234.8	7093	3244.1	4878.58	1601.8	3491.86	4261.48	48990.68
	Rubble	5.92	16.64	9.78	8.84	0	9.8	7.08	17.1	0	0	8.62	5.12	88.9
Glass	Flat Glass	0	0	0	0	0	0	0	2.9	0	0	1.82	0	4.72
Compost	Compost	0	0	0	0	0	0	0	0	0	0	0	0	0
	Brown Bin	81.64	0	0	0	32.8	23.12	0	0	0	0	0	0	137.56
	Brown Bin UDC	33.14	0	0	0	0	0	0	0	0	0	0	0	33.14
	Brown Bin Commercial	5.4	0	0	0	0	0	0	0	0	0	0	0	5.4
	Garden CoCo	0	0.04	0	0	0	0.26	0.98	0	0	0	0	0	1.28
	Garden UDC	0	0	0	0	0	0	0	0	0.16	0	0	0	0.16
	Garden Private	0	30.82	0	0	0	0	0	0	0	0	0	0	30.82
Timber	Timber	12.1	9.88	7.96	9.68	10.58	13.28	10	9.86	11.62	8.96	7.78	4.12	115.82
Hazardous	Aerosols	0	0	0	0	0.08	0	0	0	0	0	0.03	0	0.11
	Flourescent Lamps	0.08	0	0	0	0.22	0	0	0	0.06	0	0.26	0	0.62
	Cooking Oil	0	0	0	0	0.14	0	0.84	0	0	0	0	0	0.98

	Paint	0	0	0	0	0	0	0	0	0	0.76	0.38	0	1.14
	Car Filters	0	0.4	0	0	0	0	0	0	0	0	0	0	0.4
	Batteries	0	1.72	0	0	1.24	0	0.2	0	0	0.12	0.32	0	3.6
Total Accepted		3020.78	4316.8	12119.78	617.66	2643.54	4649.2	7525.9	3725.07	5193.12	2108.1	3849.23	4707.56	54476.67

Waste Transferred															0
Compost	Compost	0	0	3.14	0	0	0	0	0	3.48	3	0	0	0	9.62
	CompostUDC	0	0	0	0	0	3.22	0	0	0	3.6	8.26	0	0	15.08
	Brown Bins	126.12	0	0	0	28.7	15.6	0	0	0	0	0	0	0	170.42
	Fridges	1.92	4	1.58	3.92	0.76	2.92	3.32	0.4	5.38	1.104	3	2.68	0	30.984
	Large Household	8.98	13.08	10.68	5.62	9.7	7.56	12.12	13.86	9.7	6.044	6.58	6.84	0	110.764
	Small Household	4.52	1.54	0.98	3.62	3.58	1.42	5.3	7.86	3.28	5.448	2.42	0	0	39.968
	Polluted Appliances	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TV's Monitors	2.92	1.7	1.38	3.04	0.92	1.16	4.21	3.25	0	2.504	0	0	0	21.084
Recycling*	Dry Materials	13.42	9.38	6.02	7.96	6.18	8.16	8.02	10.7	7.82	7.14	7.06	9.3	0	101.16
	Textiles	0.56	0.38	0.34	0.08	0	0.68	0	1.1	0	0	0.74	0	0	3.88
	Timber	11.86	9.76	7.96	9.56	10.2	13.16	9.84	9.74	11.52	9.02	7.82	4.08	0	114.52
Scrapmetal	Scrapmetal	3.68	7.14	3	4.82	5.12	3.08	3.76	3.26	5.4	2.9	2.88	2.16	0	47.2
Recovery	Clay	0	0	0	0	0	0	6.76	0	0	0	0	0	0	6.76
	Rubble	5.96	0	9.72	8.76	0	9.8	7.1	17.02	0	0	8.62	5.18	0	72.16
	Dom CoCo	498.4	336.56	455.02	429.54	337	382.64	359.66	416.04	274.98	424.18	315.42	407.32	0	4636.76
	Garden CoCo	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glass	Flat Glass	0	0	0	0	0	0	0	2.9	0	0	1.82	0	0	4.72
	Leachate	11.04	0	26.92	0	0	0	0	0	0	0	0	0	0	37.96
Hazardous	Aerosols	0	0	0	0	0.08	0	0	0	0	0	0.03	0	0	0.11
	Flourescent Lamps	0.06	0	0	0	0.08	0	0	0	0.06	0	0.18	0	0	0.38
	Cooking Oil	0	0	0	0	0.14	0	0.86	0	0	0	0	0	0	1
	Paint	0	0	0	0	0	0	0	0	0	0.76	0.3	0	0	1.06
	Car Filters	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0.4
	Batteries	0	1.64	0	0	1.24	0	0.2	0	0	0.12	0.32	0	0	3.52
Total		689.44	385.58	526.74	476.92	403.7	449.4	421.15	486.13	321.62	465.82	365.45	437.56	0	5429.51

Appendix D – Current Waste Licence

Headquarters
P.O. Box 3000
Johnstown Castle Estate
County Wexford
Ireland

WASTE LICENCE

Licence Register Number: 32-2

Licensee: Waterford County Council

Location of Facility: Dungarvan Waste Disposal Site,
Ballynamuck Middle, Dungarvan,
County Waterford.

INTRODUCTION

This introduction is not part of the licence and does not purport to be a legal interpretation of the licence.

A review of the existing licence is sought at Dungarvan Landfill & Civic Waste Facility for the following reasons:

- To focus the principal waste activities on-site to 4th Schedule activities at the front end of the facility by authorising the composting facility (initially at 1000T) and Civic Waste Facility [CWF], and ensure their proper operation as required by Section 40(4) of the WMAs;
- To authorise the transfer station, but require the licensee to upgrade the facility to BAT before waste can be stored there;
- To specify and re-confirm the required restoration works at the closed landfill as per Licence Reg No. 32-1, including the installation of landfill gas management infrastructure and capping;
- To re-schedule waste tonnages caused by the cessation of municipal waste disposal to landfill, and enable the disposal/recovery tonnages envisaged by the applicant at the composting unit. Overall this will cause a reduction of waste handling at the facility from c.20,000T/annum to c. 12,000T/annum.

As landfilling of waste no longer takes place at the facility the licence requires the restoration and remediation of the closed landfill, with ongoing leachate and landfill gas management.

The licence allows composting of biodegradable waste and green waste in enclosed vessels. The quantity to be composted is limited to a trial scheme of 1,000 tonnes of biowaste per year, with the provision to increase tonnages upon agreement with the Agency. This licence authorises the use of wood chipping infrastructure at the facility.

The licensee must manage and operate the facility to ensure that the activities do not cause environmental pollution. The licensee is required to carry out regular environmental monitoring and submit all monitoring results, and a wide range of reports on the operation and management of the facility, to the Agency.

The licence sets out in detail the conditions under which Waterford County Council will operate and manage this facility.

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Glossary of Terms

All terms in this licence should be interpreted in accordance with the definitions in the Waste Management Acts 1996 to 2003, (the Acts), unless otherwise defined in this section.

Aerosol	A suspension of solid or liquid particles in a gaseous medium.
Adequate lighting	20 lux measured at ground level.
AER	Annual Environmental Report.
Agreement	Agreement in writing.
Annually	At approximately twelve monthly intervals.
Attachment	Any reference to Attachments in this licence refers to attachments submitted as part of this licence application.
Application	The application by the licensee for this licence.
Appropriate facility	A waste management facility, duly authorised under relevant law and technically suitable.
BAT	Best Available Techniques. As required by Section 40(4)(c) of the WMAs.
Bi-annually	All or part of a period of six consecutive months.
Biennially	Once every two years.
BOD	5 day Biochemical Oxygen Demand.
CEN	Comité Européen De Normalisation – European Committee for Standardisation.
Bioaerosol	An aerosol of biological particles.
Biodegradable waste	Any waste that is capable of undergoing anaerobic or aerobic decomposition, such as food, garden waste, sewage sludge, paper and paperboard.
Compost	Stable, sanitised and humus like material rich in organic matter and free from offensive odours resulting from composting, of separately collected biowaste which complies with the environmental quality classes outlined in <i>Schedule F: Standard for Compost Quality</i> , of this licence.
COD	Chemical Oxygen Demand.
Construction and Demolition Waste	Wastes that arise from construction, renovation and demolition activities: Chapter 17 of the EWC or as otherwise may be agreed.
Containment boom	A boom which can contain spillages and prevent them from entering drains or watercourses or from further contaminating watercourses.
Daily	During all days of plant operation, and in the case of emissions, when emissions are taking place; with at least one measurement on any one day.
Day	Any 24 hour period.
Daytime	0800 hrs to 2200 hrs.
dB(A)	Decibels (A weighted).

DO	Dissolved Oxygen.
Documentation	Any report, record, result, data, drawing, proposal, interpretation or other document in written or electronic form which is required by this licence.
Drawing	Any reference to a drawing or drawing number means a drawing or drawing number contained in the application, unless otherwise specified in this licence.
EMP	Environmental Management Programme.
Emission Limits	Those limits, including concentration limits and deposition rates established in <i>Schedule B: Emission Limits</i> , of this licence.
Environmental Damage	Has the meaning given it in Directive 2004/35/EC.
EPA	Environmental Protection Agency.
European Waste Catalogue (EWC)	A harmonised, non-exhaustive list of wastes drawn up by the European Commission and published as Commission Decision 2000/532/EC and any subsequent amendment published in the Official Journal of the European Community.
Facility	Any site or premises used for the purposes of the recovery or disposal of waste.
Emergency	Those occurrences defined in Condition 9.
Forced aeration	The supply of air to a compost pile, by pumping (positive pressure) or by sucking air through the composting material (negative pressure).
Fortnightly	A minimum of 24 times per year, at approximately two week intervals.
GC/MS	Gas Chromatography/Mass Spectroscopy.
Green waste	Waste wood (excluding timber), plant matter such as grass cuttings, and other vegetation.
Heavy Metals	This term is to be interpreted as set out in "Parameters of Water Quality, Interpretation and Standards" published by the Agency in 2001. ISBN 1-84095-015-3.
HFO	Heavy Fuel Oil.
Hours of Operation	The hours during which the facility is authorised to be operational.
Hours of Waste Acceptance	The hours during which the facility is authorised to accept waste.
ICP	Inductively Coupled Plasma Spectroscopy.
Incident	The following shall constitute an incident for the purposes of this licence:

	<ul style="list-style-type: none"> a) an emergency; b) any emission which does not comply with the requirements of this licence; c) any exceedence of the daily duty capacity of the waste handling equipment; d) any trigger level specified in this licence which is attained or exceeded; and, e) any indication that environmental pollution has, or may have, taken place.
Installation	A stationary technical unit or plant where the activity concerned referred to in the First Schedule of EPA Acts 1992 and 2003 is or will be carried on, and shall be deemed to include any directly associated activity, which has a technical connection with the activity and is carried out on the site of the activity.
IPPC	Integrated Pollution Prevention & Control.
Industrial Waste	As defined in Section 5(1) of the Waste Management Acts 1996 to 2003.
Inert waste	Waste that does not undergo any significant physical, chemical or biological transformations. Inert waste will not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm human health. The total leachability and pollutant content of the waste and the ecotoxicity of the leachate must be insignificant, and in particular not endanger the quality of surface water and/or groundwater.
In-vessel composting	Different composting methods in which material for composting is contained in a building, reactor or vessel.
K	Kelvin.
kPa	Kilo Pascals.
Landfill Directive	Council Directive 1999/31/EC.
Leq	Equivalent continuous sound level.
Licence	A Waste Licence issued in accordance with the Acts.
Licensee	Waterford County Council.
Liquid Waste	Any waste in liquid form and containing less than 2% dry matter.
List I	As listed in the EC Directives 76/464/EEC and 80/68/EEC and amendments.
List II	As listed in the EC Directives 76/464/EEC and 80/68/EEC and amendments.
Local Authority	Waterford County Council.
Maintain	Keep in a fit state, including such regular inspection, servicing, calibration and repair as may be necessary to adequately perform its function.
Mass Flow Limit	An Emission Limit Value which is expressed as the maximum mass of a substance which can be emitted per unit time.
Mass Flow Threshold	A mass flow rate, above which, a concentration limit applies.

Monthly	A minimum of 12 times per year, at approximately monthly intervals.
Night-time	2200 hrs to 0800 hrs.
Municipal waste	As defined in Section 5(1) of the Acts.
Noise Sensitive Location (NSL)	Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.
Oil Separator	Device installed according to I.S. EN 585-2:2003 (separator systems for light liquids).
PER	Pollution Emission Register.
Quarterly	All or part of a period of three consecutive months beginning on the first day of January, April, July or October.
Regional Fisheries Board	Southern Regional Fisheries Board.
Sanitary Authority	Waterford County Council.
Sanitary Effluent	Waste water from facility toilet, washroom and canteen facilities.
Sample(s)	Unless the context of this licence indicates to the contrary, samples shall include measurements by electronic instruments.
SOP	Standard Operating Procedure.
Standard Method	A National, European or internationally recognised procedure (eg. I.S. EN, ISO, CEN, BS or equivalent), as an in-house documented procedure based on the above references, a procedure as detailed in the current edition of “Standard Methods for the Examination of Water and Wastewater”, (prepared and published jointly by A.P.H.A., A.W.W.A & W.E.F), American Public Health Association, 1015 Fifteenth Street, N.W., Washington DC 20005, USA; or, an alternative method as may be agreed by the Agency.
Storm Water	Rain water run-off from roof and non-process areas.
Sludge	The accumulation of solids resulting from chemical coagulation, flocculation and/or sedimentation after water or wastewater treatment, with greater than 2% dry matter.
Specified Emissions	Those emissions listed in <i>Schedule B: Emission Limits</i> of this licence.
Stabilised Biowaste	Waste resulting from the mechanical/biological treatment of unsorted waste or residual municipal waste including treated biowaste which does not comply with the environmental quality classes outlined in <i>Schedule F: Standards for Compost Quality</i> , of this licence.
The Agency	Environmental Protection Agency.
TOC	Total Organic Carbon.
Trade Effluent	Trade Effluent has the meaning given in the Water Pollution Acts 1977 and 1990.
Trigger Level	A parameter value, the achievement or exceedance of which requires certain

	actions to be taken by the licensee.
Windrow	An elongated pile of composting material.
Weekly	During all weeks of plant operation, and in the case of emissions, when emissions are taking place; with at least one measurement in any one week.
WWTP	Waste Water Treatment Plant.

Decision & Reasons for the Decisions

Reasons for the Decision

The Agency is satisfied, on the basis of the information available, that subject to compliance with the conditions of this licence, any emissions from the activity will comply with and will not contravene any of the requirements of Section 40(4) of the Waste Management Acts 1996 to 2003.

In reaching this decision the Environmental Protection Agency has considered the application and supporting documentation received from the applicant and the report of its inspector. No objection having been received to the Proposed Decision, the licence is granted in accordance with the terms of the Proposed Decision and the reasons therefor.

Part I Schedule of Activities Licensed

In pursuance of the powers conferred on it by the Waste Management Acts 1996 to 2003, the Environmental Protection Agency (the Agency), under Section 46(2) of the said Acts hereby grants this Waste Licence to Waterford County Council to carry on the waste activities listed below at Dungarvan Waste Disposal Site, Ballynamuck Middle, Dungarvan, County Waterford subject to conditions, with the reasons therefor and the associated schedules attached thereto set out in the licence.

Licensed Waste Disposal Activities, in accordance with the Third Schedule of the Waste Management Acts 1996 to 2003

Class 4.	Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons.
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 Acts 1996 to 2003

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 9.	Use of any waste principally as a fuel or other means to generate energy.
Class 11.	Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule.
Class 13.	Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced.

Part II Schedule of Activities Refused

The Environmental Protection Agency (the Agency) proposes not to refuse any of the waste disposal and waste recovery activities applied for.

Part III Conditions

Condition 1. Scope

- 1.1 Waste activities at this facility shall be restricted to those listed and described in Part I Activities Licensed and shall be as set out in the licence application or as modified under Condition 1.6 of this licence and subject to the conditions of this licence.
- 1.2 Activities at this facility shall be limited as set out in *Schedule A: Limitations*, of this licence.
- 1.3 Before commencing operations the licensee must satisfy the Agency that it has obtained consent from the Department of Agriculture and Food to treat animal by-products in composting/biogas facilities.
- 1.4 The facility shall be controlled, operated, and maintained and emissions shall take place as set out in this licence. All programmes required to be carried out under the terms of this licence, become part of this licence.
- 1.5 For the purposes of this licence, the facility authorised by this licence, is the area of land outlined in red on Drawing No. DLRA - 01 of the application. Any reference in this licence to “facility” shall mean the area thus outlined in red. The licensed activities shall be the carried on only within the area outlined.
- 1.6 No alteration to, or reconstruction in respect of, the activity or any part thereof which would, or is likely to, result in
- (a) a material change or increase in:
 - The nature or quantity of any emission,
 - The abatement/treatment or recovery systems,
 - The range of processes to be carried out,
 - The fuels, raw materials, intermediates, products or wastes generated, or
 - (b) any changes in:
 - Site management infrastructure or control with adverse environmental significance,
- shall be carried out or commenced without prior notice to, and without the agreement of, the Agency.
- 1.7 Waste Acceptance Hours and Hours of Operation
- 1.7.1 Waste may only be accepted at the landfill and the Civic Waste Facility between the hours of 09:00 to 17:00 Monday to Friday inclusive (Bank Holidays excluded) and 09:00 to 13:00 on Saturday.
- 1.7.2 The facility may only be operated during the hours of 08:30 to 18:00 Monday to Friday inclusive and 08:30 and 14:00 on Saturday.
- 1.8 This licence is being granted in substitution for the waste licence granted to the licensee on 29 November 2002 and bearing Waste Licence Register No: 32-1. The previous waste licence (Register No: 32-1) is superseded by this licence.

Reason: *To clarify the scope of this licence.*

Condition 2. Management of the Facility

2.1 Facility Management

2.1.1 The licensee shall employ a suitably qualified and experienced facility manager who shall be designated as the person in charge. The facility manager or a nominated, suitably qualified and experienced, deputy shall be present on the facility at all times during its operation or as otherwise required by the Agency.

2.1.2 The licensee shall ensure that personnel performing specifically assigned tasks shall be qualified on the basis of appropriate education, training and experience, as required and shall be aware of the requirements of this licence. In addition, the facility manager and his/her deputy shall successfully complete FAS waste management training programme or equivalent agreed with the Agency.

2.2 Environmental Management System (EMS)

2.2.1 The licensee shall establish and maintain an Environmental Management System (EMS). The EMS shall be updated on an annual basis.

2.2.2 The EMS shall include as a minimum the following elements:

2.2.2.1 Management and Reporting Structure.

2.2.2.2 Schedule of Environmental Objectives and Targets.

The licensee shall prepare a Schedule of Environmental Objectives and Targets. The Schedule shall as a minimum provide for a review of all operations and processes, including an evaluation of practicable options, for energy and resource efficiency, the use of cleaner technology, cleaner production, and the prevention, reduction and minimisation of waste, and shall include waste reduction targets. The Schedule shall include time frames for the achievement of set targets and shall address a five year period as a minimum. The Schedule shall be reviewed annually and amendments thereto notified to the Agency for agreement as part of the Annual Environmental Report (AER).

2.2.2.3 Environmental Management Programme (EMP)

The licensee shall, not later than six months from the date of grant of this licence, submit to the Agency for agreement an EMP, including a time schedule, for achieving the Environmental Objectives and Targets. Once agreed the EMP shall be established and maintained by the licensee. It shall include:

- (a) designation of responsibility for targets;
- (b) the means by which they may be achieved;
- (c) the time within which they may be achieved.

The EMP shall be reviewed annually and amendments thereto notified to the Agency for agreement as part of the Annual Environmental Report (AER).

A report on the programme, including the success in meeting agreed targets, shall be prepared and submitted to the Agency as part of the AER. Such reports shall be retained on-site for a period of not less than seven years and shall be available for inspection by authorised persons of the Agency.

2.2.2.4 Documentation

- (i) The licensee shall establish and maintain an environmental management documentation system which shall be to the satisfaction of the Agency.
- (ii) The licensee shall issue a copy of this licence to all relevant personnel whose duties relate to any condition of this licence.

2.2.2.5 Corrective Action

The licensee shall establish procedures to ensure that corrective action is taken should the specified requirements of this licence not be fulfilled. The responsibility and authority for initiating further investigation and corrective action in the event of a reported non-conformity with this licence shall be defined

2.2.2.6 Awareness and Training

The licensee shall establish and maintain procedures for identifying training needs, and for providing appropriate training, for all personnel whose work can have a significant effect upon the environment. Appropriate records of training shall be maintained.

2.2.2.7 Communications Programme

The licensee shall establish and maintain a Communications Programme to ensure that members of the public can obtain information at the facility, at all reasonable times, concerning the environmental performance of the facility.

Reason: To make provision for management of the activity on a planned basis having regard to the desirability of ongoing assessment, recording and reporting of matters affecting the environment.

Condition 3. Infrastructure and Operation

- 3.1 The licensee shall establish all infrastructure referred to in this licence prior to the commencement of the licensed activities or as required by the conditions of this licence. Waste shall not be deposited, stored or recovered at the Transfer Station prior to the infrastructure requirements of Condition 3.14 being met to the satisfaction of the Agency.
- 3.2 Facility Notice Board
 - 3.2.1 The licensee shall provide and maintain an Facility Notice Board on the facility so that it is legible to persons outside the main entrance to the facility. The minimum dimensions of the board shall be 1200 mm by 750 mm.

- 3.2.2 The board shall clearly show:-
- a) the name and telephone number of the facility;
 - b) the normal hours of opening;
 - c) the name of the licence holder;
 - d) an emergency out of hours contact telephone number;
 - e) the licence reference number; and
 - f) where environmental information relating to the facility can be obtained.
- 3.3 The licensee shall install on all emission points such sampling points or equipment, including any data-logging or other electronic communication equipment, as may be required by the Agency. All such equipment shall be consistent with the safe operation of all sampling and monitoring systems.
- 3.4 Sampling equipment shall be operated and maintained such that sufficient sample is collected to meet both internal monitoring requirements and those of the Agency. A separate composite sample or homogeneous sub-sample (of sufficient volume as advised) should be retained as required for EPA use.
- 3.5 The licensee shall clearly label and provide safe and permanent access to all on-site sampling and monitoring points and to off-site points as required by the Agency.
- 3.6 Tank and Drum Storage Areas
- 3.6.1 All tank and drum storage areas shall be rendered impervious to the materials stored therein.
- 3.6.2 All tank and drum storage areas shall, as a minimum, be bunded, either locally or remotely, to a volume not less than the greater of the following:-
- (i) 110% of the capacity of the largest tank or drum within the bunded area; or
 - (ii) 25% of the total volume of substance which could be stored within the bunded area.
- 3.6.3 All drainage from bunded areas shall be diverted for collection and safe disposal.
- 3.6.4 All inlets, outlets, vent pipes, valves and gauges must be within the bunded area.
- 3.6.5 The integrity and water tightness of all the bunding structures and their resistance to penetration by water or other materials stored therein shall be tested and demonstrated by the licensee at least once every three years. This testing shall be carried out in accordance with any guidance published by the Agency.
- 3.7 The licensee shall have in storage an adequate supply of containment booms and/or suitable absorbent material to contain and absorb any spillage at the facility. Once used the absorbent material shall be disposed of at an appropriate facility.
- 3.8 The licensee shall install and maintain silt traps and oil separator at the facility to ensure that all storm water discharges from the facility pass through a silt trap and oil separator prior to discharge. The separator shall be a Class I full retention separator and the silt traps and separator shall be in accordance with I.S. EN 585-2:2003 (separator systems for light liquids).

- 3.9 All pump sumps, storage tanks, lagoons or other treatment plant chambers from which spillage of environmentally significant materials might occur in such quantities as are likely to breach local or remote containment or separator, shall be fitted with high liquid level alarms (or oil detectors as appropriate) within six months from the date of grant of this licence.
- 3.10 All wellheads, whose locations are shown on Map DLBH-04 of the licence application, shall be adequately protected to prevent contamination or physical damage.
- 3.11 The licensee shall, within three months of the date of grant of this licence, install or maintain in a prominent location on the site a wind sock, or other wind direction indicator, which shall be visible from the public roadway outside the facility.
- 3.12 Specified Engineering Works
- 3.12.1 The licensee shall submit proposals for any Specified Engineering Works, as defined in *Schedule E: Specified Engineering Works*, of this licence, to the Agency for its agreement at least two months prior to the intended date of commencement of any such works. No such works shall be carried out without the prior agreement of the Agency.
- 3.12.2 All specified engineering works shall be supervised by an appropriately qualified person, and that person, or persons, shall be present at all times during which relevant works are being undertaken.
- 3.12.3 Following the completion of any specified engineering works, the licensee shall complete a construction quality assurance validation. The validation report shall be made available to the Agency on request. The report shall, as appropriate, include the following information:-
- (a) A description of the works;
 - (b) As-built drawings of the works;
 - (c) Records and results of all tests carried out (including failures);
 - (d) Drawings and sections showing the location of all samples and tests carried out;
 - (e) Name(s) of contractor(s)/individual(s) responsible for undertaking the specified engineering works;
 - (f) Records of any problems and the remedial works carried out to resolve those problems; and
 - (g) Any other information requested in writing by the Agency.
- 3.13 Civic Waste Facility
- 3.13.1 The licensee shall establish and maintain the Civic Waste Facility infrastructure referred to in Drawing No. DLRA - 01.
- 3.13.2 The licensee shall provide and maintain appropriate receptacles at the Civic Waste Facility for the storage of various waste types.
- 3.13.3 The Civic Waste Facility shall be used only by private vehicles. The Civic Waste Facility shall not be used as a transfer station for disposal of waste by commercial waste disposal contractors or local authority waste collection vehicles.
- 3.13.4 All waste deposited in the Civic Waste Facility shall be either:-
- (a) into a skip;

- (b) into the hopper of the compactor for disposal;
 - (c) into a receptacle for recovery; or
 - (d) in the case where inspection is required, into a designated inspection area.
- 3.13.5 The licensee shall assign and clearly label each container/bay at the Civic Waste Facility to indicate their contents.
- 3.13.6 At the end of the working day the floor of the Civic Waste Facility, the hopper and the compactor shall be cleared of waste.
- 3.13.7 All waste accepted at the Civic Waste Facility for disposal shall be removed within 24 hours of its arrival on-site.
- 3.14 Transfer Station Building
 - 3.14.1 Appropriate infrastructure for the Transfer Station Building and the storage and transfer of waste shall be established and maintained at the facility prior to the handling of any waste. This infrastructure shall at a minimum comprise the following:
 - (a) A drainage infrastructure that can contain all possible contaminated run-off from the storage area;
 - (b) A dedicated area for quarantine of unacceptable wastes.
 - 3.14.2 The existing plastic drain pipes at the Transfer Station and Civic Waste Facility which drain to the leachate pond shall be disconnected and sealed.
 - 3.14.3 All biodegradable waste shall be removed from the Transfer Station Building, within 48 hours of its arrival.
 - 3.14.4 Following the completion of the Transfer Station Building, the licensee shall submit a construction quality assurance validation report to the Agency for its agreement.
- 3.15 Waste Inspection and Quarantine Areas
 - 3.15.1 A Waste Inspection Area and a Waste Quarantine Area shall be provided and maintained at the facility.
 - 3.15.2 These areas shall be constructed and maintained in a manner suitable, and be of a size appropriate, for the inspection of waste and subsequent quarantine if required. The waste inspection area and the waste quarantine area shall be clearly identified and segregated from each other.
 - 3.15.3 Drainage from the quarantine area shall be directed to the leachate management system.
- 3.16 The licensee shall provide and maintain a weighbridge at the facility.
- 3.17 Compost facility
 - 3.17.1 Appropriate infrastructure for the composting of waste shall be established and maintained at the facility prior to any waste being composted. This infrastructure shall at a minimum comprise the following:

- (a) The licensee shall maintain the enclosed biodegradable waste composting units and shall install biofilters and associated infrastructure at the facility, at a location to be agreed by the Agency within three months from the date of grant of this licence.
- (b) All wastewater from composting operations shall be collected and re-used in the composting process where possible. Any wastewater from the composting operations that is not re-used shall be either discharged to the leachate drainage system or tankered off-site for treatment at a location to be agreed in advance with the Agency.
- (c) To provide for aerobic composting (indoor or outdoor), the licensee shall provide the composting material with: a 5% minimum concentration of oxygen within the pore spaces, appropriate moisture levels, pH 6.0-9.0, appropriate C:N ratio.
- (d) Emissions from the biofilters shall not exceed those ELVs set out in *Schedule B: Emission Limits*, of this licence.

3.18 Landfill Gas Management

- 3.18.1 Infrastructure for the active collection and flaring of landfill gas shall be installed and commissioned at the facility from the date of grant of this licence. The flare shall be of an enclosed type design.
- 3.18.2 Until the operation of the landfill gas flare, passive landfill gas management at the facility shall be carried out. Landfill gas management and infrastructure shall meet the recommendations given in the Agency Manual on "Landfill Operational Practices". All vents installed to facilitate passive gas venting shall be fitted with an effective activated carbon filter.
- 3.18.3 All buildings constructed on the facility shall have regard to the guidance given in the Department of Environment 1994 publication "Protection of New Buildings and Occupants from Landfill Gas" and any subsequent revisions.

3.19 Leachate Management and Trade Effluent Infrastructure

- 3.19.1 The existing unlined leachate pond and associated leachate sump shall be decommissioned within one month of the date of grant of this licence.
- 3.19.2 Leachate management infrastructure at the landfill facility shall be installed and commissioned at the facility from the date of grant of this licence. The infrastructure shall provide for the abstraction of leachate from the waste, the collection of leachate in a leachate collection drain around the entire perimeter of the landfill, the collection of trade effluent from the composting area, CWF and Waste Transfer Station, leachate treatment at a suitable treatment works and the monitoring of the effectiveness of the leachate collection drain. The leachate collection drain shall be maintained in accordance with the details shown on Drawing No. Dun EIS-004 Rev.O dated March 1999 unless otherwise agreed in advance with or specified by the Agency.
- 3.19.3 The licensee shall provide and maintain a lined leachate storage lagoon at the facility to facilitate the storage of leachate abstracted/collected from the waste and closed landfill.
- 3.19.4 The lining system for the leachate storage lagoon shall comprise the following (or equivalent): a composite liner consisting of at minimum a basal soil/clay layer of at least 1m in thickness with a permeability of less

than 1×10^{-9} ms⁻¹ overlain by a 2mm thick high density polyethylene (HDPE) layer. The side walls shall be designed and constructed to achieve an equivalent protection.

3.20 Groundwater Management

Effective groundwater management infrastructure shall be provided and maintained at the facility during construction, operation, restoration and aftercare of the facility. As a minimum, the infrastructure shall protect the groundwater resources from contamination by the waste activities (including restoration of the facility) and the storage of leachate and contaminated surface water at the facility.

REASON: To provide for appropriate operation of the facility to ensure protection of the environment.

Condition 4. Interpretation

4.1 Emission limit values for emissions to atmosphere in this licence shall be interpreted in the following way:

4.1.1 Continuous Monitoring:

- (i) No 24 hour mean value shall exceed the emission limit value.
- (ii) 97% of all 30 minute mean values taken continuously over an annual period shall not exceed 1.2 times the emission limit value.
- (iii) No 30 minute mean value shall exceed twice the emission limit value.

4.1.2 For Non-Continuous Monitoring

- (i) For any parameter where, due to sampling/analytical limitations, a 30 minute sample is inappropriate, a suitable sampling period should be employed and the value obtained therein shall not exceed the emission limit value.
- (ii) For flow, no hourly or daily mean value, calculated on the basis of appropriate spot readings, shall exceed the relevant limit value.
- (iii) For all other parameters, no 30 minute mean value shall exceed the emission limit value.

4.2 The concentration and volume flow limits for emissions to atmosphere specified in this licence shall be achieved without the introduction of dilution air and shall be based on gas volumes under standard conditions of:-

4.2.1 In the case of landfill gas flare:

Temperature 273 K, pressure 101.3 kPa, dry gas at 3% oxygen; and,

4.2.2 In the case of landfill gas combustion plant:

Temperature 273 K, pressure 101.3 kPa, dry gas; 5% oxygen.

- 4.3 Emission limit values for emissions to sewer/waters in this licence shall be interpreted in the following way:-
- 4.3.1 Continuous monitoring:
- (i) No flow value shall exceed the specified limit.
 - (ii) No pH value shall deviate from the specified range.
 - (iii) No temperature value shall exceed the limit value.
- 4.3.2 Composite Sampling:
- (i) No pH value shall deviate from the specified range.
 - (ii) For parameters other than pH and flow, eight out of ten consecutive composite results, based on flow proportional composite sampling, shall not exceed the emission limit value. No individual result similarly calculated shall exceed 1.2 times the emission limit value.
- 4.3.3 Discrete Sampling
- For parameters other than pH and temperature, no grab sample value shall exceed 1.2 times the emission limit value.
- 4.4 Where the ability to measure a parameter is affected by mixing before emission, then, with agreement from the Agency, the parameter may be assessed before mixing takes place.
- 4.5 Noise
- 4.5.1 Noise from the facility shall not give rise to sound pressure levels (Leq,T) measured at the boundary of the facility which exceed the limit value(s).

Reason: To clarify the interpretation of emission limit values fixed under the licence.

Condition 5. Emissions

- 5.1 No specified emission from the facility shall exceed the emission limit values set out in *Schedule B: Emission Limits* of this licence. There shall be no other emissions of environmental significance.
- 5.2 The licensee shall ensure that the activities shall be carried out in a manner such that emissions including odours do not result in significant impairment of, and/or significant interference with amenities or the environment beyond the facility boundary.
- 5.3 No substance shall be discharged in a manner, or at a concentration which, following initial dilution, causes tainting of fish or shellfish.
- 5.4 The licensee shall ensure that vermin, birds, flies, mud, dust, litter and odours do not give rise to nuisance at the facility or in the immediate area of the facility. Any

method used by the licensee to control any such nuisance shall not cause environmental pollution.

5.5 Emissions to Surface Water

5.5.1 Unless otherwise agreed by the Agency no trade effluent or leachate shall be discharged to surface water drains and courses.

5.5.2 There shall be no direct emissions to groundwater.

Reason: To provide for the protection of the environment by way of control and limitation of emissions.

Condition 6. Control and Monitoring

6.1 The licensee shall carry out such sampling, analyses, measurements, examinations, maintenance and calibrations as set out below and as in accordance with *Schedule C: Control & Monitoring*, of this licence:

6.1.1 Analysis shall be undertaken by competent staff in accordance with documented operating procedures.

6.1.2 Such procedures shall be assessed for their suitability for the test matrix and performance characteristics determined.

6.1.3 Such procedures shall be subject to a programme of Analytical Quality Control using control standards with evaluation of test responses.

6.1.4 Where analysis is sub-contracted it shall be to a competent laboratory.

6.2 All automatic monitors and samplers shall be functioning at all times (except during maintenance and calibration) when the activity is being carried on unless alternative sampling or monitoring has been agreed in writing by the Agency for a limited period. In the event of the malfunction of any continuous monitor, the licensee shall contact the Agency as soon as practicable, and alternative sampling and monitoring facilities shall be put in place. Agreement for the use of alternative equipment, other than in emergency situations, shall be obtained from the Agency.

6.3 Monitoring and analysis equipment shall be operated and maintained as necessary so that monitoring accurately reflects the emission or discharge.

6.4 All treatment/abatement and emission control equipment shall be calibrated and maintained, in accordance with the instructions issued by the manufacturer/supplier or installer.

6.5 The frequency, methods and scope of monitoring, sampling and analyses, as set out in this licence, may be amended with the agreement of the Agency following evaluation of test results.

6.6 The licensee shall prepare a programme, to the satisfaction of the Agency, for the identification and reduction of fugitive emissions. This programme shall be included in the Environmental Management Programme.

- 6.7 The integrity and water tightness of all underground pipes and tanks and their resistance to penetration by water or other materials carried or stored therein shall be tested and demonstrated by the licensee. This testing shall be carried out by the licensee at least once every three years thereafter and reported to the Agency on each occasion. A written record of all integrity tests and any maintenance or remedial work arising from them shall be maintained by the licensee.
- 6.8 Storm water
- 6.8.1 A visual examination of the storm water discharge from the final interceptor chamber shall be carried out daily. A log of such inspections shall be maintained.
- 6.8.2 The drainage system, bunds, silt traps and oil separators shall be inspected weekly, desludged as necessary and properly maintained at all times. All sludge and drainage from these operations shall be collected for safe disposal.
- 6.9 The licensee shall carry out a noise survey of the site operations annually. The survey programme shall be undertaken in accordance with the methodology specified in the 'Environmental Noise Survey Guidance Document' as published by the Agency.
- 6.10 The licensee shall prepare and maintain a PER for the site. The substances to be included in the PER shall be agreed by the Agency each year by reference to the list specified in the Agency's AER Guidance Note. The PER shall be prepared in accordance with any relevant guidelines issued by the Agency and shall be submitted as part of the AER.
- 6.11 Within nine months of the date of grant of this licence a continuous monitoring system shall be installed and maintained at the facility. All facility operations linked to the telemetry system shall also have a manual control which will be reverted to in the event of break in power supply or during maintenance. As a minimum the system shall record and relay the following information:
- (a) temperature and oxygen content of the compost at all stages during its production.

Reason: To provide for the protection of the environment by way of treatment and monitoring of emissions.

Condition 7. Resource Use and Energy Efficiency

- 7.1 The licensee shall carry out an audit of the energy efficiency of the site within one year of the date of grant of this licence. The audit shall be carried out in accordance with the guidance published by the Agency; "Guidance Note on Energy Efficiency Auditing". The energy efficiency audit shall be repeated at intervals as required by the Agency.
- 7.2 The audit shall identify all opportunities for energy use reduction and efficiency and the recommendations of the audit will be incorporated into the Schedule of Environmental Objectives and Targets of the AER.
- 7.3 The licensee shall identify opportunities for reduction in the quantity of water used on site including recycling and reuse initiatives, wherever possible. Reductions in

water usage shall be incorporated into the Schedule of Environmental Objectives and Targets.

- 7.4 The licensee shall undertake an assessment of the efficiency of use of raw materials in all processes, having particular regard to the reduction in waste generated. The assessment should take account of best international practice for this type of activity. Where improvements are identified, these shall be incorporated into the Schedule of Environmental Objectives and Targets.

Reason: To provide for the efficient use of resources and energy in all site operations.

Condition 8. Materials Handling

- 8.1 Disposal or recovery of waste shall only take place in accordance with the conditions of this licence and in accordance with the appropriate National and European legislation and protocols.
- 8.2 Waste sent off-site for recovery or disposal shall be transported only by an authorised waste contractor. The waste shall be transported only from the site of the activity to an approved site of recovery/disposal in a manner which will not adversely affect the environment and in accordance with the appropriate National and European legislation and protocols.
- 8.3 The licensee shall ensure that waste prior to transfer to another person shall be classified packaged and labelled in accordance with National, European and any other standards which are in force in relation to such labelling.
- 8.4 Waste shall be stored in designated areas, protected as may be appropriate, against spillage and leachate run-off. The waste is to be clearly labelled and appropriately segregated.
- 8.5 No waste classified as green list waste in accordance with the EU Transfrontier Shipment of Waste Regulations (Council Regulation EEC No.259/1993, as amended) shall be consigned for recovery without the agreement of the Agency.
- 8.6 Unless approved in writing by the Agency the licensee is prohibited from mixing a hazardous waste of one category with a hazardous waste of another category or with any other non-hazardous waste.
- 8.7 All waste processing for disposal shall be carried out inside the waste transfer building.
- 8.8 Waste Acceptance and Characterisation Procedures at the Landfill and Transfer Station.
- 8.8.1 Waste shall only be accepted, from Local Authority waste collection or transport vehicles or holders of waste permits, unless exempted or excluded, issued under the Waste Management (Collection Permit) Regulations 2001.

- 8.8.2 No hazardous wastes (other than as may be permitted under Condition 8.4) or liquid wastes shall be disposed of at the facility.
- 8.8.3 Inert waste accepted at the facility shall comply with the standards established in the EU Decision (2003/33/EC). The licensee shall ensure that inert waste accepted at the facility is subject to treatment where technically feasible.
- 8.8.4 Waste arriving at the facility shall be inspected at the point of entry to the facility and subject to this inspection, weighed, documented and directed to the Waste Transfer Building. Each load of waste arriving at the Waste Transfer Building shall be inspected upon tipping within this building. Only after such inspections shall the waste be processed for disposal or recovery.
- 8.8.5 Any waste deemed unsuitable for processing at the facility and/or in contravention of this licence shall be immediately separated and removed from the facility at the earliest possible time. Temporary storage of such wastes shall be in a designated Waste Quarantine Area. Waste shall be stored under appropriate conditions in the quarantine area to avoid putrefaction, odour generation, the attraction of vermin and any other nuisance or objectionable condition.
- 8.8.6 A record of all inspections of incoming waste loads shall be maintained.
- 8.8.7 Waste shall be accepted at the facility only from known customers or new customers subject to initial waste profiling and waste characterisation off-site. There shall be no casual public access to the facility.
- 8.9 Compost
- 8.9.1 The licensee shall operate a trial composting scheme for a period of twelve months at the existing composting unit and shall not process greater than 1,000 tonnes of waste during the period of the trial. Upon completion of the trial scheme, the licensee shall submit a report to the Agency on the outcome of the trial. The report shall include as a minimum the scope of the trial, location, throughput, and the composting system employed.
- 8.9.2 Following the trial period the licensee shall recommence the acceptance of biowaste at the composting facility without the prior written agreement of the Agency. Written records of the quantities and type of wastes composted must be maintained.
- 8.9.3 Unless otherwise agreed with the Agency, only source separated organic waste and green waste shall be used in the operation of the waste composting facility.
- 8.9.4 All Category 3 animal by-product waste accepted at the facility for treatment shall be treated in accordance with the requirements of the *'European Parliament and Council Regulation No 1774/2002 laying down health rules concerning animal by-products not intended for human consumption'* and associated National Legislation.
- 8.9.5 The bulking agent to facilitate the composting process shall be bark mulch or other such similar bulking material agreed in advance with the Agency.

- 8.9.6 All putrescible wastes accepted to the composting unit shall be introduced into the compost process within 24 hours of delivery.
- 8.9.7 All waste water and contaminated surface water/run-off from composting operations shall be diverted to the leachate management system.
- 8.9.8 Procedures for the operation of the wood chipper shall be submitted to the Agency for agreement prior to the commencement of any wood chipping.
- 8.10 Compost Quality
- 8.10.1 Compost quality monitoring shall be undertaken as set out in *Schedule F: Standards for Compost Quality*, of this licence.
- 8.10.2 Any compost not meeting any standard as per *Schedule F: Standards for Compost Quality*, of this licence may be reused in the process or handled as a waste and details recorded as per Waste Records condition.

Reason: To provide for the appropriate handling of materials and the protection of the environment.

Condition 9. Accident Prevention and Emergency Response

- 9.1 The licensee shall ensure that a documented Accident Prevention Policy is in place which will address the hazards on-site, particularly in relation to the prevention of accidents with a possible impact on the environment. This procedure shall be reviewed annually and updated as necessary.
- 9.2 The licensee shall ensure that a documented Emergency Response Procedure is in place, which shall address any emergency situation which may originate on-site. This Procedure shall include provision for minimising the effects of any emergency on the environment. This procedure shall be reviewed annually and updated as necessary.
- 9.3 In the event of an incident the licensee shall immediately:-
- (i) isolate the source of any such emission;
 - (ii) carry out an immediate investigation to identify the nature, source and cause of the incident and any emission arising therefrom;
 - (iii) evaluate the environmental pollution, if any, caused by the incident;
 - (iv) identify and execute measures to minimise the emissions/malfunction and the effects thereof;
 - (v) identify the date, time and place of the incident;
 - (vi) provide a proposal to the Agency for its agreement within one month of the incident occurring or as otherwise agreed with the Agency to:-

- identify and put in place measures to avoid reoccurrence of the incident; and
- identify and put in place any other appropriate remedial action.

Reason: To provide for the protection of the environment.

Condition 10. Closure, Restoration and Aftercare

- 10.1 Unless otherwise agreed, the landfill shall be permanently capped by 31 December 2005.
- 10.2 Landscaping
- 10.2.1 Landscaping of the facility as described in the application documentation.
- 10.2.2 Unless otherwise agreed by the Agency, the finished (post settlement restored) levels of the landfill shall be 15m O.D Malin Head.
- 10.2.3 Completed areas of the landfill shall be profiled so that no depressions exist in which water may accumulate. Any depressions arising after profiling shall be rectified by the emplacement of suitable capping or restoration materials.
- 10.3 Final Capping
- (i) Unless otherwise agreed by the Agency, the final capping shall consist of the following:-
- (ii) Top soil (150 -300mm);
- (iii) Subsoils, such that total thickness of top soil and subsoils is at least 1m;
- (iv) Drainage layer of 0.5m thickness having a minimum hydraulic conductivity of 1×10^{-4} m/s or a geosynthetic material that provides equivalent transmissivity;
- (v) Compacted mineral layer of a minimum 0.6m thickness with a permeability of less than 1×10^{-9} m/s or a geosynthetic material (e.g. GCL) or similar that provides equivalent protection; and
- (vi) Gas collection layer of natural material (minimum 0.3m) or a geosynthetic layer.
- 10.4 No material or object that is incompatible with the proposed restoration of the facility shall be present within one metre of the final soil surface levels.
- 10.5 All soils shall be stored to preserve the soil structure for future use.
- 10.6 Closure, Restoration & Aftercare Management Plan (CRAMP):

- 10.6.1 The licensee shall prepare for agreement by the Agency, a fully detailed and costed plan for the closure, restoration and long-term aftercare of the site or part thereof.
- 10.6.2 The plan shall be maintained and 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 written agreement of the Agency.
- 10.7 The CRAMP shall include as a minimum, the following:-
- 10.7.1 A scope statement for the plan.
- 10.7.2 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.
- 10.7.3 A programme to achieve the stated criteria.
- 10.7.4 Where relevant, a test programme to demonstrate the successful implementation of the plan.
- 10.7.5 Details of the long-term supervision, monitoring, control, maintenance and reporting requirements for the restored facility.
- 10.7.6 Details of costings for the plan and the financial provisions that will underwrite these costs.
- 10.8 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.

Reason: To make provision for the proper closure of the activity ensuring protection of the environment.

Condition 11. Notifications, Records and Reports

- 11.1 The licensee shall notify the Agency by both telephone and either facsimile or electronic mail, if available, to the Agency's Headquarters in Wexford, or to such other Agency office as may be specified by the Agency, as soon as practicable after the occurrence of any of the following:
- 11.1.1 Any release of environmental significance to atmosphere from any potential emission point including bypasses.
- 11.1.2 Any emission which does not comply with the requirements of this licence.
- 11.1.3 Any malfunction or breakdown of key control equipment or monitoring equipment set out in *Schedule C: Control & Monitoring*, of this licence which is likely to lead to loss of control of the abatement system.

11.1.4 Any incident with the potential for environmental contamination of surface water or groundwater, or posing an environmental threat to air or land, or requiring an emergency response by the Local Authority.

The licensee shall include as part of the notification, date and time of the incident, summary details of the occurrence, and where available, the steps taken to minimise any emissions.

- 11.2 In the case of any incident which relates to discharges to water, the licensee shall notify the Local Authority and the Southern Regional Fisheries Board as soon as practicable after such an incident.
- 11.3 The licensee shall make a record of any incident. This record shall include details of the nature, extent, and impact of, and circumstances giving rise to, the incident. The record shall include all corrective actions taken to; manage the incident, minimise wastes generated and the effect on the environment, and avoid recurrence. The licensee shall as soon as practicable following incident notification, submit to the Agency the incident record.
- 11.4 The licensee shall record all complaints of an environmental nature related to the operation of the activity. Each such record shall give details of the date and time of the complaint, the name of the complainant and give details of the nature of the complaint. A record shall also be kept of the response made in the case of each complaint.
- 11.5 The licensee shall record all sampling, analyses, measurements, examinations, calibrations and maintenance carried out in accordance with the requirements of this licence and all other such monitoring which relates to the environmental performance of the facility.
- 11.6 The licensee shall as a minimum keep the following documents at the facility:-
- (i) the licences relating to the facility;
 - (ii) the current EMS for the facility;
 - (iii) the previous year's AER for the facility;
 - (iv) records of all sampling, analyses, measurements, examinations, calibrations and maintenance carried out in accordance with the requirements of this licence and all other such monitoring which relates to the environmental performance of the facility;
 - (v) relevant correspondence with the Agency;
 - (vi) an up to date site drawings/plans showing the location of key process and environmental infrastructure, including monitoring locations and emission points

and this documentation shall be available to the Agency for inspection at all reasonable times.

- 11.7 The licensee shall submit to the Agency, by the 31st March of each year, an AER covering the previous calendar year. This report, which shall be to the satisfaction of the Agency, shall include as a minimum the information specified in *Schedule D: Annual Environmental Report*, of this licence and shall be prepared in accordance with any relevant guidelines issued by the Agency.

- 11.8 A full record, which shall be open to inspection by authorised persons of the Agency at all times, shall be kept by the licensee on matters relating to the waste management operations and practices at this site. This record shall be maintained on a monthly basis and shall as a minimum contain details of the following:
- 11.8.1 The tonnages and EWC Code for the waste materials imported and/or sent off-site for disposal/recovery.
 - 11.8.2 The names of the agent and carrier of the waste, and their waste collection permit details, if required (to include issuing authority and vehicle registration number).
 - 11.8.3 Details of the ultimate disposal/recovery destination facility for the waste and its appropriateness to accept the consigned waste stream, to include its permit/licence details and issuing authority, if required.
 - 11.8.4 Written confirmation of the acceptance and disposal/recovery of any hazardous waste consignments sent off-site.
 - 11.8.5 Details of all wastes consigned abroad for Recovery and classified as 'Green' in accordance with the EU Transfrontier Shipment of Waste Regulations (Council Regulation EEC No. 259/1993, as amended). The rationale for the classification must form part of the record.
 - 11.8.6 Details of any rejected consignments.
 - 11.8.7 Details of any approved waste mixing.
 - 11.8.8 The results of any waste analyses required under *Schedule C: Control & Monitoring*, of this licence.
 - 11.8.9 The tonnages and EWC Code for the waste materials recovered/disposed on-site.
- 11.9 A record shall be kept of each consignment of trade effluent, leachate and/or contaminated storm water removed from the facility. The record shall include the following:-
- a) the name of the carrier;
 - b) the date and time of removal of trade effluent, leachate and/or contaminated storm water from the facility;
 - c) the volume of trade effluent, leachate and/or contaminated storm water, in cubic metres, removed from the facility on each occasion;
 - d) the name and address of the Waste Water Treatment Plant to which the trade effluent, leachate and/or contaminated storm water was transported; and
 - e) any incidents or spillages of trade effluent, leachate and/or contaminated storm water during its removal or transportation.
- 11.10 Where compost product contains sewage sludge the licensee shall retain the following records on site:
- a) A copy of the notifications to the Local Authority as required under Article 8(1) and Article 8(3) of SI 148 of 1998 (Waste Management (Use of sewage sludge in agriculture) Regulations, 1998).

- b) This shall include inter alia; sludge analysis, records of sludge quantities, sludge properties, treatment type and location/name of the recipient of the sludge (sludge meaning compost containing treated sludge).

Reason: To provide for the collection and reporting of adequate information on the activity.

Condition 12. Financial Charges and Provisions

12.1 Agency Charges

12.1.1 The licensee shall pay to the Agency an annual contribution of €16,948 or such sum as the Agency from time to time determines, having regard to variations in the extent of reporting, auditing, inspection, sampling and analysis or other functions carried out by the Agency, towards the cost of monitoring the activity as the Agency considers necessary for the performance of its functions under the Waste Management Acts 1996 to 2003. The first payment shall be a pro-rata amount for the period from the date of this licence to the 31st day of December, and shall be paid to the Agency within one month from the date of the licence. In subsequent years the licensee shall pay to the Agency such revised annual contribution as the Agency shall from time to time consider necessary to enable performance by the Agency of its relevant functions under the Waste Management Acts 1996 to 2003, and all such payments shall be made within one month of the date upon which demanded by the Agency.

12.1.2 The licensee shall as part of the AER provide an annual statement as to the measures taken or adopted at the site in relation to the prevention of environmental damage, and the financial provisions in place in relation to the underwriting of costs for remedial actions following anticipated events or accidents/incidents, as may be associated with the carrying on of an activity.

Reason: To provide for adequate financing for monitoring and financial provisions for measures to protect the environment.

SCHEDULE A: Limitations

A.1

The following waste related processes are authorised:

- i. Composting
- ii. C & D waste recovery (incl. crushing, screening, sorting, blending)
- iii. Use of compost & inert waste in landfill operation
- iv. Storage of waste subject to Condition 3.1
- v. Recovery of dry recyclables at the Civic Waste Facility

No addition to these processes are permitted unless agreed in advance with the Agency.



A.2 Waste Acceptance

A.2 Waste Categories and Quantities

WASTE TYPE ^{Note 2, Note 4}	MAXIMUM (TONNES PER ANNUM) ^{Note 3}
Municipal Waste	10,000
Hazardous Municipal Waste (separately collected fractions including white goods WEEE): 20 01 21* 20 01 23* 20 01 33* 20 01 35* 20 01 36 20 01 37*	400
Inert Waste	See ^{Note 1}
Garden Waste	1,120
Total	11,520

Note 1: Volume of inert waste for recovery and landfill restoration works cannot exceed 20,000T during lifetime of the licence, unless otherwise agreed by the Agency. Inert waste accepted at the facility shall comply with the standards established in the EU Decision (2003/33/EC).

Note 2: 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.

Note 3: The individual limitation on waste streams may be varied with the agreement of the Agency subject to the overall total limit staying the same.

Note 4: Unless otherwise agreed by the Agency, only the wastes as listed under Annex 1 of the EC Working Document 'Biological Treatment of Biowaste' (2nd draft) or subsequent amendments shall be accepted at the facility for the production of compost.



SCHEDULE B: Emission Limits

B.1 Emissions to Air

Landfill Derived Gas Concentration Limits:

(Measured in any building on or adjacent to the facility and perimeter boreholes).

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



Emission Limits Values for Landfill Gas Plant:

Emission Point Reference numbers: (To be agreed by Agency in advance.)

Minimum discharge height: 5m

Parameter	Flare (enclosed) Emission Limit Value ^{Note 1}	Utilisation Plant Emission Limit Value ^{Note 1}
Nitrogen oxides (NO _x)	150 mg/m ³	500 mg/m ³
Carbon monoxide (CO)	50 mg/m ³	1400 mg/m ³
VOC (asC)	10 mg/m ³	1000 mg/m ³
Non-methane VOC	5 mg/m ³	75 mg/m ³

Note 1: Dry gas referenced to 5% oxygen by volume for utilisation plants and 3% oxygen by volume for flares.



Dust Deposition Limits:

Measured at the three monitoring points as agreed by the Agency

Level (mg/m ² /day) ^{Note 1}
350

Note 1: 30 day composite sample with the results expressed as mg/m² /day.



Emission Limit Values from Biodegradable Waste Composting

Emission Point Reference Number: Emission point from Biodegradable Waste Composting Unit, to be agreed in advance with the Agency.

Parameter	Emission Limit Value
Total Particulates	50 mg/m ³
Ammonia	50 (ppm v/v)
Amines	5 (ppm v/v)
Hydrogen Sulphide & Mercaptans	5 (ppm v/v)



B.2 Emissions to Water

There are no Emissions to Water of environmental significance.

**B.3 Emissions Limits for Treated Leachate Discharged to Surface Water**

To be agreed by the Agency in advance

**B4. Noise Emissions**

Daytime dB(A) $L_{Aeq}(30 \text{ minutes})$	Night-time dB(A) $L_{Aeq}(30 \text{ minutes})$
55 ^{Note 1}	45 ^{Note 1}

Note 1: There shall be no clearly audible tonal component or impulsive component in the noise emission from the activity at any noise sensitive location.



SCHEDULE C: Control & Monitoring

C.1.1 Control of Emissions to Air

Emission Point Reference No.: Flare Stacks & Generation Plant

Description of Treatment: Gas Extraction & Combustion

Control Parameter	Monitoring	Key Equipment ^{Note 1}
Continuous burn	Continuous with alarm/call-out	Flame detector or equivalent approved Pumps/engines
Extraction	Continuous with alarm/call-out	Pressure gauge or equivalent approved Pumps/engines

Note 1: The licensee shall maintain appropriate access to standby and/or spares to ensure the operation of the abatement system.

Emission Point Reference No.: Emission point from Biodegradable Waste Composting Unit, to be agreed in advance by the Agency.

Description of Treatment: To be agreed in advance by the Agency.

Control Parameter	Monitoring	Key Equipment ^{Note 1}
Extraction	Continuous with alarm/call-out	Pressure gauge or equivalent approved Pumps/engines
Aeration	Continuous	Oxygen probe
Temperature control of compost	Continuous	Temperature probe

Note 1: The licensee shall maintain appropriate access to standby and/or spares to ensure the operation of the abatement system.



C.1.2 Monitoring of Emissions to Air

Emission Point Reference
No.:

Flare Stacks & Generation Plant

Parameter	Flare (enclosed) Monitoring Frequency	Utilisation Plant Monitoring Frequency	Analysis Method ^{Note 1} /Technique
Inlet			
Methane (CH ₄) % v/v	Continuous	Weekly	Infrared analyser or equivalent approved
Carbon dioxide (CO ₂) % v/v	Continuous	Weekly	Infrared analyser or equivalent approved
Oxygen (O ₂) % v/v	Continuous	Weekly	Electrochemical or equivalent approved
Process Parameters			
Combustion Temperature	Continuous	Quarterly	Temperature Probe/datalogger
Residence Time	Quarterly	Quarterly	To be agreed.
Outlet			
Carbon monoxide (CO)	Continuous	Continuous	Flue gas analyser/datalogger or equivalent approved
Nitrogen Oxides (Nox)	Biannually	Biannually	Flue gas analyser or equivalent approved
Sulphur dioxide (SO ₂)	Biannually	Biannually	Flue gas analyser or equivalent approved
Particulates	Not applicable	Annually	Isokinetic/Gravimetric or equivalent approved

Note 1: All monitoring equipment used should be intrinsically safe.



C.1.3 Monitoring of Landfill Gas Emissions

Location: Perimeter Landfill Gas boreholes and other selected locations as may be specified^{Note 1}

Parameter	Monitoring Frequency	Analysis Method/Technique ^{Note 2}
Methane (CH₄)	Monthly	InfraRed Analyser/FID
Carbon Dioxide (CO₂)		InfraRed
Oxygen (O₂)		Electrochemical Cell
Atmospheric pressure & Trend		Standard method

Note 1: All perimeter monitoring boreholes must be installed to the standards specified in the Agency Guidance on Landfill Monitoring.

Note 2: Or other method agreed.

C.1.4 Monitoring of Composting Emissions

Parameter ^{Note 1}	Monitoring Frequency	Analysis Method/Technique
Dust (mg/m ² /day)	Quarterly ^{Note 2}	Standard Method ^{Note 3}
Odour	Quarterly ^{Note 5}	See ^{Note 4}
Bacteria	Bi-annually	Grab sample ^{Note 5}
Aspergillus fumigatus	Annually	Grab sample ^{Note 5}

Note 1: Meteorological monitoring to be carried out concurrently with all above monitoring.

Note 2: Twice during the period May to September, or as otherwise specified in writing by the Agency.

Note 3: Standard method VDI2119 (Measurement of Dustfall, Determination of Dustfall using Bergerhoff Instrument (Standard Method) German Engineering Institute).

Note 4: Odour measurements shall be by olfactometric measurement and analysis for mercaptans, hydrogen sulphide, ammonia, amines as set out in Table F.4.3.

Note 5: Enumeration of colonies to be carried out as described in 'Standardised Protocol for the Sampling and Enumeration of Airborn Micro-organisms at composting Facilities' the Composting Association 1999.

C1.5 Monitoring of Composting Emissions at Bio-filters

Emission Point Reference No.: To be agreed in advance by the Agency

Parameter	Monitoring Frequency	Analysis Method/Technique ^{Note 1}
Bed Media		
Odour assessment ^{Note 2}	Daily	Subjective Inspection
Condition and depth of biofilter ^{Note 3}	Daily	Visual Inspection
Moisture content	Bi-annually	Standard laboratory method
pH	Bi-annually	pH probe
Ammonia	Bi-annually	Standard laboratory method
Total viable counts	Bi-annually	Standard laboratory method
Inlet and Outlet Gas		
Ammonia	Bi-annually	Colourimetric Indicator Tubes
Hydrogen sulphide	Bi-annually	Colourimetric Indicator Tubes
Mercaptans	Bi-annually	Colourimetric Indicator Tubes

Note 1: All analyses shall be carried out by a competent laboratory using standard and internationally acceptable techniques. The testing laboratory and the testing technique shall be agreed by the Agency in advance.

Note 2: This subjective assessment should be carried out by a staff member immediately upon arriving on-site.

Note 3: The biofilter shall be examined to ensure that no channelling is evident, and that moisture content is adequate. Watering, turning, restructuring and the addition of supplementary bed materials, or total bed replacement shall be carried out, as required, subject to bed performance.



C.2.1 Control of Emissions to Water**Emission Control Location:** Interceptor**Description of Treatment:** Tank and Gates

Control Parameter	Monitoring	Key Equipment ^{Note 1}
Residence time & Flow restriction	Flow rate, depth	Flow meter, overflow alarm, emergency storage

Note 1: The licensee shall maintain appropriate access to standby and/or spares to ensure the operation of the abatement system.

C.2.2 Monitoring of Storm Water Emissions**Emission Point Reference No.:** Last Chamber of Interceptor

Parameter	Monitoring Frequency	Analysis Method/Technique
Biochemical Oxygen Demand	Monthly	Standard Method
Oils, fats & greases/Mineral Oils	Monthly	Standard Method
Suspended Solids	Monthly	Standard Method
Toxicity ^{Note 1}	As may be required	To be agreed by the Agency
Visual Inspection	Weekly	Sample and examine for colour and odour

Note 1: The number of toxic units (Tu) = 100/x hour EC/LC₅₀ in percentage vol/vol so that higher Tu values reflect greater levels of toxicity. For test regimes where species death is not easily detected, immobilisation is considered equivalent to death.

C2.3 Leachate Monitoring

Location: Leachate Holding Tank, Leachate Sumps and Leachate Monitoring Points in the Cells.

PARAMETER ^{Note 1}	LEACHATE ^{Note 2} Monitoring Frequency
Visual Inspection/Odour	Daily
Leachate Level	Weekly
BOD	Quarterly
COD	Quarterly
Chloride	Annually
Ammoniacal Nitrogen	Annually
Electrical Conductivity	Annually
Ph	Annually
Metals / non metals ^{Note 3}	Annually
Cyanide (Total)	Annually
Fluoride	Annually
List I/II organic substances ^{Note 4}	Annually
Mercury	Annually
Sulphate	Annually
Total P/orthophosphate	Annually
Total Oxidised Nitrogen	Annually

Note 1: All the analysis shall be carried out by a competent laboratory using standard and internationally accepted procedures.

Note 2: Visual Inspection and Leachate Levels to be monitored at all leachate monitoring points in the cells, collection sumps and holding tank. Leachate composition to be monitored at the leachate holding tank.

Note 3: Metals and elements to be analysed by AA/ICP should include as a minimum: boron, cadmium, calcium, chromium (total), copper, iron, lead, magnesium, manganese, nickel, potassium, sodium and zinc.

Note 4: Samples screened for the presence of organic compounds using Gas Chromatography / Mass Spectrometry (GC/MS) or other appropriate techniques and using the list I/II Substances from EU Directive 76/464/EEC and 80/68/EEC as a guideline. Recommended analytical techniques include: volatiles (US Environmental Protection Agency method 524 or equivalent), semi-volatiles (USEPA method 525 or equivalent, and pesticides (USEPA method 608 or equivalent).

C.3.1 Control of Emissions to Sewer

There are no Process Effluent Emissions to Sewer.

C.3.2 Monitoring of Emissions to Sewer

There are no Process Effluent Emissions to Sewer.

C.4 Waste Monitoring

Not applicable

C.5 Noise Monitoring

There is no additional noise monitoring required in this schedule.



C.6 Ambient Monitoring

Groundwater Monitoring

Location: Groundwater Wells BHG04E; BHG04D; BHG04G; BHG04B; GW 2A; RC6A; RC3; and RC4, as specified in Drawing No. DLBH-04

Parameter ^{Note 1}	GROUNDWATER Monitoring Frequency
Visual Inspection/Odour ^{Note 2}	Quarterly
Groundwater Level	Monthly
Ammoniacal Nitrogen	Quarterly
Chloride	Quarterly
Dissolved Oxygen	Annually
Electrical Conductivity	Quarterly
pH	Quarterly
Temperature	Quarterly
Cadmium	Annually
Chromium (Total)	Annually
Copper	Annually
Cyanide (Total)	Annually
Iron	Quarterly
Lead	Annually
List I/II organic substances ^{Note 3}	Annually
Magnesium	Annually
Manganese	Annually
Mercury	Annually
Nickel	Annually
Potassium	Annually
Sulphate	Annually
Total Alkalinity	Annually
Total Phosphorus / orthophosphate	Annually
Total Oxidised Nitrogen	Quarterly
Zinc	Annually
Phenols	Annually

Note 1: All the analysis shall be carried out by a competent laboratory using standard and internationally accepted procedures.

Note 2: Where there is evident gross contamination of leachate, additional samples should be analysed.

Note 3: Samples screened for the presence of organic compounds using Gas Chromatography / Mass Spectrometry (GC/MS) or other appropriate techniques and using the list I/II Substances from EU Directive 76/464/EEC and 80/68/EEC as a guideline. Recommended analytical techniques include: volatiles (US Environmental Protection Agency method 524 or equivalent), semi-volatiles (US Environmental Protection Agency method 525 or equivalent), and pesticides (US Environmental Protection Agency method 608 or equivalent).

Receiving Water Monitoring**Location:** SW1, SW2, and SW4 in Drawing Ref: Drawing No. DLBH-04

Parameter	Monitoring Frequency	Analysis Method/Technique
Biological Quality (Q) Rating/Q Index	Annually ^{Note 1}	To be agreed with the Agency
Parameters in Table C2.2	Visual Inspection Weekly All others Quarterly unless specified as Annually in Table C2.2	Standard Methods

Note 1: Monitoring period - June to September.**Meteorological Monitoring****Location:** At the facility at a location to be agreed, or from an agreed representative station in the region.

Parameter	Monitoring Frequency	Analysis Method/Technique
Precipitation Volume	Daily	Standard
Temperature (min/max.)	Daily	Standard
Wind Direction	Daily	Standard
Wind Force ^{Note 1}	Daily	Standard
Atmospheric Pressure ^{Note 1}	Daily	Standard

Note 1: Monitoring frequency for these parameters may be decreased with the agreement of the Agency.

SCHEDULE D: Annual Environmental Report

Annual Environmental Report Content ^{Note 1}

<p>Summary of emissions from the installation/facility.</p> <p>Waste management record.</p> <p>Waste (sludge) analysis.</p> <p>Waste Recovery Report.</p> <p>Topographical survey.</p> <p>Remaining void, projected completion date.</p> <p>Resource consumption summary.</p> <p>Complaints summary.</p> <p>Schedule of Environmental Objectives and Targets.</p> <p>Environmental management programme – report for previous year.</p> <p>Environmental management programme – proposal for current year.</p> <p>Pollution emission register – report for previous year.</p> <p>Pollution emission register – proposal for current year.</p> <p>Noise monitoring report summary.</p> <p>Meteorological data summary.</p> <p>Ambient monitoring summary.</p> <p>Current monitoring location reference drawing.</p> <p>Tank and pipeline testing and inspection report.</p> <p>Reported incidents summary.</p> <p>Energy efficiency audit report summary.</p> <p>Report on progress made and proposals being developed to minimise generation of leachate for disposal.</p> <p>Development / Infrastructural works summary (completed in previous year or prepared for current year).</p> <p>Report on management and staffing structure of the installation/facility.</p> <p>Report on the programme for public information.</p> <p>Reports on financial provision made under this licence.</p> <p>Statement on the costs of Landfill.</p> <p>Review of Environmental Liabilities.</p> <p>Statement of financial provisions in relation to prevention of environmental damage and remedial actions (Environmental Liabilities).</p> <p>Any amendments to the CRAMP.</p> <p>Detailed Statement, with mass balance, of C & D wastes and compost used in construction.</p> <p>Any other items specified by the Agency.</p>

Note 1: Content may be revised subject to the agreement of the Agency

SCHEDULE E: Specified Engineering Works

Specified Engineering Works

Development of the Transfer Station including BAT upgrade works.

Final capping.

Installation of Landfill Gas Management Infrastructure.

Installation of Leachate Management Infrastructure.

Installation of Groundwater Control Infrastructure.

Installation of Surface Water Management Infrastructure.

Any other works notified in writing by the Agency.



SCHEDULE F: Standards for Compost Quality

The following criteria are deemed a quality standard for the use of compost as a soil improver and should not be deemed as criteria for fertiliser. In addition N, P, K, NH₄-N, NO₃-N, pH and dry matter content should also be measured. Use of compost is subject to the “European Parliament and Council Regulation No. 1774/2002 laying down health rules concerning animal by-products not intended for human consumption and associated National Legislation.

Compost shall be deemed unsatisfactory if more than 10% of samples fail the criteria below. No sample shall exceed 1.2 times the quality limit values set.

1. Maturity

Compost shall be deemed to be mature if it meets two of the following requirements:

- C/N ratio ≤ 25;
- oxygen uptake rate ≤ 150 mg O₂/kg volatile solids per hour;
- germination of cress (*Lepidium sativum*) seeds and of radish (*Raphanus sativus*) seeds in compost must be greater than 90 percent of the germination rate of the control sample, and the growth rate of plants grown in a mixture of compost and soil must not differ more than 50 percent in comparison with the control sample; and
- Elimination of the following test organisms (used to evaluate composting system efficiency in removing plant pathogens and weed seeds during the composting process): *Plasmodiophora brassicae*, tobacco-mosaic-virus (TMV) and tomato seeds.

Guidance on test may be obtained from the German document LAGA M10 ‘Quality Criteria and Application Recommendations for Compost’.

2. Foreign Matter

Compost must not contain any sharp foreign matter measuring over a 2 mm dimension that may cause damage or injury to humans, animals and plants during or resulting from its intended use.

Foreign matter content as a percentage of oven-dried mass	≤1.5%
Foreign matter, maximum dimensions, in mm	25 mm

3. Trace Elements

Maximum Trace Element Concentration Limits for Compost^{Note 2}

Trace Elements	(mg/kg, dry mass)
Arsenic (As) ^{Note 1}	15
Cadmium (Cd)	1.5
Chromium (Cr)	100
Copper (Cu)	100
Mercury (Hg)	1
Molybdenum (Mo) ^{Note 1}	5
Nickel (Ni)	50
Lead (Pb)	150
Selenium (Se) ^{Note 1}	2
Zinc (Zn)	350

Note 1: Monitoring of these parameters required if waste from an industrial source.

Note 2: The above alone should not be taken as an indication of suitability for addition to soil as the cumulative metal additions to soil should be first calculated.

4. Pathogens

Pathogenic organism content must not exceed the following limits:

- Escherichia coli ≤1,000 CFU/g
- Salmonella species absent in 25 g sample.

5. Monitoring

The licensee shall submit to the Agency for its agreement, prior to commencement of compost operations, details of methods of analyses, methods of sampling and sample numbers.

The analyses shall be carried out:

- (a) every six months for plants producing more than 500 and up to 1,000 tonnes of treated biowaste per year;
- (b) at intervals of at least every 1,000 tonnes of treated biowaste produced or every 3 months, whichever comes first, for plants producing more than 1,000 and up to 10,000 tonnes of treated biowaste per year;
- (c) every month for plants producing more than 10,000 tonnes of treated biowaste per year.



SCHEDULE G: Reporting

Completed reports shall be submitted to:

The Environmental Protection Agency
Office of Environmental Enforcement
EPA Headquarters
PO Box 3000

Johnstown castle estate

Co. Wexford **or** Any other address as may be specified by the Agency

Reports are required to be forwarded as required in the licence and as may be set out below:

Report	Reporting Frequency ^{Note1}	Report Submission Date
Annual Environment Report (AER)	Annually	By 31 st March of each year.
Record of incidents	As they occur	Within five days of the incident.
Specified Engineering Works reports	As they arise	Prior to the works commencing.
Monitoring of landfill gas	Quarterly	Ten days after end of the quarter being reported on.
Monitoring of Surface Water Quality	Quarterly	Ten days after end of the quarter being reported on.
Monitoring of Groundwater Quality	Quarterly	Ten days after end of the quarter being reported on.
Monitoring of Leachate	Quarterly	Ten days after end of the quarter being reported on.
Dust Monitoring	Quarterly	Ten days after end of the quarter being reported on.
Drawing with Monitoring locations	-	Prior to commencement of waste disposal
Schedule of Objectives & Targets	-	3 months prior to commencement of development
Leachate Disposal Agreement	-	Prior to commencement of waste disposal

Note 1: Unless altered at the request of the Agency.



Sealed by the seal of the Agency on this the day of May, 2005

PRESENT when the seal of the Agency
was affixed hereto:

Padraic Larkin, Director



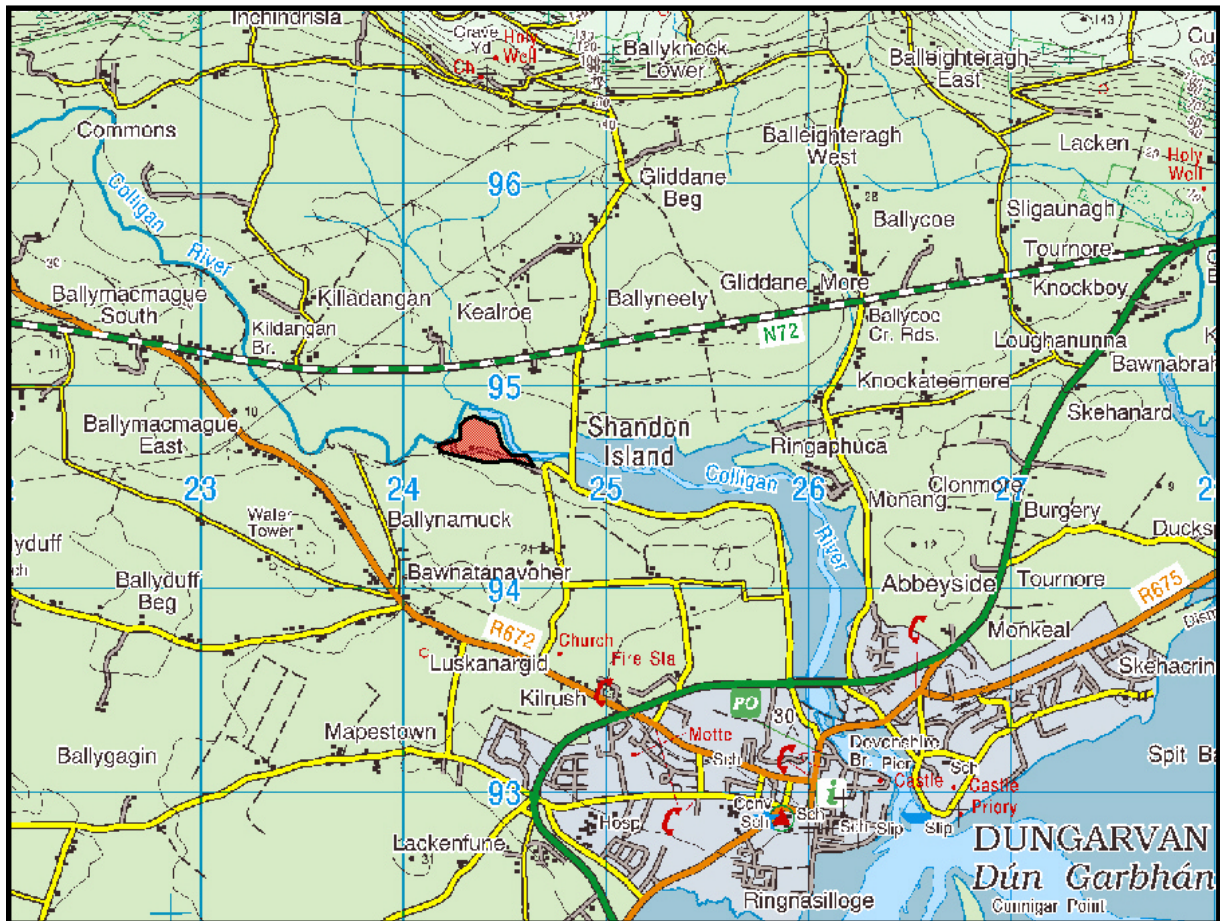
WASTE Application Form

Appendix E – Conditioning Plan



Waterford County Council
Comhairle Chontae Phortlairge

DUNGARVAN LANDFILL



CONDITIONING PLAN



DOCUMENT CONTROL SHEET

Client	Waterford County County Council					
Project Title	Dungarvan Landfill Waste Licence Compliance					
Document Title	Dungarvan Landfill Conditioning Plan					
Document No.	065509001Rp003A01					
This Document Comprises	DCS	TOC	Text	List of Tables	List of Figures	No. of Appendices
	1	1	20	0	0	2

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
A01	Final	G O' Sullivan			Carnegie House	

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1 INTRODUCTION

MC O'Sullivan & Co Ltd (MCOS) on behalf of Waterford County Council has prepared this Conditioning Plan for Dungarvan Landfill. It has been prepared to fulfil the requirements of the European Council Directive 1999/31/EC, Landfill of Waste.

The Conditioning Plan consists of the completed 'Pro-forma' published by the Environmental Protection Agency (Agency) and attachments as required to provide further information. The Conditioning Plan refers to the Waste Licence Proposed Decision 32-1, the Waste Licence Application the Proposed Regional Waste Management Plan for the South East Region.

A Waste Licence Proposed Decision (PD) was issued to Waterford County Council in June 2001. An objection to the PD was made by the Council in July 2001. Waterford County Council have operated the landfill generally in accordance with the conditions of the PD with the exception of those included on the Objection. In some instances Waterford County Council have undertaken to comply with the conditions before the dates proposed in the PD.

2 LICENCE DETAILS

WASTE LICENCE REG NO.	32-1
LICENSEE	Waterford County Council
LOCATION OF FACILITY	Ballinamuck Middle, Dungarvan, Co Waterford.
CONTACT DETAILS	
Name:	Mr. Paul Daly, Senior Engineer.
Address:	Environment Section, Waterford County Council, Civic Offices, Dungarvan, Co. Waterford.
Tel No:	058 22000
Fax No.	058 20889

3 ARTICLE 3 INFORMATION

Article 3(4)	
Scope	Please indicate if your landfill serves an Island or an Isolated Settlement. If yes provide supporting evidence. (y / n)
Landfill sites for non-hazardous or inert wastes with a total capacity not exceeding 15,000 tonnes or with an annual intake not exceeding 1,000 tonnes serving islands, where this is the only landfill on the island and where this is exclusively destined for the disposal of waste generated on that island.	N
Landfill sites for non-hazardous or inert waste in isolated settlements if the landfill site is destined for the disposal of waste generated only by that isolated settlement. Where isolated settlement means a settlement With no more than 500 inhabitants per municipality or settlement and no more than five inhabitants per square kilometre and, Where the distance to the nearest urban agglomeration with at least 250 inhabitants per square kilometre is not less than 50km, or with difficult access by road to those nearest agglomerations, due to harsh meteorological conditions during a significant part of the year.	N
Attachment A3 included	Yes <input type="checkbox"/> No <input type="checkbox"/> Not Applicable <input checked="" type="checkbox"/>

4 ARTICLE 4 INFORMATION

Article 4	Existing Landfill Sites	Please indicate one class only
Class of Landfill	Date of Compliance	
Landfill for hazardous waste	16/7/2002	N/A
Landfill for non-hazardous waste	Latest 16/7/2009	16/7/2002
Landfill for inert waste	Latest 16/7/2009	N/A

5 ARTICLE 5 INFORMATION

Article 5(3)	Existing Landfill Sites	Please indicate one class only
Waste & Treatment not acceptable in Landfills ^{Note 4}	Please indicate if any of the listed wastes are accepted for disposal to landfill (y / n)	Specify the date on which the facility will comply with this requirement (latest date is 16/7/2006 for landfills classified as non-hazardous or inert)
Liquid Waste ^{Note 1}	N	16/07/2002
Waste which, in the conditions of landfill, is explosive, corrosive, oxidising, highly flammable or flammable, as defined in Annex III to Directive 91/689/EEC ^{Note 1}	N	16/07/2002
Hospital and other clinical wastes which are infectious ^{Note 1}	N	16/07/2002
Whole used tyres (excluding tyres used as engineering material) ^{Note 2}	N	16/07/2002
Shredded used tyres ^{Note 3}	N	16/07/2002
Any other type of waste which does not fulfil the acceptance criteria determined in accordance with Annex II of the Landfill Directive. ^{Note 1}	N	16/07/2002
Waste which has been diluted or mixed solely to meet the relevant acceptance criteria ^{Note 1}	N	16/07/2002

Note 1: Landfill Directive prohibits the acceptance of these wastes for disposal at 'existing hazardous waste' landfills from 16 July 2002.

Note 2: Landfill Directive requires these not to be accepted for disposal at 'existing hazardous waste' landfills from 16 July 2003, excluding bicycle tyres and tyres with an outside diameter above 1.4m.

Note 3: Landfill Directive requires these not to be accepted for disposal at 'existing hazardous waste' landfills from 16 July 2004

Note 4: Hazardous waste can only be accepted at landfills classified as landfills for hazardous waste from 16/07/02.

Attachment A5 included	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Not Applicable <input type="checkbox"/>
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6 ARTICLE 6 INFORMATION

Article 6	Hazardous Waste Landfill	Non-hazardous Waste Landfill	Inert Waste Landfill	Specify the date on which the facility will comply with this requirement and provide details on measures to meet the specific requirement.
Waste to be accepted in the different classes of landfill				
Waste to be treated prior to disposal	16/7/2004	16/7/2009	16/7/2009	16/07/2005
Ban on any waste other than hazardous waste that fulfils criteria in Annex II being assigned to a hazardous waste landfill	16/7/2004	Not applicable	Not applicable	N/A
Non-hazardous waste landfill may be used for: municipal waste, non-hazardous waste of any other origin and stable, non-reactive hazardous wastes	Not applicable	16/7/2009	Not applicable	16/07/2002
Inert landfills can only accept inert waste	Not applicable	Not applicable	16/7/2002	N/A

Attachment A6 included

Yes No Not Applicable

7 ARTICLE 8 INFORMATION

Article 8	
Conditions of the Permit	Provide details on meeting compliance with the following requirements – where relevant cross refer to your IPC/waste licence:
The Management of the landfill site will be in the hands of a natural person who is technically competent to manage the site; professional and technical development and training of landfill operators and staff is provided.	<ul style="list-style-type: none"> Refer to Proposed Waste Licence Conditions 2.1, 2.3 and 11.10
Necessary measures are taken to prevent accidents and limit their consequences.	<ul style="list-style-type: none"> Refer to Proposed Waste Licence Conditions 9 and 2.3.
Adequate financial provisions will be made by the applicant	<ul style="list-style-type: none"> Waterford County Council has applied for a licence for the facility. Refer to PWLC 12.2.
Landfill project is in line with the relevant waste management plan.	<ul style="list-style-type: none"> Yes – Refer to The Proposed joint Waste Management Plan for The South East Region, Summary Section 3.5.

Attachment A8 included

Yes No Not Applicable

8 ARTICLE 9 INFORMATION

Article 9	
Content of the Permit	Provide details on the following requirements – where relevant cross refer to your waste licence:
Class of landfill	<ul style="list-style-type: none"> • Non hazardous Waste Landfill.
Waste type & Total quantity of waste to be deposited	<ul style="list-style-type: none"> • Refer to the Objection to the Proposed Waste Licence (July 2001). • Total quantity of waste deposited at Dungarvan Landfill will be 560,000 tonnes.
Requirements for preparations, operations and monitoring and control procedures, provisional requirements for the closure and aftercare operations.	<ul style="list-style-type: none"> • Refer to Proposed Waste Licence Conditions 4, 5, 8 and 12.
Obligation to report (waste types, quantities and monitoring)	<ul style="list-style-type: none"> • Refer to Conditions 11.3 and 11.10 and Schedule E of the Proposed Waste Licence.

Attachment A9 included	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Not Applicable <input type="checkbox"/>
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9 ARTICLE 10 INFORMATION

Article 10	
Cost of the landfill of waste	Provide details on measures to meet this specific requirement.
Price charged by the operator must include setting up and operational costs, and the estimated costs of the closure and aftercare of the site for at least 30 years.	An estimation of investment, operational and aftercare costs was carried out by Waterford County Council in 2001. The gate fees at the landfill are €114 per tonne of Commercial waste and €63 per tonne of municipal waste (this is exclusive of the Landfill Levy). It is expected that the revenue from the gate fees will provide for investment, operational, restoration and aftercare costs. Refer also to Condition 12.2 of the Proposed Waste Licence.

Attachment A10 included	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Not Applicable <input type="checkbox"/>
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10 ARTICLE 11 INFORMATION

Article 11		
Waste Procedures	Acceptance	Specify the date on which the facility will comply with these requirements and provide details on measures to meet the specific requirement
Measures must be place in order to enable holder/operator to show that the waste accepted at the site complies with the permit and fulfils the acceptance criteria set out in Annex II		<ul style="list-style-type: none"> 16/07/2002 – Refer to the Waste licence Application Form, 1998, Section E “Waste Acceptance and Handling”
Measures must be in place to ensure the operator checks documentation, visually inspects the waste at entrance and point of deposit, keeps a register of the waste and provides written acknowledgement of each delivery.		<ul style="list-style-type: none"> 16/07/2002 – Refer to the Waste licence Application Form, 1998, Section E “Waste Acceptance and Handling”
Measures must be in place to ensure that the operator notifies the competent authority if waste not accepted.		<ul style="list-style-type: none"> 16/07/2002 – Refer to the Waste licence Application Form, 1998, Section E “Waste Acceptance and Handling”
Measures to provide for regular visual inspection of waste deposited at island or isolated settlement sites to ensure that only non-hazardous waste accepted		N/A
Measures to ensure that a register on quantities of waste that are deposited at an exempted landfill site are kept		N/A

Attachment A11 included

Yes No Not Applicable

11 ARTICLE 12 INFORMATION

Article 12	
Control and monitoring procedures in the operational phase	Specify the date on which the facility will comply with these requirements and provide details on measures to meet the specific requirement
Control and monitoring programme in operational phase as specified in Annex III of the Directive;	<ul style="list-style-type: none"> • 16/07/2002 - Refer to Conditions 6 and 8 and Schedule C and D of the Proposed Waste Licence.
Operator to inform competent authority of any significant adverse environmental effects and corrective measures to be taken;	<ul style="list-style-type: none"> • 16/07/2002 - Refer to Proposed Waste Licence Conditions 2.3.2, 9.1, 9.4 and 11.2.
Operator to report results of monitoring to competent authority at least once a year;	<ul style="list-style-type: none"> • 16/07/2002 - Refer Schedule D and E of the Proposed Waste Licence.
Quality control of the analytical operations are carried out by competent laboratories.	<ul style="list-style-type: none"> • 16/07/2002 - Monitoring is carried out in the Local Authority Laboratory and the EPA Regional Laboratory in Kilkenny, both laboratories participate in the EPA Inter-calibration Programme.

Attachment A12 included	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Not Applicable <input type="checkbox"/>
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12 ARTICLE 13 INFORMATION

Article 13 ^{Note 1} Closure and Aftercare Procedures	Specify the date on which the facility will comply with these requirements and provide details on measures to meet the specific requirement
Measures must be in place to ensure closure procedures start when relevant conditions in the permit are met; or under the authorisation of the competent authority at the request of the operator; or by reasoned decision of the competent authority.	<ul style="list-style-type: none"> 16/07/2002 - Refer to Condition 4 of the Proposed Waste Licence
Measures to be in place to ensure that the operator is responsible for maintenance, monitoring & control in the aftercare phase, and informs the competent authority of any adverse environmental effects.	<ul style="list-style-type: none"> 16/07/2002 – Refer to Proposed Waste Licence Conditions 4 and 12.
Measures to be in place to ensure that the operator is responsible for monitoring and analysing gas and leachate and the groundwater regime for as long as the competent authority considers that the landfill is likely to cause a hazard.	<ul style="list-style-type: none"> 16/07/2002 – Refer to Proposed Waste Licence Conditions 8.5, 8.6 and 8.7.

Existing sites which have not closed by 16 July 2001 will be subject to closure requirements of the landfill directive (Articles 7(g) and 13).

Attachment A13 included	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Not Applicable <input type="checkbox"/>
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13 ANNEX I INFORMATION

General Requirements for all Classes of Landfills

13.1 WATER CONTROL AND LEACHATE MANAGEMENT

Water control and leachate management	Specify the date on which the facility will comply with these requirements and provide details on measures to meet the specific requirement
Control water from precipitations entering into the landfill body	<ul style="list-style-type: none"> 16/07/2002 – Temporary capping covers all filled areas of the landfill, a daily cover is placed over the active cells.
Prevent surface water and/or groundwater entering into the landfilled waste	<ul style="list-style-type: none"> Surface Water – 16/07/2002 - Refer to Proposed Waste Licence Conditions 3.16. Groundwater – N/A - Refer to Attachment B2.
Collect contaminated water and leachate	<ul style="list-style-type: none"> 16/07/2003 - Refer to Proposed Waste Licence Condition 3.13 and Section 1 of the Objection to the Proposed Decision.
Treat contaminated water and leachate collected from the landfill to the appropriate standard required for their discharge	<ul style="list-style-type: none"> 16/07/2003 - Refer to Proposed Waste Licence Condition 3.13 and Section 1 of the Objection to the Proposed Decision.

Attachment B1 included	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Not Applicable <input type="checkbox"/>
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13.2 PROTECTION OF SOIL AND WATER

Protection of Soil and Water	Specify the date on which the facility will comply with these requirements and provide details on measures to meet the specific requirement
By the combination of a geological barrier and a bottom liner during the operation/active phase.	<ul style="list-style-type: none"> Refer to Attachment B2.
By the combination of a geological barrier and a top liner during the passive phase/post closure.	<ul style="list-style-type: none"> 16/07/2002 –Refer to Attachment B2.
Geological barrier no less than 0.5 meter thick giving equivalent protection to one of the following: Landfill for hazardous waste: $k \leq 1.0 \times 10^{-9} \text{m/s}$; thickness $\geq 5\text{m}$. Landfill for non-hazardous waste: $k \leq 1.0 \times 10^{-9} \text{m/s}$; thickness $\geq 1\text{m}$. Landfill for inert waste: $k \leq 1.0 \times 10^{-7} \text{m/s}$; thickness $\geq 1\text{m}$.	<ul style="list-style-type: none"> Refer to Attachment B2.
Leachate collection and sealing system: Artificial sealing liner (e.g. geomembrane) Drainage layer $\geq 0.5\text{m}$	<ul style="list-style-type: none"> Refer to Attachment B2
Capping system	<ul style="list-style-type: none"> 16/07/2005- Refer to Waste Licence Condition 4.4 and 4.7.

Attachment B2 included	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Not Applicable <input type="checkbox"/>
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13.3 GAS MANAGEMENT

Gas Management	Specify the date on which the facility will comply with these requirements and provide details on measures to meet the specific requirement
Measures to control the accumulation and migration of landfill gas	<ul style="list-style-type: none"> 31/12/2003 - Refer to Proposed Waste Licence Condition 3.14.
Landfill gas from landfills receiving biodegradable waste must be collected used to produce energy or flared in manner which minimises damage to or deterioration of the environment and risk to human health	<ul style="list-style-type: none"> 31/12/2003 - The feasibility of using landfill gas to produce energy will be investigated as part of the design for the landfill gas management system. Composition of the waste and expected gas yield will be taken into account. Flaring of the gas will be carried out according to Waste Licence Condition 3.14.1 if energy recovery is not viable.

Attachment B3 included	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Not Applicable <input type="checkbox"/>
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13.4 NUISANCES AND HAZARDS

Nuisances and hazards	Specify the date on which the facility will comply with these requirements and provide details on measures to meet the specific requirement
Measures to minimise nuisances and hazards arising from the landfill through: Emissions of odours and dust Wind blown materials Noise and traffic Birds, vermin and insects Formation and aerosols Fires	<ul style="list-style-type: none"> Dust – 16/07/2002, Refer to Proposed Waste licence Condition 7.4 Wind Blown Material – 16/07/2002, Refer to Proposed Waste Licence Conditions 7.3. Odours – 16/07/2002, Continual compaction and covering of wastes, refer to Proposed Waste Licence Conditions 5.4 and 5.5. Traffic – 16/07/2002, Refer to Proposed Waste Licence Conditions 3.5 and 7.2. Birds – 16/07/2002, Refer to Proposed Waste licence Condition 7.7. Vermin and insects – 16/07/2002, Refer to Proposed Waste Licence Condition 11.5. Formation of aerosols – 16/07/2002, Controlled by daily covering of waste, maintaining the on site equipment to minimise exhaust emissions, and use of water sprayers when necessary.
Landfill equipped so that dirt originating from the site is not dispersed onto public roads and the surrounding land	<ul style="list-style-type: none"> 16/07/2002 - Refer to Proposed Waste Licence Condition 7.5 and 3.9.

Attachment B4 included	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Not Applicable <input type="checkbox"/>
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13.5 STABILITY

Stability	Specify the date on which the facility will comply with these requirements and provide details on measures to meet the specific requirement
Emplacement of waste takes place in such a way as to ensure stability of the mass of waste and associated structures, particularly in respect of avoidance of slippages.	<ul style="list-style-type: none"> 16/07/2002 - Refer to Proposed Waste Licence Condition 8.12.
Where an artificial barrier is established the geological substratum is sufficiently stable to prevent settlement that may cause damage to the barrier.	N/A

Attachment B5 included	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Not Applicable <input type="checkbox"/>
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13.6 BARRIERS

Barriers	Specify the date on which the facility will comply with these requirements and provide details on measures to meet the specific requirement
Landfill shall be: Secure to prevent free access to the site; and The gates shall be locked outside operating hours.	<ul style="list-style-type: none"> 16/07/2002 - Refer to Proposed Waste Licence Condition 3.4.
The system of control and access to the facility contains a programme of measures to detect and discourage illegal dumping in the facility.	<ul style="list-style-type: none"> 16/07/2002 - Security fencing, signage and supervision of site discourage illegal dumping.

Attachment B6 included	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Not Applicable <input type="checkbox"/>
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14 ANNEX II INFORMATION

Waste Acceptance Criteria and Procedures

14.1 WASTE ACCEPTANCE CRITERIA AND PROCEDURES

Waste Acceptance Criteria and procedures	Specify the date on which the facility will comply with these requirements and provide details on measures to meet the specific requirement
Guidelines for preliminary waste acceptance procedure: Acceptance procedure per Article 11 of the directive. For waste acceptance further requirements are likely to be issued by the Commission.	16/07/02 – Refer to Waste Licence Application Form, 1998. Section E “ Waste Acceptance and Handling”.

Landfill Operator should Cross Refer to Article 11 to ensure requirements of the Directive are satisfied.

15 ANNEX III INFORMATION

Control and monitoring procedures in operation and after-care phases

15.1 METEOROLOGICAL DATA

Meteorological data	
Is meteorological data collected onsite (y/n)	No
If offsite name of station	Rosslare Meteorological Station.
Is the following data collected daily (operation phase):	
Volume of precipitation;	Yes
Temperature (min, max 14.00 h CET);	Yes
Direction and force of prevailing wind;	Yes
Evaporation;	Yes
Atmospheric humidity (14.00 h CET).	Yes

Attachment D1 included

Yes

No

Not Applicable

15.2 EMISSION DATA: WATER, LEACHATE AND GAS CONTROL

15.2.1 Monitoring Locations

Landfill Gas ^{Note 1}	Refer to “ Monitoring Programme for Gas, Noise and Dust” Dun-EIS-003.
Surface Water ^{Note 2}	Refer to “Monitoring Programme for Groundwater, Surface Water and Leachate” Dun-EIS-002.
Ground Water ^{Note 3}	Refer to “Monitoring Programme for Groundwater, Surface Water and Leachate” Dun-EIS-002.
Leachate ^{Note 4}	Refer to “Monitoring Programme for Groundwater, Surface Water and Leachate” Dun-EIS-002.
Dust	Refer to “ Monitoring Programme for Gas, Noise and Dust” Dun-EIS-003.
PM₁₀	N/A Refer to Licence.
Noise	Refer to “ Monitoring Programme for Gas, Noise and Dust” Dun-EIS-003.
Other monitoring locations ^{Note 3}	Refer to “Sampling Locations on the Colligan River for invertebrates and indicator organisms” Dun-MON-001.

Note 1: Include locations on boundary, within waste mass and emission points from landfill gas flare etc

Note 2: List locations on receiving waters (1 up and 1 down as a minimum)

Note 3: List locations (up and down gradient)

Note 4: Include details on the following where relevant (holding lagoon, lined cells, unlined areas). Sampling and measuring (volume and composition) of leachate must be performed separately at each point at which leachate is discharged from the site – the number of discharge points should be provided with relevant monitoring details.

Note 5: Site Specific monitoring may be required e.g. ecological etc.

15.2.2 Frequency of Monitoring

Landfill Gas Constituents.

	Operational Phase	After-Care Phase
Boundary Locations	Monthly	Monthly
Within Waste	Monthly	Monthly
Landfill Gas Flare/ Combustion Plant	Weekly & Biannually	Weekly & Biannually

Surface Waters & Groundwaters

	Operational Phase	After-care Phase
Surface Water Volume/Flows	N/A - Not required by Proposed Waste Licence.	N/A - Not required by Proposed Waste Licence.
Surface Water Composition ^{Note 1}	Weekly, Quarterly & Annually	Weekly, Quarterly & Annually
Groundwater Level	Monthly	Monthly
Groundwater Composition ^{Note 1}	Monthly, Quarterly & Annually	Monthly, Quarterly & Annually

Note 1: Include details of parameters to be tested in Attachment D2.

Leachate Levels and Composition ^{Note 1}

	Operational Phase	After-care Phase
Leachate in Active Cells	Weekly & Monthly	Monthly
Leachate in Closed Cells	Weekly & Monthly	Monthly
Leachate Wells in unlined areas	Weekly & Monthly	Monthly
Lagoon / Holding Tank	N/A – leachate lagoon not yet in place.	Monthly

Note 1: Include details of parameters to be tested in Attachment D2.

Other Site-specific Monitoring ^{Note 1}

	Operational Phase	After-care Phase
Other monitoring stations	Biological Assessment. Annually	 Annually

Note 1: Examples include dust, PM₁₀, noise, ecological. Include details of parameters to be tested in Attachment D2.

Date for Compliance

Specify the date on which the facility will comply with the monitoring location and frequency requirements:

DATE FOR COMPLIANCE	16/07/2002 – Gas, Surface Water, Groundwater and Leachate. 31/12/03 – Biological Assessment.	31/12/2005
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Attachment D2 included	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Not Applicable <input type="checkbox"/>
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15.3 TOPOGRAPHY OF THE SITE: DATA ON THE LANDFILL BODY

Topography of the site: data on the landfill body	Specify the date on which the facility will comply with these requirements and provide details on measures to meet the specific requirement
Structure and composition of landfill body to be done yearly consisting of: Surface occupied by waste; Volume and composition of waste; Methods of depositing; Time and duration of depositing; Calculation of the remaining capacity still available at the landfill.	<ul style="list-style-type: none"> • Surface occupied by waste: 16/07/2002, refer to Proposed Waste Licence Condition 8.10. • Volume and Composition of waste: 16/07/2002, calculated from annual topographical survey, waste acceptance records and site investigation results. • Method of Depositing: 31/09/2003 – Refer to AER Schedule G of Proposed Licence. • Remaining Capacity: 31/09/2003 – Refer to AER Schedule G of Proposed Licence.
Settling behaviour of the level of the landfill body measured yearly	<ul style="list-style-type: none"> • 16/07/2002, calculated from the annual topographic survey in accordance with Condition 8.10 of the Waste Licence.

Attachment D3 included	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Not Applicable <input type="checkbox"/>
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16 DECLARATION

I/we hereby submit a Conditioning Plan, pursuant to the provisions of the **European Council Directive on the Landfill of Waste (1999/31/EC)** and Regulations made thereunder.

I/we certify that the information given in this Plan is truthful, accurate and complete (see note below).

I/we have no objection to the provision by the Agency or local authority of a copy of the Plan or parts thereof to any person.

Signature:	_____	_____	_____
Print name:	_____	_____	_____
Date:	_____	_____	_____
Position in organisation:	_____	_____	_____
On behalf of (name of organisation):	Waterford County Council	_____	_____

**Note:*

- *in the case of a partnership, all partners should sign the declaration; and,*
- *if the application is signed by an agent/consultant, the proposed licence holder must also sign and date the declaration.*

<i>Company/local stamp or seal:</i>	<i>authority</i>

ATTACHMENT B2

PROTECTION OF SOIL AND WATER.

Requirement 1 – By the combination of a geological barrier and a bottom liner during the operation/active phase

- Dungarvan Landfill commenced operations in 1968.
- There is no engineered geological barrier or bottom liner existing under the landfill, although there is a layer of boulder clay underneath the landfill.
- Impact on the groundwater is limited due to a continuous layer of low permeability clay which underlines the site.

Requirement 2 – By the combination of a geological barrier and a top liner during the passive phase/post closure

- Wastes are covered daily and a temporary cap is in place across most of the site.
- Final Capping of part of the Landfill will commence in August 2002. The remaining area of the landfill will be capped on a phased basis.

Requirement 3 – Geological barrier no less than 0.5 metres thick giving equivalent protection of, Landfill for non-hazardous waste, $k \leq 1 \times 10^{-9} \text{m/s}$, thickness $\geq 1 \text{m}$

- As the landfill has been in operation since the 1968, there is no geological barrier that meets this specification.
- No extensions to the landfill requiring new cells have been licensed or required, therefore there is no need to install this type of barrier layer. (Future filling will take place above area's that have previously been filled)
- Capping will, however, provide a layer meeting this specification that will cover the wastes **once completed**.

Requirement 4 – Leachate Collection and sealing system, artificial sealing liner and drainage layer $\geq 0.5 \text{m}$.

- As described above there is no artificial sealing liner or drainage layer underlying Dungarvan Landfill.

ATTACHMENT D2

MONITORING

15.2.2 – PARAMETERS TO BE TESTED.**Surface Water Composition, Groundwater Composition and Leachate Composition.**

Information taken from Table D.5.1 in Schedule D of the Proposed Waste Licence, indicating what parameters are monitored.

Parameter	Surface Water	Groundwater	Leachate
Visual Inspection/Odour	Yes	Yes	Yes
Ground water level	N/A	Yes	N/A
Leachate Level	N/A	N/A	Yes
Ammoniacal Nitrogen	Yes	Yes	Yes
BOD	Yes	N/A	Yes
COD	Yes	N/A	Yes
Chloride	Yes	Yes	Yes
Dissolved Oxygen	Yes	Yes	N/A
Electrical Conductivity	Yes	Yes	Yes
pH	Yes	Yes	Yes
Total Suspended Solids	Yes	N/A	N/A
Temperature	Yes	Yes	Yes
Boron	N/A	Yes	Yes
Cadmium	Yes	Yes	Yes
Calcium	Yes	Yes	Yes
Chromium (total)	Yes	Yes	Yes
Copper	Yes	Yes	Yes
Cyanide (total)	N/A	Yes	Yes
Fluoride	N/A	Yes	Yes
Iron	Yes	Yes	Yes
Lead	Yes	Yes	Yes
List I/II organic substances	Yes	Yes	Yes
Magnesium	Yes	Yes	Yes
Manganese	Yes	Yes	Yes
Mercury	Yes	Yes	Yes
Potassium	Yes	Yes	Yes
Sulphate	Yes	Yes	Yes
Sodium	Yes	Yes	Yes
Total Alkalinity	Yes	Yes	Yes
Total Phosphorus/ orthophosphate	Yes	Yes	Yes
Total Oxidised Nitrogen	Yes	Yes	Yes
Total Organic Carbon	N/A	Yes	N/A
Residue on evaporation	N/A	Yes	N/A
Zinc	Yes	Yes	Yes
Phenols	N/A	Yes	N/A
Faecal Coliforms	N/A	Yes	Yes
Total Coliforms	N/A	Yes	Yes