# WATERFORD COUNTY COUNCIL
***Director of Planning & Environment***

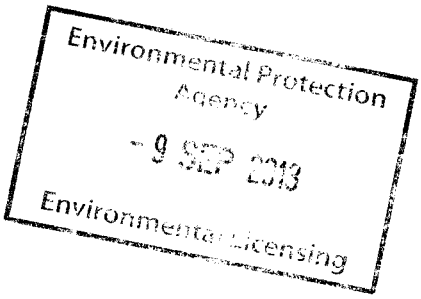
# COMHAIRLE CONTAE PHORT LÁIRGE
***Stiúrthóir Pleanála & Comhshaoil***


My Reference: Mo Thag: GH/MS

Your Reference: Do Thag: W0032-03

Date: Dáta: 6th September 2013

Administration,
Licensing Unit,
Office of Climate, Licensing
And Resource Use,
Environmental Protection Agency,
Headquarters,
PO Box 3000,
Johnstown Castle Estate,
Co. Wexford






Dear Sir,

**Re: Reg No. W0032-03 – Notice in Accordance with Article 14 (2) b (ii) of the Waste Management (Licensing) Regulations**

I refer to the above reference application for a waste licence relating to a facility at Dungarvan Waste Disposal Site, Ballinamuck Middle, Dungarvan, Co. Waterford.

I attach herewith a response to the queries raised in your Notice dated 21st June 2013, which also includes a non-technical summary. Please note two hard copies of the information is attached, and one electronic version on a CD-ROM.

If you require any additional information, please contact the undersigned.

Yours faithfully,

Gabriel Hynes,
Senior Engineer,
Environment

Encs.

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# Waste Licensing

## Waste Disposal Activities

## (Landfill Sites)



Application by Waterford County Council for Waste Licence Application W0032-03 for Dungarvan Landfill, County Waterford

| | |
|---|---|
| **EPA Ref. Nº:** | **W0032-03** |

Replies to Request for further information in accordance with Article 14(2)(b)(ii) of the Waste Management Regulations

August 2013

# Dungarvan Landfill Waste Licence Application Article 14 Response

# DOCUMENT CONTROL SHEET



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|---|---|---|---|---|---|---|
| Client | Waterford County Council | | | | | |
| Project Title | Dungarvan Landfill Remediation Works | | | | | |
| Document Title | Waste Licence Application W0032-03 Article 14 Response | | | | | |
| Document No. | MDR0450Rp1031 | | | | | |
| This Document Comprises | DCS | TOC | Text | List of Tables | List of Figures | No. of Appendices |
| | 1 | 1 | 7 | - | - | 6 |

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| F01 | Final | J Bennett | B Deegan | L O'Toole | West Pier | August 2013 |
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# 1 INTRODUCTION

This report has been compiled to supply additional information in response to a Notice in accordance with Article 14 (2) (b) (ii) of the Waste Management (Licensing) Regulations from the Environmental Protection Agency dated June 21st 2013.

A revised non technical summary to reflect the information supplied in compliance with the notice in accordance with Article 14 (2) (b) (ii) of the Waste Management (Licensing) Regulations is included in Appendix 1.

A register of drawings submitted in response to the Notice in accordance with Article 14(2)(b)(ii) is presented in Appendix 5. This register details drawing titles, numbers and titles and revision status.

# 2 NON-TECHNICAL SUMMARY

## 2.1 REQUEST FOR INFORMATION

*Your reply to this notice should include a revised **non-technical summary** which reflects the information you supply in compliance with the notice, insofar as that information impinges on the non technical summary.*

## 2.2 RESPONSE TO REQUEST

**Attachment A1 – Non-Technical Summary**

# ARTICLE 12 COMPLIANCE REQUIREMENTS

## 2.3 ITEM 1

*Submit a response to the Agency's Article 14(2)(b)(ii) notice issued on 29 August 2011*

### 2.3.1 Response to Request

The licensee is not in a position to underwrite the costings outlined in the CRAMP by way of financial provision insofar as this condition essentially refers to the provision of a financial bond, a procedure that is not normally undertaken by local authorities. The licensee is of the opinion that a policy in this regard should be adopted at national level prior to the financial provision referred to in Condition 10.8 (vi) of License W0075-02 being addressed.

## 2.4 ITEM 2

*Undertake a screening for Appropriate Assessment and state whether the activity, individually or in combination with other plans or projects is likely to have a significant affect on a European Sites, in view of best scientific knowledge and the conservation objectives of the site(s).*

*Where it cannot be excluded, on the basis of objective scientific information, following screening for Appropriate Assessment, that an activity, either individually or in combination with other plans or projects is likely to have a significant affect on a European Site, provide a Natura Impact Statement, as defined in Regulation 2(1) of the European Communities (Birds and Natural Habitats) Regulations (S.I. No. 477 of 2011). Where based on the screening it is considered that an Appropriate Assessment is not required, provide a reasoned response.*

*You are furthermore advised to refer to the document 'Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities', issued in 2009 by the Department of the Environment, heritage and Local Government, and revised in 2010.*



### 2.4.1 Response to Request

A screening for Appropriate Assessment has been carried out as attached in Appendix 2.

The following was concluded:

Due to the low bird usage of this sub-section of the SPA and mitigation measures to control leachate effluent into the River Colligan from the landfill it can be concluded that there are no significant adverse impacts posed to Dungavan Bay SPA or the conservation status of the wintering bird species for which the site has been designated.

The development of wetlands and grassland on the landfill serves to enhance the ecological network of natural habitats surrounding the landfill including the River Colligan and adjacent areas of wet grassland, marsh, brackishwater and estuarine habitats.

Since 2008 with succession of habitats including establishment of 6 wetland cells, grassland and increasing scrub cover it is apparent that the site is demonstrating increased biodiversity value providing good feeding grounds for a variety of birds and some mammal and invertebrate species

along with amphibians. The 2013 site visit observed an abundance of frogspawn in the wetland cells and 8 Snipe and 5 Moor Hen were noted whilst walking the site.

Significant impacts can be ruled out and no further assessment is required.

## 2.5 ITEM 3

*Provide an impact assessment of the proposed water abstraction on the Colligan River. State whether this abstraction requires planning permission and provide a copy if obtained.*

### 2.5.1 Response to Request

The leachate abstraction and treatment system was completed in 2012 and uses a groundwater well to provide dilution water rather than river water abstraction as originally designed in 2008 (the original design was described in detail in the in the submission *'Report on Response to EPA on Request for Information on Leachate Treatment', August 2008).* Full details of the dilution water well and the as-built leachate abstraction and treatment system are provided in Appendix 3 *'Leachate Abstraction and Treatment System – Description and Performance' (2013).*



## 2.6 ITEM 4

*Complete Section E.2 of the application form and associated Tables E.2(i) and E2(ii).*

### 2.6.1 Response to Request

**E.2 Emissions to Surface Waters**

Tables E.2(i) and E.2(ii) are attached.

A drawing of the surface water drainage system and emissions to surface water are illustrated on Drawing DG0714, and the leachate abstraction system is illustrated on FG002 and DG0706.

As the landfill is located on the banks of the river Colligan, surface water drainage from the side slopes runs-off towards the surface water carrier drain, along the northern and eastern boundaries. The carrier drain then discharges into the River Colligan at various locations as shown on drawing DG0714.

Surface water arising from the green waste reception area, composting area, and waste transfer station is collected as shown on Drawing DG0706, and discharges to the leachate collection system and into the leachate treatment system (wetland ponds) via the old leachate collector sump and new leachate collector pump sump shown. The septic tank serving the 'washing area / toilet' in the civic amenity area also connects to the leachate treatment system in this manner.

Surface water drainage from the civic reception area discharges via a 'first flush' valve and oil/petrol interceptor to the Colligan River as shown is shown on Drawing DG0706.

The main emission of significance is from the leachate treatment system. The leachate treatment system at Dungarvan landfill utilises a set of Integrated Constructed Wetlands (ICW's). Leachate is extracted from the borehole system, diluted to acceptable strength, and then passes through the series of five wetland ponds, before discharging to the leachate lagoon (which is hydraulically connected to the Colligan River). A SCADA system controls the operation, and outlet monitoring records the discharge quality. Treated leachate from the final pond can be recycled back through the system. If the treated effluent achieves the discharge limit standards, it can be discharged to the river Colligan. If the sample is above the discharge limit values the flow is redirected to the dilution tank or Wetland Cell 1B. In this case, all leachate abstraction is ceased until the outlet sample comes back within standards, the actuated valve closes thus raising pond 5 water levels and maximising storage therein, and recycle pumping to pond 1B is maximised.

The emission flow figures and quality standards are set as detailed in the following section and in Appendix 3 *'Leachate Abstraction and Treatment System – Description and Performance' (2013).*

## 2.7 ITEM 5

*Provide details and an assessment of the impact of the discharge(s) on receiving waters.*

### 2.7.1 Response to Request

A full assessment of the impact of the discharges on receiving waters is provided in Appendix 3 *'Leachate Abstraction and Treatment System – Description and Performance' (2013).*



In summary, the impact on the receiving water, the Colligan River, was assessed against EPA's proposed Environmental Quality standards in Rivers in Ireland (EPA 1997), "Parameters of Water Quality Interpretation and Standards", and EU Salmonid regulations (SI No 293 of 1988. Although the Colligan is not a Salmonid river the limits in these standards was applied in the proposed assimilative calculations.

A review of EPA 2011 Water Quality data for the Colligan River indicates that water quality is of satisfactory quality ranging from Q4- Q4-5 with no change from 2010. Biological assessment of the River Colligan at the location of the landfill was most recently carried out in 2009 and 2011, and suggested a fair to good water quality sampling sites. Both stations SW1 and SW2 are subject to tidal influences and may at times be brackish, depending on river flow and tidal range, and this may have an influence on relatively lower Q-value scores for the river location at the landfill compared to the EPA stations upstream.

Ecological assessments carried out indicate the site and its surrounding environs continue to support a diversity of wildlife due to the variety of habitats present.

The assimilative capacity and impact assessment concluded that the Colligan River has ample assimilative capacity to receive large volumes of treated effluent from the leachate treatment system, but with some restriction based on allowable ortho-phosphate limits.

The table below details the revised proposed emission limits that are to be applied to the treated effluent.

| Parameter | Emission Limit (all units in mg/l except pH) |
|---|---|
| pH | 5 - 9 |
| BOD | 45 |
| Suspended Solids | 50 |
| Orthophosphate (mg/l P) | 2 |
| Ammonium (as N) | 15 |

The proposed emission limits are well below the assimilative capacity of the receiving water. The implementation of 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.

## 2.8 ITEM 6

*Provide details of the lining of the constructed wetlands.*



### 2.8.1 Response to Request

The wetlands were constructed as part of the capping and lining works in 2008, and cross section details are shown on drawings DG0506 and DG0103(a).

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 (see DG0506).

## 2.9 ITEM 7

*Having regard to Table H1(c) of the information dated 6 August 2010, clarify the total amount of inert waste for restoration purposes to be accepted over the facility's lifetime.*

### 2.9.1 Response to Request

The total amount of inert waste for restoration purposes to be accepted over the facility's lifetime as per Table H1(c) of the information dated 6 August 2010 is 48,990 tonnes (existing) plus 20,000 (proposed), a total of 68,990 tonnes.

## 2.10 ITEM 8

*Provide a report on the status of all on-site landfill gas wells (abstraction and monitoring) and propose actions to be taken in relation to any wells that are not fit for purpose. Include a drawing showing the wells.*

### 2.10.1 Response to Request

Please find Drawing No. DG0505 (Rev F02) attached showing all current monitoring locations together with their descriptions and symbols, together with DG0607 showing the gas collection system.

There are 23 no. gas abstraction boreholes, four no. combined leachate/gas monitoring boreholes (L1, L2A, L4, L5A), and seven groundwater boreholes used for gas monitoring (designated RC/GW on drawing).

Each well is monitored monthly in accordance with the licence and results are submitted annually in the AER. Generally the AER's indicate low concentrations of methane in boreholes within the landfill site and no landfill gas reaching the monitoring boreholes outside the landfill site or at the landfill site buildings.

It is notable on review of monitoring data that certain boreholes within the landfill site have typically zero levels of landfill gas; GW2A, L4, RC3A, RC4, RC8, GW1. All of these boreholes are at the extreme edge of the landfill waste area, aside from GW2A, and thus could conceivably have no landfill gas. GW2A would be expected to exhibit some degree of landfill gas, and is close to borehole L5A which does show significant levels of gas. Boreholes L1A, L2B, and L5A were drilled in 2011 to replace collapsed existing wells.

All abstraction and monitoring wells are to be examined by CCTV by end of September 2013 and an assessment prepared, towards replacement of any wells that are not fit for purpose. It is anticipated that replacement of wells (if required) will be tendered in October, complete by November, and an update provided to the Agency in December 2013.

# APPENDIX 1

# REVISED NON TECHNICAL SUMMARY

## 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 green waste composting area
- 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 ingression 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 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 5,500m$^2$ 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 are collected by the landfill gas management system and flared off.

**Green Waste Composting Area**

Waterford County Council ceased the acceptance of source segregated organic waste at the composting facility in 2007 due to odour concerns. In early 2008, the two enclosed in-vessel composting units were decommissioned and removed from site as they were no longer required.

Currently the composting area on site only accepts green waste in the form of bushes, trees, grass etc which is then collected and transported to O'Toole Composting in County Carlow.

**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 Drehid Landfill in County Kildare or the composting facilities at O'Toole Composting in County Carlow. The facility is washed down and cleaned after compostable material is transferred. Compostable waste, residual municipal waste, and dry recyclables are collected on a three week cycle, but the transfer station deals only with the first two types. Dry recyclables go directly from collection routes to Waterford County Council's Materials Recycling Facility at Shandon, Dungarvan, and do not enter the transfer station.

**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 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 as amended.

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 have been 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 Drehid 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 W032-02.

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.1.3 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 composting area and the waste transfer station. Electricity is used in the site lighting, weighbridge, office and garage buildings, and leachate pumping and treatment system.

### A.1.4 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 Drehid landfill in County Kildare for disposal within 48 hours.



All waste accepted by the compost area (green waste only) and civic amenity area is inspected prior to admission. In the past the facility included two enclosed in-vessel units for composting, but these were decommissioned and removed from site in 2008. 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/$m^2$/day.

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

**Emissions to Groundwater**

As mentioned previously, the landfill body itself is unlined resulting in the threat of leachate ingression 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, a fully engineered landfill cap has been constructed in accordance with Waste Licence 032-2 to prevent ingress of moisture into the waste body of the landfill, thus mitigating against future leachate generation. Because the landfill is now closed and 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 is collected via a series of stone filled carrier drains that discharge into the River Colligan.

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

Wastewater from the composting area and the waste transfer station is 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 area.

***Avoidance of Emissions to Water***
- The civic amenity area, the waste transfer station and the compost area are paved allowing collection of all surface water generated.
- All surface water from the civic amenity area is passed through a first fluch and petrol/oil interceptor before being discharged to the Colligan River.
- Wastewater from the composting area and waste transfer station is 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 has completed the course and obtained 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. In addition it is proposed to carry out monthly dust monitoring at monitoring locations B1-B4 and D2, D2A, D3 and D4. It is also proposed to conduct monthly odour monitoring at locations OM1 – OM2 and daily odour inspections at locations Oi1 – Oi4.

It is proposed that monitoring at such locations will allow emissions generated from the landfill, civic amenity area, composting area and waste transfer facility to be detected.

Monitoring locations are specified on drawing number MDR0350DG0505 (Rev R02).



### A.1.9 Off-site Treatment of Waste

All outgoing waste from the Waste Transfer Station is sent to either composting facilities or Drehid Landfill in County Kildare (Waste Licence W0201-01). 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 and 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

# APPENDIX 2

# APPROPRIATE ASSESSMENT

# Dungarvan Landfill

# Habitats Directive Project Screening Assessment



## Waterford County Council
## Comhairle Chontae Phort Láirge

**July 2013**

# Habitats Directive Project Screening Assessment

## Table 1: Project Details

| | |
|---|---|
| **Development Consent Type** | Waste Licence Application |
| **Development Location** | Ballynamuck Middle, Dungarvan, Co Waterford |
| **File Ref** | W0032-03 |
| **Description of the project** | Dungarvan Landfill |

## Table 2: Identification of Natura 2000 Sites (SACs and SPAs) Which May Be Impacted By The Proposed Development

Please answer the following five questions in order to determine whether there are any Natura 2000 sites which could potentially be impacted by the proposed development.

| | | |
|---|---|---|
| **Impacts on SACs** | | |
| 1 | **Impacts On Freshwater Habitats**<br>*Is the development within a Special Area of Conservation whose qualifying interests include freshwater habitats, or in the catchment of same?*<br><br>**Sites to consider: Blackwater River, Lower River Suir, Waterford Estuary**<br><br>**Habitats to consider:**<br>Rivers, Lakes and Lagoons. | No |
| 2 | **Impacts On Wetland Habitats**<br>*Is the development within a Special Area of Conservation whose qualifying interests include wetland habitats, or within 1 km of same?*<br><br>**Sites to consider: Comeragh Mountains**<br><br>**Habitats to consider:**<br>Bogs, Fens, Marshes and Wet Heaths. | No |
| 3 | **Impacts on Intertidal and Marine Habitats**<br>*Is the development located within a Special Area of Conservation whose qualifying interests include intertidal and/or marine habitats and species, or within the catchment of same.*<br><br>**Sites to consider: Tramore Dunes and Backstrand**<br><br>**Habitats to consider:**<br>Mudflats, Sandflats, Saltmarsh, Estuary; Shingle, Reefs, Sea Cliffs. | No |
| 4 | **Impacts On Woodlands , Grasslands and Dry Heaths**<br>*Is the development within a Special Area of Conservation whose qualifying habitats include woodlands or grasslands habitats, or within 200m of same.*<br><br>**Sites to consider: Glendine Wood Nire Valley Woods, Ardmore Head, Helvick Head**<br><br>**Habitats to consider:**<br>Woodlands, Grasslands or Dunes. | No |
| **Impacts on SPAs** | | |
| 5 | **Impacts On Birds**<br>*Is the development within a Special Protection Area, or within 1 km of same.*<br><br>**Sites to consider: Tramore Backstrand, Dungarvan Bay, Blackwater Callows, Blackwater Estuary, Helvick Head –Ballyquin Coast, Mid Waterford Coast** | Yes<br><br>Dungarvan Bay |

**Conclusion Table 2:**

If the answer to all of these questions is **No**, significant impacts can be ruled out for Natura 2000 sites. No further assessment is required, proceed to the Habitats Directive Conclusion Statement.

If the answer to any of these questions is **Yes** lease refer to tables 3 and 4 below.

**Table 3: Determination of Possible Impacts On Natura 2000 Sites.**
Where it has been identified that there is a Natura 2000 site within the potential impact zone of the proposed development, it is necessary to try to determine the nature of the possible impacts. Please answer the following questions as appropriate.

| **1** | **Impacts on designated freshwater habitats (rivers, lakes streams and lagoons).**<br><br>**Sites to consider: Blackwater River, Lower River Suir, Waterford Estuary**<br><br>*Please answer the following if the answer to question 1 in table 2 was yes.*<br><br>*Does the development involve any of the following:* | |
|---|---|---|
| | ***Works inside the boundary of designated site*** | |
| 1.1 | All works within the boundary of any SAC whose qualifying features include freshwater habitats/species, excluding small extensions/alterations to existing buildings. | |
| | ***Works outside the boundary of designated site*** | |
| 1.2 | Discharge to surface water or groundwater within the boundary of an SAC whose qualifying features include freshwater habitats/species. | |
| 1.3 | Abstraction from surface water or groundwater within 1km of the boundary of an SAC whose qualifying features include freshwater habitats or species. | |
| 1.4 | Removal of topsoil within 100m of the boundary of an SAC, whose qualifying features include freshwater habitats/species. | |
| 1.5 | Infilling or raising of ground levels within 100m the boundary of any SAC whose qualifying features include freshwater habitats/species. | |
| 1.6 | Construction of drainage ditches within 1km of the boundary of an SAC whose qualifying features include freshwater habitats/species. | |
| 1.7 | Installation of waste water treatment systems; percolation areas; septic tanks within 100 m of the boundary of an SAC site whose qualifying features include freshwater habitats/species. | |
| 1.8 | Construction within a floodplain of EU designated watercourse whose qualifying features include freshwater habitats/species. | |
| 1.9 | Crossing or culverting of rivers or streams within 1km of the boundary of any SAC whose qualifying features include freshwater habitats. | |
| 1.10 | Storage of chemicals hydrocarbons or organic wastes within 100 m of the boundary of an SAC whose qualifying features include freshwater habitats/species. | |
| 1.11 | Development of a large scale, within catchment of an EU designated watercourse or waterbody, which involves the production of an EIS. | |
| 1.12 | Development or expansion of quarries within catchment of an EU designated watercourse or waterbody.<br>. | |
| 1.13 | Development or expansion of windfarms within catchment of an EU designated watercourse or waterbody. | |
| 1.14 | Development of pumped hydro electric stations within catchment of an EU designated watercourse or waterbody. | |

| | | |
|---|---|---|
| **2** | **Impacts on designated wetland habitats (bog, heath, marsh, fen).**<br><br>**Sites to consider: Comeragh Mountains**<br><br>*Please answer the following if the answer to question 2 in table 2 was yes.*<br><br>*Does the development involve any of the following:* | |
| | ***Works inside the boundary of designated site*** | |
| 2.1 | All works within the boundary of an SAC whose qualifying features include heath, marsh, fen or bog, excluding small extensions/alterations to existing buildings. | |
| | ***Works outside the boundary of designated site*** | |
| 2.2 | Construction of roads or other infrastructure on peat habitats within 1km of any SAC whose qualifying features include heath, marsh, fen or bog. | |
| 2.3 | Development of a large scale within 1km of any SAC, whose qualifying features include heath, marsh, fen or bog, which involves the production of an EIS. | |
| ***3*** | **Impacts on designated intertidal and marine habitats (mudflats, sandflats, estuaries, reefs and sea cliffs).**<br><br>**Sites to consider: Tramore Dunes and Backstrand**<br><br>*Please answer the following if the answer to question 3 in table 2 was yes.*<br><br>*Does the development involve any of the following:* | |
| | ***Works inside the boundary of designated site*** | |
| 3.1 | All works within the boundary of any SAC whose qualifying features include intertidal or marine habitats, excluding small extensions/alterations to existing buildings. | |
| | ***Works outside the boundary of designated site*** | |
| 3.2 | Coastal protection works within 5km of any SAC whose qualifying features include intertidal or marine habitats. | |
| 3.3 | Development of piers, slipways, marinas, pontoons or any other infrastructure within 5km of any SAC whose qualifying features include intertidal or marine habitats. | |
| 3.4 | Dredging within 5km of any SAC whose qualifying features include intertidal or marine habitats. | |
| 3.5 | Works within 1km of any SAC whose qualifying features include intertidal or marine habitats, which will result in discharges to rivers or streams directly connected to the designated site. | |
| 3.6 | Infilling of coastal habitats within 500m of any SAC whose qualifying features include intertidal or marine habitats. | |
| 3.7 | Removal of topsoil or infilling of terrestrial habitats within 100m of any SAC whose qualifying features include intertidal or marine habitats. | |
| 3.8 | Development of a large scale within 1km of any SAC whose qualifying features include intertidal or marine habitats, which involves the production of an EIS. | |

| | | |
|---|---|---|
| **4** | **Impacts on other designated woodlands and grasslands** (woodland, upland grassland, lowland grassland, coastal grassland including dunes).<br><br>**Sites to consider:** Glendine Wood Nire Valley Woods, Ardmore Head, Helvick Head<br><br>*Please answer the following if the answer to question 4 in table 2 was yes.*<br><br>*Does the development involve any of the following:* | |
| | ***Works inside the boundary of designated site*** | |
| 4.1 | All works within the boundary of any SAC whose qualifying interests include woodland or grassland habitat types excluding small extensions/alterations to existing buildings. | |
| | ***Works outside the boundary of designated site*** | |
| 4.2 | Development within 200m of any SAC whose qualifying interests include woodland or grassland habitat types. | |
| 4.3 | Development of a large scale within 1km of any SAC, whose qualifying interests include woodland or grassland habitat types, which involves the production of an EIS. | |
| **5** | **Impacts on birds in SPAs**<br><br>**Sites to consider: Tramore Backstrand, Dungarvan Bay, Blackwater Callows, Blackwater Estuary, Helvick Head –Ballyquin Coast, Mid Waterford Coast**<br><br>*Please answer the following if the answer to question 5 in table 2 was yes.*<br><br>*Does the development involve any of the following:* | |
| | ***Works inside the boundary of designated site*** | |
| 5.1 | All works within the boundary of any SPA excluding small extensions/alterations to existing buildings. | |
| | ***Works outside the boundary of designated site*** | |
| 5.2 | Erection of wind turbines within 1km of any SPA. | |
| 5.3 | All construction works within 100m of any SPA. | |
| 5.4 | Infilling of coastal habitats within 500m of intertidal SPA. | |
| 5.5 | Works within 1km of coastal/wetland SPAs which will result in discharges to rivers or streams that are directly connected to designated sites. | Yes |
| 5.6 | Development of cycleways or walking routes within 100m of SPAs. | |



**Conclusion Table 3:** If the answer to all of the above is no or n/a, significant impacts on Natura 2000 sites can be ruled out. No further assessment is required, proceed to the Screening Conclusion Statement. If the answer to any question in table 3 is yes, you may require further information, unless you are satisfied that the project proponents have incorporated adequate mitigation into their design to avoid impacts on the Natura 2000 site (e.g. water pollution protection measures). Such information should be provided in the form of a Natura Impact Statement which should address the particular issues of concern as identified through the above.

**Table 4: Consideration of Potential Impacts on Protected Species**

Many of our Special Areas of Conservation are designated for species as well as for habitats. These are listed below, alongside the sites for which they are designated. Included is a short list of the types of activities which could have an impact on these species. Please tick if you are concerned that the proposed development could have an impact on these species.

| Species | Relevant Sites | Activites which could have impacts on species | Possible Impacts Identified? Y/N |
|---|---|---|---|
| Otter | Lower River Suir<br>River Blackwater<br>Waterford Estuary | Activities that interfere with river banks. | No |
| Bats (all species outside designated sites) | Blackwater River, Lower River Suir, Waterford Estuary<br>Glendine Wood, Lismore Woods Nire Valley Woods<br><br>Along with above, in general **all sites** with any of the following; woods, mature treelines and hedgerows, old buildings and bridges | Activities that result in loss of woodland or hedgerow habitat or causes disturbance to roost sites. Renovations of old buildings; R-epointing of old bridges. | No |
| Salmon | Lower River Suir<br>River Blackwater<br>Waterford Estuary | Activities that interfere with water quality, levels or the river bed; | No |
| River Lamprey | Lower River Suir<br>River Blackwater<br>Waterford Estuary | Activities that interfere with water quality, levels or the river bed; | No |
| Brook Lamprey | Lower River Suir<br>River Blackwater<br>Waterford Estuary | Activities that interfere with water quality, levels or the river bed; | No |
| Sea Lamprey | Lower River Suir<br>River Blackwater<br>Waterford Estuary | Activities that interfere with water quality or the river bed ï estuarine areas; | No |
| Twaite Shad<br>Allis Shad | Lower River Suir<br>River Blackwater<br>Waterford Estuary | Activities that interfere with water quality or the river bed ï estuarine areas; | No |
| White-clawed Crayfish | Lower River Suir<br>River Blackwater<br>Waterford Estuary | Activities that interfere with water quality or the river bed; | No |
| Freshwater Pearl Mussel | Lower River Suir<br>River Clodiagh<br>River Lickey<br>River Blackwater | Activities that interfere with water quality, levels or the river bed ; | No |
| Whorled Snail *Vertigo moulinsiana* | River Blackwater | Activities that result in loss of fen, marsh or wet grassland habitat within or close to the SAC. | No |
| Killarney Fern | Glendine Wood<br>Lismore Woods (River Blackwater) | Woodland clearance or other activities resulting in loss or disturbance to woodland habitat within the relevant SACs. | No |



**Conclusion Table 4:** If the answer to all of the above is no, significant impacts on species can be ruled out. If the answer to any of the above is yes, then further information is likely to be required in relation to potential for impact on that particular species. Where potential impacts on the above listed species are within designated sites, then further information should be sought in the form of a Natura Impact Statement. Where impacts are outside designated sites, then a species specific survey should be requested.

**Habitats Directive Screening Conclusion Statement**

| | |
|---|---|
| **Development Type** | Waste Licence Application |
| **Development Location** | Ballynamuck Middle, Dungarvan, Co Waterford |
| **Natura 2000 sites within impact zone** | Dungarvan Bay SPA |
| **Planning File Ref** | Reg No. W0032-03 |

**Description of the project**

Dungarvan Landfill site is located at Ballynamuck Middle, Dungarvan, Co Waterford north-east of the town of Dungarvan (Grid ref X 245 948). The principal land use around the landfill site is agricultural. The River Colligan flows in a west to east direction along the northern perimeter of the site before flowing beneath Ballyneety Bridge down the River Colligan Estuary into Dungarvan Harbour.

After 30 years of operation, Dungarvan landfill was closed and capped in 2003. The site now operates as an integrated waste management facility and closed landfill under EPA Licence Reg. No. 32-2.

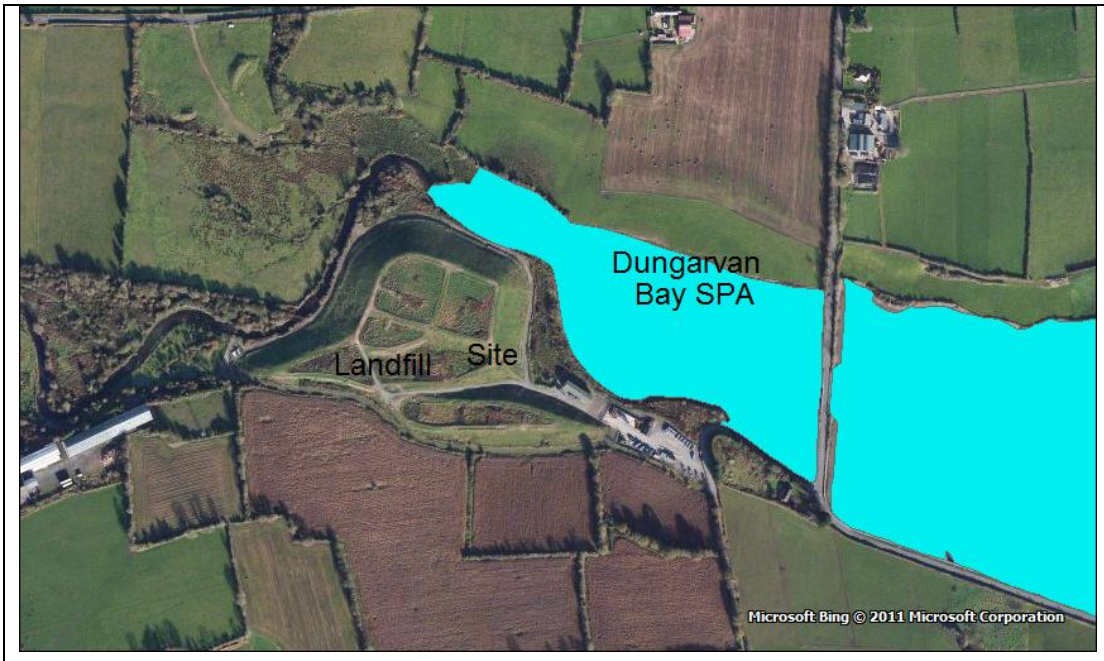
Dungarvan landfill consists of a capped mound that is now completely vegetated. A series of constructed wetland cells installed to collect and treat residual leachate in autumn 2008 now exhibit dense growth of submerged and emergent wetland vegetation.

The major landscape feature in the vicinity of the landfill is the River Colligan which flows along the northern perimeter of the site in a west to east direction.

**Describe how the project or plan (alone or in combination) could affect Natura 2000 site(s).**

## Background

Dungarvan Harbour is a significant wetland in County Waterford and is considered the 14th most important wetland site in Ireland and the second most important wetland in the South-East after Wexford Harbour. Dungarvan Harbour is recognised as a wetland of international importance under the Ramsar Convention of 1971 and was designated a Special Protection Area in 1994. The designated area (code 4032) covers an area of 2,219 hectares and extends along the River Colligan estuary as far upstream as Ballyneety Bridge. A similar area to the SPA is a designated Ramsar Site (Site Code 835). Appendix 2 details the site synopsis.




The conservation objective for the Natura 2000 site is to maintain the favourable conservation status of the qualifying interests of the SPA as follows:-

Great Crested Grebe (*Podiceps cristatus)* wintering
Light-bellied Brent Goose (*Branta bernicla hrota)* wintering
Shelduck (*Tadorna tadorna)* wintering
Red-breasted Merganser (*Mergus serrator)* wintering
Oystercatcher (*Haematopus ostralegus)* wintering
Golden Plover (*Pluvialis apricaria)* wintering
Grey Plover (*Pluvialis squatarola)* wintering
Lapwing (*Vanellus vanellus)* wintering
Knot (*Calidris canutus)* wintering
Dunlin (*Calidris alpine)* wintering
Black-tailed Godwit (*Limosa limosa)* wintering
Bar-tailed Godwit (*Limosa lapponica)* wintering
Curlew (*Numenius arquata)* wintering
Redshank (*Tringa tetanus)* wintering
Turnstone (*Arenaria interpres)* wintering



The favourable conservation status of a species is achieved when:
Åpopulation dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
Åthe natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
Åthere is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.
Appendix 1 details population trends for these bird species.

The conservation objective for the habitat is to maintain the favourable conservation condition of the wetland habitat in Dungarvan Harbour SPA as a resource for the regularly-occurring migratory waterbirds that utilise it. The permanent area occupied by

the wetland habitat should be stable and not significantly less than the area of 2,219ha, other than that occurring from natural patterns of variation.

Among the bird species occurring in numbers of conservation significance is Brent Goose. The race of Brent Goose that occurs in Ireland Light-Bellied Brent Goose (*Branta bernica hrota)* is listed under Annex II of the EU Birds Directive. Dungarvan Harbour supported a mean population of 1,185 Light-bellied Brent Geese between 2002 and 2010. The population at Dungarvan has increased since 2000 and has been fairly stable in recent winters at around 1,000 birds. The area supports two flocks of Brent Geese which tend to remain separate through the winter. The main flock which tends to be distributed around Dungarvan eastwards to the Kilminnin area and occasionally upstream along the Colligan River. The other flock is smaller; its activity is centred on Clonea area to the east of Dungarvan Harbour.

In order to inform this AA screening, a review of bird usage of the Ballyneety bridge and Shandon Island areas section of the SPA was carried out in order to closely assess the impacts of the landfill on the relevant birds that forage and or roost in and around this area. This was enabled by consulting Appendix 7- Waterbird distribution (dot-density diagrams) recorded during low tide surveys (October 2009- February 2010) in the NPWS Conservation Objectives Supporting Document for Dungarvan Harbour SPA (2011). The area corresponds with sub-site OM411-Ballyneety Bridge which has one of the lowest species richness of all the sub-sites within the SPA. No bird roost locations were recorded during the survey for this sub-site. The adjacent sub-site OM412 Shandon Island which is located to the east of Ballyneety Bridge is used by bird species such as Black-Headed Gull, Black-tailed Godwit, Curlew and Oystercatcher.

**Potential Impacts**

The potential impacts from the Dungarvan Landfill that may affect Dungarvan Bay SPA are contamination and water pollution in runoff to the Colligan River which flows into Dungarvan Bay.



**If there are potential negative impacts, explain whether you consider if these are likely to be significant, and if not, why not.**

Run-off from the landfill site to the River Colligan involves surface water drainage from the side slopes and the civic reception area and discharge from the leachate treatment system. Leachate is extracted from the borehole system, diluted to acceptable strength, and then passes through the series of five wetland ponds, before discharging to the leachate lagoon which is hydraulically connected to the Colligan River. A SCADA system controls the operation, and outlet monitoring records the discharge quality. Treated leachate from the final pond can be recycled back through the system. If the treated effluent achieves the discharge limit standards, it can be discharged to the River Colligan. If the sample is above the discharge limit values the flow is redirected to the dilution tank or Wetland Cell 1B. In this case, all leachate abstraction is ceased until the outlet sample comes back within standards.

As part of annual environmental monitoring the impact on the receiving water, the Colligan River, was assessed against EPAôs proposed Environmental Quality standards in Rivers in Ireland (EPA 1997), ñParameters of Water Quality Interpretation and Standardsò

and EU-Salmonid regulations (SI No 293 of 1988).

A review of EPA 2011Water Quality data[1] for the Colligan River indicates that water quality is of satisfactory quality ranging from Q4- Q4-5 with no change from 2010. Lower reaches are tidal. Biological assessment of the River Colligan at the location of the landfill was most recently carried out in 2009 and 2011, and suggested fair to good water quality sampling sites. Both stations SW1 and SW2 are subject to tidal influences and may at times be brackish, depending on river flow and tidal range, and this may have an influence on relatively lower Q-value scores for the river location at the landfill compared to the EPA stations upstream.

Assessment of impacts on the river water quality concluded that the Colligan River has ample assimilative capacity to receive large volumes of treated effluent from the leachate treatment system, but with some restriction based on allowable ortho-phosphate limits.

The application of EU Salmonid Regulations limits to discharge effluent along with the assimilative capacity of the receiving water and the SCADA monitoring system that controls the leachate discharge to the dilution tank and the river mitigate for any adverse impact on the receiving waters of the River Colligan, water quality in Dungarvan Bay and on the habitat of wintering birdlife for which the SPA is designated.

During 2012 an 2013 abundant frogspawn was noted in the wetland cells on the landfill reflecting an increasing biodiversity of the site. Data is being collected on Otter activity in the area and indicates active Otter use along the River Colligan. Frogspawn will be an important food source for Otters in the area. The presence of Otter indicates favourable ecological status of the River Colligan water corridor



**Conclusion of assessment**

Due to the low bird usage of this sub-section of the SPA and mitigation measures to control leachate effluent into the River Colligan from the landfill it can be concluded that there are no significant adverse impacts posed to Dungavan Bay SPA or the conservation status of the wintering bird species for which the site has been designated.

The development of wetlands and grassland on the landfill serves to enhance the ecological network of natural habitats surrounding the landfill including the River Colligan and adjacent areas of wet grassland, marsh, brackishwater and estuarine habitats.

Since 2008 with succession of habitats including establishment of 6 wetland cells, grassland and increasing scrub cover it is apparent that the site is demonstrating increased biodiversity value providing good feeding grounds for a variety of birds and some mammal and invertebrate species along with amphibians. The 2013 site visit observed an abundance of frogspawn in the wetland cells and 8 Snipe and 5 Moor Hen were noted whilst walking the site.

[1] EPA Integrated Water Quality Report South East Ireland 2011

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| Review of I-WeBs data indicates continuing favourable conservation status of Dungarvan Bay SPA for qualifying interests including Brent Geese and Bar-tailed Godwits.<br><br>Significant impacts can be ruled out and no further assessment is required. |
| **Documentation reviewed for making of this statement.** |
| *Dungarvan Harbour Special Protection Area Conservation Objectives Supporting Document* (NPWS 2011)<br><br>NPWS Site Synopsis Dungarvan Bay SPA<br><br>IWeBS Data for Dungarvan Bay ï Birdwatch Ireland |

| | |
|---|---|
| **Completed By** | Bernadette Guest |
| **Date** | 4th July 2013 |

## Appendix 1 Review of I-WeBs data

Dungarvan Harbour is a large, south-east facing circular bay, sheltered at its eastern extent, by Helvick Head to the south and Ballinacourty point to the north. The inner harbour is almost completely enclosed by the Cunnigar ï a linear sand spit extending from Ballynacourty North creating a sheltered environment. The Colligan, Brickey and Glendine rivers drain into Dungarvan Harbour. The absence of a large river system entering the harbour results in a mainly marine habitat in the area.

Large expanses of intertidal mudflat and associated wetland habitats of Dungarvan harbour are important feeding and roosting areas for migratory wintering wading birds and wildfowl. The presence of ñinternationallyò important populations of wintering waterbirds resulted in Dungarvan Harbour being designated a Special Protection Area. The qualifying interests for designation are internationally important wintering populations of Brent Goose, Black-tailed Godwit and Bar-tailed Godwit along with a range of other over wintering waterbird species.

Dungarvan Harbour is also a Ramsar site (Ramsar Convention) and recognised as an Important Bird Area (Birdlife International).

Waterbirds in Dungarvan Harbour are counted annually during winter as part of the Irish Wetland Bird Survey (I-WeBS). The count area includes the Colligan estuary as far upstream as Ballyneety Bridge. The review assesses recent waterbird data (2002/03- 20010/11) obtained from Birdwatch Ireland.

### Waterbirds that occur in internationally important numbers

Internationally important numbers of birds are those that correspond to 1% or more of the individuals in a population and threshold levels are based on population status as published in Wetlands International (2006).

Current data shows that Dungarvan Harbour supports two species in internationally important numbers- Light-bellied Brent Goose and Black-tailed Godwit. The average number of Bar-tailed Godwits is close to the International threshold. Although numbers show great variety between years the majority of years show wintering populations that surpass the international threshold.



| | 2002/03 | 2004/05 | 2005/06 | 2006/07 | 2008/09 | 2009/10 | 2010/11 | Mean |
|---|---|---|---|---|---|---|---|---|
| Light Bellied Brent Goose (International Threshold 260) | 531 | 948 | 1009 | 728 | 1,767 | 1,867 | 1,110 | 1,137 |
| Black-tailed Godwit (International Threshold 470) | 1608 | 559 | 800 | 155 | 1,248 | 1,458 | 1,648 | 1,068 |

**Table 1. Bird species that occur in numbers of international importance**

### Waterbirds that occur in nationally important numbers

A species that occurs in numbers that correspond to 1% or more of the individuals in the national population of a species or subspecies is said to occur in nationally important numbers. The current national threshold is defined by Birdwatch Ireland.

I-WeBS data (2002/03- 2008/09) shows that Dungarvan Harbour continues to support 10 species in nationally important numbers (based on average numbers over the past five available count years). Great-crested Grebe, Golden Plover, Grey Plover, Knot, Sanderling, Dunlin, Bar-tailed Godwit,

Redshank, Greenshank and Turnstone. Average numbers of Red-breasted Merganser, Oystercatcher, Ringed Plover, Lapwing and Curlew are close to the national threshold.

**Waterbirds that occur that are listed on Annex 1 of the EU Birds Directive (EU/709/409)**
During the winter months, Dungarvan Harbour supports four species that are listed on Annex 1 of the EU Birds Directive; Great Northern Diver, Little Egret, Golden Plover and Bar-tailed Godwit.

**Total waterbird numbers across Dungarvan Harbour**
The average number of total waterbirds found at Dungarvan Harbour (based on the six most recent winter counts) is 19,103. Dungarvan Harbour is currently considered the 14th most important wetland site in Ireland and the second most important wetland site in the south-east after Wexford Harbour.

| | 2001/02 | 2002/03 | 2004/05 | 2005/06 | 2006/07 | 2008/09 |
|---|---|---|---|---|---|---|
| Total wildfowl | 1,260 | 1,868 | 2,196 | 2,137 | 1,532 | 2,667 |
| Total waders | 18,115 | 21,196 | 18,943 | 16,817 | 12,208 | 15,599 |
| Total waterbirds | 19,375 | 23,064 | 21,140 | 19,136 | 13,743 | 18,266 |

**Waterbirds showing a trend for decrease and increase at Dungarvan Harbour**
The most recent I-WeBS data (2002/03-2010/11) show a possible trend for increase in Curlew and Bar-tailed Godwits. The data also shows a trend for decrease in Redshank and Little Egret, the latter having naturally colonised the south coast of Ireland and been steadily increasing in terms of both breeding and wintering numbers ever since. Similarly, Light-bellied Brent Geese have appeared to increase steadily in numbers in recent years having shown a decline in previous years.



| | 1998/99 | 1999/00 | 2001/02 | 2002/03 | 2003/04 | 2005/06 | 2006/07 | 2008/09 | 2009/2010 | 2010/2011 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Light-bellied Brent Goose** | 381 | 527 | 556 | 531 | 948 | 1009 | 728 | 1,767 | 1,867 | 1,110 |
| **Shelduck** | 335 | 573 | 176 | 560 | 371 | 376 | 333 | 314 | 269 | 399 |
| **Little Egret** | 4 | 6 | 14 | 5 | 17 | 14 | 12 | 9 | 9 | |
| **Oystercatcher** | 952 | 538 | 994 | 360 | 789 | 658 | 780 | 1,055 | 827 | 1,011 |
| **Lapwing** | 2323 | 910 | 3542 | 4092 | 2702 | 3125 | 1246 | 2,345 | 1,768 | 1,564 |
| **Dunlin** | 4923 | 1905 | 2737 | 5546 | 5050 | 3118 | 2138 | 3,763 | 3,150 | 1,381 |
| **Black-tailed Godwit** | 944 | 325 | 1129 | 1608 | 559 | 800 | 155 | 1,248 | 1,458 | 1,648 |
| **Bar-tailed Godwit** | 899 | 658 | 797 | 1892 | 1083 | 905 | 834 | 621 | 1,023 | 1,000 |
| **Curlew** | 659 | 935 | 926 | 507 | 566 | 461 | 481 | 502 | 659 | 763 |
| **Redshank** | 654 | 502 | 724 | 502 | 951 | 717 | 1206 | 1,339 | 1,023 | 802 |

**Light-bellied Brent Goose** ï has shown a trend for progressive increase at Dungarvan Harbour. This is consistent with the national trend (Crowe et al. 2008).

**Golden Plover** ï despite wide variation in annual indices, the site trend was reasonably stable or slightly increasing up to 2004/05. However, since 2004 numbers have dropped sharply.

**Dunlin** ï numbers have declined progressively at Dungarvan Harbour. This is in line with the national trend (Crowe et al.2008) and that evident in Northern Ireland and Britain (Calbrade et al. 2010).

**Bar-tailed Godwit –** site numbers showed a slight increase up to 2004/05 then declined and have showed an increase since 2008/09.

**Redshank –** although numbers fluctuated widely between some years, the smoothed trend highlights the relatively consistent increase in numbers across the data period.

**Red-breasted Merganser –** numbers of this species have fluctuated widely between years. A period of higher numbers in the years 1997/98 to 1999/00 was followed by a decline. However the short-term trend suggests some recovery.

**Oystercatcher –** exhibits a trend for consistent increase in numbers across the data period. Numbers recorded in 2008/09 and 2010/11were the highest since the data period began.

**Lapwing –** numbers have declined steadily which is consistent with the all-Ireland trend (Crowe et al. 2008).

**Knot –** numbers have fluctuated widely between years but the smoothed trend indicates a relatively stable site population across time with a recent increase; numbers recorded in 2007/08 and 2008/09 were the highest since the data period began.

**Appendix 2**

## SITE SYNOPSIS

## SITE NAME: DUNGARVAN HARBOUR SPA
## SITE CODE: 004032

In landscape terms Dungarvan Harbour lies at the eastern end of the River Blackwater valley, though this river now turns south at Cappoquin, vacating its more obvious (and former) course. The Colligan River, running south from the Comeragh Mountains, enters the bay by Dungarvan itself. The River Brickey flows from the west while the Glendine River flows into the harbour from the north. The absence of a large river means that the bay is essentially a marine habitat though it dries out at low tide to give extensive mud and sand flats. The inner bay 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.

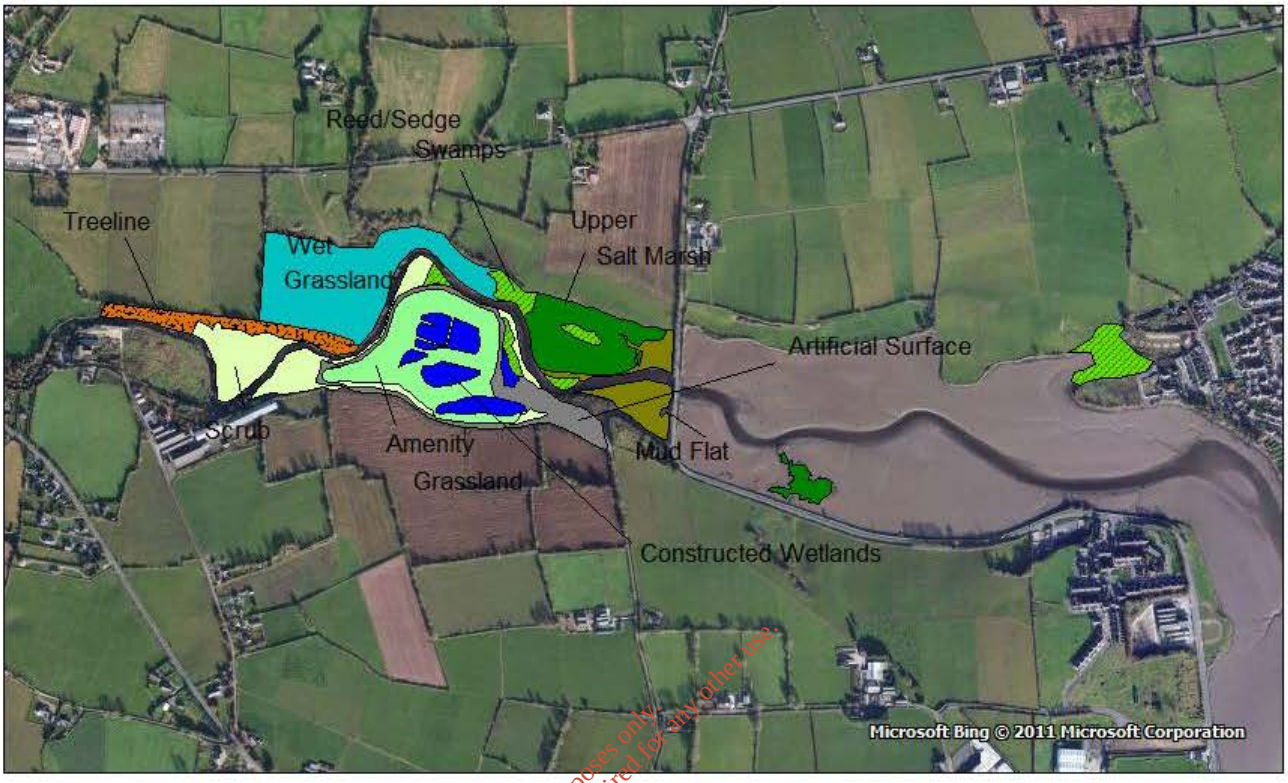
The rock type of most of the area is limestone though this is only exposed on flat rocks at Ballynacourty. Elsewhere saltmarsh, glacial drift and sand form the shore with a narrow stony beach in places. The most natural saltmarsh occurs at Kilminnin on the north shore and west of the Cunnigar on the south. 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 Club-rush (*Scirpus maritimus*) in drains. Sometimes this community gradually blends with a freshwater marsh including Tufted Hair Grass (*Deschampsia cespitosa*), Soft rush (*Juncus effusus*), Brown Sedge (*Carex disticha*) and Fleabane (*Pulicaria dysenterica*). Eelgrass (*Zostera* sp.) has been recorded in the area.

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 - 1986/87 and from 1994/95 onwards showed that Brent Goose (616 in 1995), Black-tailed Godwit (1329 [952 in 1996]) and Bar-tailed Godwit (1593 in 1996) occurred in numbers of international importance, while thirteen other species were nationally important. These are Shelduck (1721 [995 in 1995]), Wigeon (1015), Red-breasted Merganser (50), Grey Plover (359), Golden Plover (6100 in 1996), Lapwing (3775 in 1996), Knot (996 in 1996), Sanderling (83), Dunlin (6100 in 1996), Redshank (930 [910 in 1996]) and Turnstone (254). 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.

The sand flats to the east of the Cunnigar support extensive oyster farming operation. There is concern that displacement of waterfowl and disturbance may be a problem in the shellfish farming area.

Dungarvan Harbour SPA is of major conservation significance for the large numbers of many species of waterfowl that use it. The site regularly holds over 20,000 waterfowl and this qualifies the site as of International Importance. Two species that occur in important numbers are listed on Annex I of the E.U. Birds Directive, i.e. Bar-tailed Godwit and Golden Plover.

## Appendix 3 Habitat Map of Dungarvan Landfill and Environs



# APPENDIX 3

# REPORT 'LEACHATE ABSTRACTION AND TREATMENT SYSTEM – DESCRIPTION AND PERFORMANCE' (JULY 2013)

# Dungarvan Landfill Remediation Works

## Leachate Abstraction and Treatment System – Description and Performance

# DOCUMENT CONTROL SHEET



| | | | | | | |
|---|---|---|---|---|---|---|
| Client | Waterford County Council | | | | | |
| Project Title | Dungarvan Landfill Remediation | | | | | |
| Document Title | Leachate Abstraction and Treatment System – Description and Performance | | | | | |
| Document No. | MDR0450Rp1030 | | | | | |
| This Document Comprises | DCS | TOC | Text | List of Tables | List of Figures | No. of Appendices |
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| | | | | | | |
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Consulting Engineers

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# 1 INTRODUCTION

## 1.1 GENERAL

This document presents a description of the Leachate Abstraction and Treatment System completed at Dungarvan Landfill in 2012, together with results of its performance to date. System process proving commenced on 24/09/2012, and has been operating for just over 9 months at the time of writing.

This report has been prepared by RPS Consulting Engineers on behalf of Waterford County Council and should be read in conjunction with the following documents:

1. Closure Restoration & Aftercare Management Plan (January, 2008)
2. Report on Response to EPA on Request for Information on Leachate Treatment (August 2008)
3. Waste Licence W0032-02
4. Dungarvan Landfill Remediation Works - Final Construction Report (December 2012)
5. Leachate Abstraction and Treatment System - Design and Operation Manual (December 2012)



## 1.2 SITE REMEDIATION BACKGROUND

Works to remediate the landfill commenced in July 2007 and the landfill site was completely capped in accordance with the Waste Licence in September 2008. A series of Integrated Constructed Wetlands (ICW) were developed on top of the landfill as part of the capping works. The purpose of the ICWs is to treat the leachate generated at the landfill and also to provide a possible future public local amenity area.

A combined landfill gas and leachate extraction system was installed where gas and leachate are collected from a common set of collection wells. A series of leachate collection pipework and pumps relays leachate to the wetlands, while the landfill gases generated within the landfill body itself are collected by the landfill gas management system and flared off. Wellheads are adapted to accept both gas control valves and leachate pump. In total, 23 wells were installed and it was designed that a total of 9 wells would be used for leachate extraction.

The ICWs and the extraction system are shown on Figure 1 and Drawing DG0606, and all works including the leachate extraction, ICW treatment system, gas extraction, and flare system are complete. A Supervisory Control and Data Acquisition (SCADA) system controls and collects information on the leachate system e.g. pumps on/off/alarms, flow rates, leachate quality and flow trends.

*Pond 3 in 2009 while the reeds were still establishing*



A leachate interceptor drain was laid along the northern boundary as shown on Drawing DG0606. The drain comprises slotted HDPE pipes laid in a gravel surround and any leachate collected in the drain is directed towards a leachate pump sump where it is also pumped to the ICW for treatment. In addition, leachate from the old leachate drains beneath the landfill, leachate from the leachate cut-off drain at the toe of Pond 4 and leachate and washings from the waste transfer station drain, including those from the septic tank and first flush storm system in the civic amenity area are collected in the pump sump and directed to the ICW for treatment.

A temporary leachate abstraction and treatment system was commissioned in May 2010 in order to test the system, operating using two leachate wells out of nine, and this operated successfully until March 2012 when it was decommissioned to make way for the full system. A summary of results is presented in this report. The last remaining element of work, the full leachate abstraction and control system, was completed in September 2012, and thus all works required to remediate the landfill are complete. Full details can be found in Dungarvan Landfill Remediation Works - Final Construction Report (December 2012) and associated drawings.

*The River Colligan and bank protection works at the landfill*



Figure 1 Overview of leachate abstraction and treatment system

## 1.3 WASTE LICENCE REQUIREMENTS

Waste licence W0032-02 specifies the following in relation to management of leachate and trade effluent:

Condition 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 x $10^{-9}$ $ms^{-1}$ overlain by a 2mm thick high density polyethylene (HDPE) layer. The side walls shall be designed and constructed to achieve an equivalent protection.



Condition 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.

3.15 Waste Inspection and Quarantine Areas

3.15.3 Drainage from the quarantine area shall be directed to the leachate management system.

3.17 Compost facility

1.17.1 (b) All wastewater from composting operations shall be collected and reused 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.

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.

B.3. Emissions Limits for Treated Leachate Discharged to Surface Water

To be agreed by the Agency in advance

Schedules C2.3 Leachate Monitoring and C6 Receiving Water Monitoring are also relevant.



*View from pond 5 at the landfill looking down towards the tidal estuary on the left, waste transfer station and civic amenity site, lagoon in forefront and green leachate system control house*

# 2 LEACHATE GENERATION AND ABSTRACTION

## 2.1 OVERVIEW

Since the site has been capped with a geomembrane liner in 2008, ongoing leachate generation due to infiltration of rainfall is assumed to be negligible, approximately 2% of precipitation. However, as the site is unlined, groundwater will contribute to some leachate generation as will some leachate disperse into groundwater. In addition the waste body will retain some reservoirs of leachate particularly between the layers of clay that would have been placed historically as daily cover. Assessments of leachate volumes at the landfill site had been made at several stages during the design process, including:

- In 2008 during abstraction and ICW systems design, as summarised in *Report on Response to EPA on Request for Information on Leachate Treatment (August 2008)*
- In 2010 in the report: *Leachate System Status and Design Update Report*

The following sections summarise and update the findings.

## 2.2 LEACHATE LEVEL MONITORING RESULTS

Leachate levels in the extraction wells were recorded from 2008 to 2012. The results show that the average leachate level at the site has decreased since the site was capped in 2008 from 7.74 to 5.85 in 2012. The leachate levels for each year 2008-2011 were also plotted at their well locations across the site and a contour map showing the leachate head for each year was prepared as shown on Figure FG0010. The contour maps show that the main body of leachate in 2008 is located in the centre of the landfill. However, since 2008, the main body of leachate has reduced in size and in 2011 is concentrated to the north of the site with a leachate head of approximately 6-8mOD. There is also another body of leachate in the south east of the site with a leachate head of approximately 5mOD. It should also be noted that the leachate head in GW2 has reduced significantly since extraction commenced at this well in May 2010.



Leachate levels are also monitored at leachate monitoring wells every month, however several of these monitoring wells were damaged from 2007-2011 when they were re-drilled, so results are limited.

## 2.3 LEACHATE WELL PUMPING TRIALS

Pumping trials were undertaken at three extraction wells (CW3, CW5, GW2) in April 2010 and at eight extraction wells in September 2010 (CW3, CW5, CW6, GW3, GW1, GW13, CW8, CW4). The testing was carried out using a 1-2 $m^3$/hr borehole pump. The leachate head in each well was taken before and after the test, and then again either later that same day or the following day. Test duration and flows were recorded.

**Table 2.1:** Pumping Trial Results

| Well | Duration Hrs | Approximate Flow m3 (total) | Drawdown | Recovery |
|---|---|---|---|---|
| **CW3** | 0.50 | 0.2 | Poor drawdown | limited recovery in 24 hours |
| **GW2** | 2.00 | 3 | Good drawdown | recovery in 12 hours |
| **CW5** | 0.15 | 2.3 | Good drawdown | recovery in 24 hours |
| **GW6** | 2.00 | 9 | Excellent drawdown | recovery in less than 24 hrs |
| **GW3** | 0.50 | 0.9 | Poor drawdown | recovery in 24 hours |
| **GW1** | 2.1 | 9 | Good drawdown | recovery in less than 24 hrs |
| **GW13** | 0.80 | 1.9 | Good drawdown | recovery in 24 hours |
| **CW8** | 0.30 | 0.8 | Poor drawdown | limited recovery in 24 hours |
| **CW4** | 0.52 | 0.9 | Poor drawdown | limited recovery in 24 hours |

As described in Section 4, a partial leachate extraction system was operated from May 2010 to March 2012, and this utilised GW2 from May 2010 and GW6 from October 2010. GW2 pumped on average 1 $m^3$/d and GW6 1.4 m3/d.

It should be noted that although leachate extraction wells exist in areas with a high leachate head, some wells will be more productive than others due to factors such as the permeability of the surrounding waste or potential clogging of the wells.



Well pumping during the nine months of the full abstraction system (September 2012 to June 2013) has confirmed that well yields are highly variable, and generally quite modest. The long term yield of the well system will become evident over time. The current estimate is that approximately 5 m3/d will be achievable with the current set of nine wells. Three replacement wells were drilled in 2011 due to problems with settlement interfering with the existing wells, ensuring sufficient areal coverage / zone of influence is maintained. It is possible that the age of the landfill and settlement over the years has resulted in a highly compacted fill, with limited yields. However, as discussed in following sections, leachate strength is quite high.

## 2.4 LEACHATE WELLS SELECTED

Based on the monitoring and test pumping results, the following wells were selected for leachate abstraction:

GW1, GW2, GW4, GW5, GW6, GW7, GW13, CW1, and CW2

These wells are located to reduce the leachate head in the two areas where the leachate head is highest.

## 2.5 LEACHATE DISPERSION

Results from the 2012 Annual Environmental Report, show that groundwater wells located to the east and west of the facility are not affected by leachate contamination and surface water monitoring results are satisfactory.

## 2.6 PREDICTED LEACHATE GENERATION

Using the EPA's water balance calculation provided in the Landfill Manual on Site Design, a further leachate generation calculation was undertaken based on the long term mean annual rainfall and assuming a water infiltration rate through the liner of 2% reflecting a welded UDPE liner installed under a strict CQA regime. The area of the landfill is approximately 7 hectares with a waste/lined area of 5.34 Ha.

**Table 2.2** Estimated Leachate Generation in 2010 at Dungarvan Landfill

| Restored Area subject to leachate Extraction | Mean Rainfall | Evapo-transpiration (assuming 650) | Effective Rainfall | $m^3$/year based on 2% Infiltration |
|---|---|---|---|---|
| 53,400 | 1207 | 650 | 557 | 595 (approx. 50$m^3$/month) |



Therefore, based on the above calculations, it can be expected that approximately 50 $m^3$/month (approximately 1.67 m3/d) of leachate will be generated from infiltration. However, this does not take into consideration any groundwater influence. This low level of leachate generation explains why the leachate head has reduced since the site was capped in 2008.

## 2.7 LEACHATE ABSTRACTION VOLUMES

The objective of the full abstraction system is to abstract leachate and therefore reduce the leachate head across the landfill. Section 2.3 showed that leachate levels were at an average of just under 6 mOD in 2012, and this compares to an average surrounding groundwater level of 1-2 mOD, and a waste bottom level of 1-2 mOD.

The full waste area of the landfill is 5.34 Ha, with an estimated 25% saturation. It is estimated that an area of 5000 m2 has an extractable head of 5m, another 10,000 m2 has an extractable head of 2m, and the remaining area of 38,400 m2 has a possible extractable head of 1m, depending on leachate head pathways and pumping zones of influence, giving a total leachate volume of 20,850 m3.

Taking into account the well yields discussed in Section 2.3, it is estimated that 5 m3/d of leachate can be abstracted from the landfill, and allowing that 1.67 m3/d is infiltration recharge, thus it would take 17 years to finish abstraction. However, given the gradually falling leachate head, this period may be shorter.

Overall, it can be said that well leachate abstraction rates are variable, quite modest, and the total volume and time needed is uncertain. In any case, once abstraction and treatment continues, the system is performing its function.

## 2.8 LEACHATE STRENGTH AND OTHER POLLUTED ARISINGS

Polluted arisings come from the following sources, and are all directed to the ICW for treatment:

1. leachate from the waste body
2. Leachate from the cut-off drain around the landfill
3. leachate from the old leachate drains beneath the landfill
4. leachate from the leachate cut-off drain at the toe of Pond 4
5. leachate and washings from the waste transfer station drain, the septic tank and first flush storm system in the civic amenity area, all collected in a pump sump
6. Well RC8A – this well is adjacent to the main body of waste, and occasionally has an elevated ammonium concentration as well as other pollutants

Ammonium concentrations were recorded between June and December 2010 at GW2, the leachate collector pump sump, and well RC8A. Ammonium is the primary parameter of concern in regards to ICW treatment of leachate and important in terms of discharge to river.

Ammonium concentrations in GW2 varied from 2,500 to almost 4,000 mg/l $NH_4$. One result of 470 mg/l $NH_4$ (not shown on graph) was available at GW6.

Initial concentrations at RC8a were in the 100-300 mg/l range when tested in June to September 2010, but levels reduced to average 90 mg/l following continual pumping from October 2010 onwards.

Similarly, ammonium concentrations at the leachate collector pump sump ranged from 500-1500 mg/l when tested in June to September 2010, but levels reduced to average 110 mg/l following continual pumping from October 2010 onwards.



## 2.9 TOTAL LOADINGS ARISING FROM LEACHATE AND OTHER POLLUTED SOURCES

The following lists the estimated loadings from the various polluted sources directed to the ICW for treatment:

Leachate from the waste body – estimated at 5 m3/d and a maximum of 2500 mg/l ammonium. Likely average case scenario is 5 m3/d at 1500 mg/l.

Leachate from the pump sump, comprising the cut-off drain around the landfill, leachate from the old leachate drains beneath the landfill, leachate from the leachate cut-off drain at the toe of Pond 4, leachate and washings from the waste transfer station drain, including those from the septic tank and first flush storm system in the civic amenity area, all collected in a pump sump:

– this averaged 9.4 m3/d during the partial system period in 2010/11. The estimated maximum during design was 20 m3/d at a maximum of 150 mg/l ammonium. The likely average case scenario estimated was 15 m3/d at 110 mg/l.

Well RC8A – the degree of pumping from this well is decided by the operator, with a maximum possible of 48 m3/d. The maximum case considered was 20 m3/d at 150 mg/l ammonium, and the likely case scenario was 20 m3/d at 100 mg/l.

In the case of the pump sump and well RC8A, previous results indicate that a higher pump rate coincides with slightly lower concentrations.

Thus the following table summarises the estimated maximum and average loadings case scenarios:

**Table 2.3** Estimated maximum and average loadings case scenarios (design)

| Source | Maximum loading | | | Likely average loading | | |
|---|---|---|---|---|---|---|
| | m3 | ammonium mg/l | Kg/d | m3 | ammonium mg/l | Kg/d |
| Leachate from the waste body | 5 | 2500 | 12.5 | 5 | 1500 | 7.5 |
| Leachate from the pump sump | 20 | 150 | 3.0 | 15 | 110 | 1.7 |
| Well RC8A | 20 | 150 | 3.0 | 20 | 100 | 2.0 |
| Total | 45 | | 18.5 | 35 | | 11.2 |



The ICW treatment system can provisionally cope with 186 m3/d at 100 mg/l, equivalent to 18.6 kg/d of ammonium, pending process proving and satisfactory performance.

## 2.10 CONCLUSIONS & RECOMMENDATIONS

The following conclusions can be made from the above leachate generation and abstraction assessment:

- The leachate head at the site has reduced since the site was capped in 2008 (as shown on Figure FG0010).

- The main body of leachate is concentrated to the north of the site with a smaller pocket in the south west of the site.

- Well leachate abstraction rates are variable, quite modest, and the total volume and time needed is uncertain. In any case, once abstraction and treatment continues, the system is performing its function. The current estimate is that 5 m3/d will be achievable with the current set of nine wells.

- Leachate strength from the wells appears to be quite strong, with results varying from 470 mg/l ammonium to almost 4000 mg/l. This must be accommodated in treatment operations.

- The estimated loadings from all polluted sources directed to the ICW for treatment is estimated at 18.5 kg/d and 11.2 kg/d, respectively, for maximum and average loading case scenarios, in terms of the key parameter ammonium. The treatment system can provisionally cope with 18.6 kg/d of ammonium, pending process proving and satisfactory performance.

The following recommendations were made based on these conclusions:

- the following wells were selected for leachate abstraction: GW1, GW2, GW4, GW5, GW6, GW7, GW13, CW1, and CW2

- Continue leachate level monitoring at all other extraction & monitoring wells in order to assess the reduction in leachate head across the landfill.

- Examine leachate extraction rates for each of the extraction wells on a monthly basis to determine the ongoing effectiveness of wells to reduce the leachate head. Leachate wells can become clogged over time, which would affect the effectiveness of the wells.

- Examine surface water and ground water quality monitoring results on a quarterly basis to understand the extent of any off site contamination.

- The pollutant loading characteristics must be taken into account during control system design and operation to ensure consistency with ICW treatment capacity

# 3 INTEGRATED CONSTRUCTED WETLANDS TREATMENT SYSTEM

## 3.1 OVERVIEW

The leachate treatment system at Dungarvan landfill utilises a set of ICW's. Leachate is extracted from the borehole system, diluted to acceptable strength, and then passes through the series of five wetland ponds, before discharging to the leachate lagoon (which is hydraulically connected to the Colligan River). A SCADA system controls the operation, and outlet monitoring records the discharge quality. Treated leachate from the final pond can be recycled back through the system.

Waterford County Council worked in conjunction with Dr Rory Harrington, Senior Scientist/Programme Manager, Integrated Constructed Wetlands Initiative, Department of Environment, Heritage and Local Government, to develop an 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).

A report, *Response to EPA on Request for Information on Leachate Treatment* was produced in August 2008 containing 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.



The following sections reiterate the above report, updating and adding as appropriate to the final design and construction of the treatment system ICW's.

## 3.2 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.

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.

## 3.3 WETLANDS DESIGN SIZING PRINCIPLES

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 18,650m$^2$, slightly less (9%) than the design target of 20,500m$^2$ due to construction space constraints. Sizing of ICW is typically based on an average requirement of 100m$^2$ per 1m$^3$ through-flow of diluted leachate per day; this would equate to a maximum daily loading of 186m$^3$.

## 3.4 BRIEF OVERVIEW OF SYSTEM

The ICW consists of a series of six wetland ponds (pond 1 is split into two: ponds 1A and 1B) 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. A leachate dilution tank, leachate collection pipework, and monitoring equipment are operated in tandem with the wetlands themselves to ensure that the system operates as designed. See drawing DG0706 for an overview of the system.

Leachate abstracted from the site via the leachate abstraction boreholes is pumped to the Dilution Tank. Monitoring equipment in this tank analyses the leachate and determines the concentration of ammonium and therefore whether dilution of the leachate is required or not. The maximum concentration of ammonium allowable is 100mg/l, to prevent shock loading of the wetland plants at the inlet point.

If dilution of the leachate is required water from the recycle sump (pond 5 discharge water) or water from the dilution well is used to dilute the leachate to the required concentration in the tank before being pumped to the wetland system. If no dilution is required the leachate will be pumped directly from the tank to the wetland system.



Once leachate is discharged to the wetland system it flows sequentially through Ponds 1-5 before being discharged to the recycle sump at the outlet of pond 5. The treated leachate is monitored in the sump before recycle or discharge. The control system may be set so that the majority or all treated effluent is recycled as dilution water or back to pond 1B, and thus little or no discharge occurs, or to recycle a minimum and allow discharge, provided the effluent meets standards. Heavy rainfall events will first result in a level rise and retention within the ponds, together with increased recycle flows to pond 1B if so set, and then finally discharge to the leachate lagoon (which is hydraulically connected to the river).

## 3.5 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 recycle sump for monitoring and either recycle to the ponds or discharge to the leachate lagoon (which is hydraulically connected to the Colligan River). The flow is regulated through the wetlands to ensure adequate retention time is achieved within the ponds before being monitored prior to discharge. A SCADA system controls flows to the ICW, leachate dilution tank and sumps, and outlets, and regulates flows based 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.

**Leachate Flow:**

The leachate flow is monitored and regulated by means of a series of tank/sumps, pipework and monitoring systems. The monitoring results are relayed back to the software system which is stored in the control building and dependent on these results the leachate is either discharged to the leachate lagoon (which is hydraulically connected to the Colligan River) or back into the wetland system. This is discussed in more detail in Section 3.8.

**Dilution Tank and recycle sump:**

The dilution storage tank is an above ground glass-fused-to-steel tanks which is constructed to BS 7543:1992 and ISO 15686. It has a nominal capacity of 25m$^3$ and an effective working volume of 20 m3 including for overflow and freeboard. The tank is bunded to 110% of the total liquid volume.

The recycle sump at pond 5 is a buried concrete ring type construction with a nominal capacity of 3.8 m3 and an effective working volume of 3 m3 including for overflow and freeboard.

**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 angustafolia* (lesser reedmace), *Scirpus lacustris* (bulrush), *Iris pseudacorus* (yellow flag iris) and *Sparganium erectum* (burreed). The planting density is approximately 1 plant / 0.6m$^2$.



## 3.6 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 dilution well.

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 has/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.



### 3.6.1 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 is of ample size to cope with this level of rainfall.

### 3.6.2 Procedures in the Event of Non-Operation of the System

Routine caretaking and troubleshooting is carried out several times per week, with text-out warning for key events such as any equipment malfunction. As part of the SCADA control system a maintenance contract is entered into with the system supplier. This contract includes a quarterly systems check and will also include for emergency call outs in the event of non-operation of the SCADA control system.

The control system has significant self-diagnostic and emergency provisions that automatically shuts down abstraction of leachate and attempts to recycle treated effluent in the event of effluent non-compliance or equipment failures. All such events and failures are alarmed to the operator. The key pumps at the dilution tank and recycle sump are dual provisioned, duty/standby. In the event that effluent cannot be recycled automatically (e.g. during heavy rain or because of multiple pump failures), then the operator can manually adjust the pond outflow to retain a large additional volume as described below.

With regard to the wetland itself the monitoring detailed in section 3.16 of this report will ensure that any operational issues are identified early and that suitable remedial works are undertaken.

### 3.6.3 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 control or monitoring system having failed
2. The wetland cell walls having failed or having been overtopped.
3. One of the tanks/sumps having failed.

In the event that the control or monitoring system has failed and effluent cannot be recycled automatically (e.g. during heavy rain or because of multiple pump failures), then the operator can manually adjust the pond outflow to retain a large additional volume as described below.

In the event that the control system is not at fault, the wetland walls and tanks/sumps 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.

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. The dilution tank is a glass fused to steel and has been constructed to BS 7543:1992 and ISO 15686. A reinforced concrete base provides a stable platform for each tank. As discussed in the section above, a maintenance contract is entered into with the suppliers of the monitoring system ensuring that the system is regularly inspected and tested.



## 3.7 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.

## 3.8 SUMMARY MODE OF OPERATION OF CONTROL SYSTEM

A full description on operation of the control system is detailed in Section 5. The following summarises the process:

1. Leachate is extracted from the 9 combined wells and pumped to the leachate-balancing and dilution tank.

2. Once a certain level has been reached in the tank, 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 the tank, the feed source pump will pump water from the recycle sump or dilution well to dilute the leachate sample to the required $NH_4$ concentration of less than 100mg/l $NH_4$.
4. Once the required dilution has been achieved, the diluted leachate is pumped to Wetland cell 1A.
5. The diluted leachate flows sequentially through each of the five ponds.
6. Flow from the last wetland cell (pond 5) discharges to a recycle sump. The concentration of the treated effluent is continuously monitored to determine the concentration of $NH_4$.
7. The control system may be set so that the majority or all treated effluent is recycled as dilution water or back to pond 1B, and thus little or no discharge occurs, or to recycle a minimum and allow discharge, provided the effluent meets standards.
8. When sufficient rainfall causes increased flow through the ponds system, such that the retention and balancing of the ponds and recycle pumping system is exceeded, then the control system gradually opens an actuated valve to discharge, or the overflow level in the sump allows discharge at even higher flows.
9. 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 tank or Wetland Cell 1B. In this case, all leachate abstraction is ceased until the outlet sample comes back within standards, the actuated valve closes thus raising pond 5 water levels and maximising storage therein, and recycle pumping to pond 1B is maximised.
10. In the event of an emergency whereby the effluent is above standards, and the retention and balancing of the ponds and recycle pumping system is exceeded, there is provision to allow manual adjustment of the pond outlets to further retain effluent, thus bringing into effect significant additional storage volume using the available freeboard. The outlets should be lowered following this event, to ensure security of the ponds from overtopping.



## 3.9 FLOW VOLUMES

As the concentration of leachate within the landfill varies considerably; the concentration of leachate within the dilution tank determines the dilution required and consequently the volumes of diluted leachate to be treated. Table 3.1 below illustrates the flow volumes through the system for various abstraction rates from the landfill, under average rainfall/P.E. conditions.

**Table 3.1: Leachate Mass Balance**

| Leachate Abstracted ($m^3$/d) | Leachate sump and RC8A[1] ($m^3$/d) | Plus Dilution Water[2] ($m^3$) | Plus Precipitation[3] ($m^3$) | Less P.E.[4] ($m^3$) | Flow ($m^3$/day) |
|---|---|---|---|---|---|
| 1 | 30 | 15 | 49.2 | 32.9 | 62 |
| 2 | 30 | 30 | 49.2 | 32.9 | 78 |
| 3 | 30 | 45 | 49.2 | 32.9 | 94 |
| 5 | 30 | 75 | 49.2 | 32.9 | 126 |
| 8 | 30 | 120 | 49.2 | 32.9 | 174 |
| 9 | 30 | 135 | 49.2 | 32.9 | 190 |

**Note 1:** Average leachate strength and volumes are considered
**Note 2:** A dilution factor of 15 has been assumed using an average $NH_4$ level of 1500mg/l in the raw leachate based on analysis of the leachate within the landfill.
**Note 3:** Precipitation has been taken from Rosslare weather station. The annual total has been distributed evenly throughout the year.
**Note 4:** Potential evapotranspiration has been taken from Casement Aerodrome and has been distributed evenly throughout the year.

Leachate analyses from monitoring points and abstraction wells show that concentrations of ammonium range from 210 mg/l to 3900 mg/l. The plants being used in the system can tolerate levels of ammonium up to 100mg/l. In addition, the ICW system has a hydraulic design load of 186 m3/d. At the upper end of leachate concentrations, the capacity to dilute becomes a factor when the hydraulic capacity of the ICW is considered, for example, at 2000 mg/l the maximum capacity is 7.8 m3/d of raw leachate, or at 4000 mg/l the maximum capacity is 3.9 m3/d of raw leachate. However, it is not considered likely that all wells would produce very high strength leachate, and even if this occurred, the leachate daily volume estimate is approximately 5 m3/d, and thus the treatment system is adequately sized.



## 3.10 POND CAPACITY, FLOW HYDRAULICS, AND FREEBOARD

The available surface area in the six wetland cells is approximately 18,650$m^2$. 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 3,700$m^3$ with a maximum capacity of 13,000$m^3$ 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 | 123 |
| 50 | 74 |
| 70 | 53 |
| 100 | 37 |
| 150 | 25 |
| 190 | 19 |

* Based on normal capacity of 3,700$m^3$, includes average precipitation less evapotranspiration.

**Table 3.2: Retention Times of the ICW**

The wetlands system together with the connected dilution and discharge tank must not overflow due to operational or rainfall events. Taking a 100 year design return period, the expected maximum one day rainfall is 75mm, increasing to 100 mm to allow for climate change. The expected maximum intensity rainfall is 200mm/hr in 2 mins, total 6.7 mm, allow 8mm.

The pond level is controlled by the inter-pond gravity pipe at higher flows (the inlet is a vertical pipe). The following table illustrates the system hydraulics.



**Table 3.3 Tank and inter-pond flow hydraulics**

| | Area | Operational depth | Freeboard | Total Depth | Min outfall gradient | Pipe size | Max outflow | Max outflow | Max outflow | |
|---|---|---|---|---|---|---|---|---|---|---|
| | m2 | mm | mm | mm | | mm | l/s | m3/hr | mm/hr | |
| Dilution tank | 9.16 | 2000 | 300 | 2634 | RM | 90 | 5.6 | 20.0 | 5 | into pond 1A |
| Pond 1A | 4219 | 200 | 500 | 700 | 1 in 70 | 160 | 25 | 90.0 | 25 | into pond 1B |
| Pond 1B | 3535 | 200 | 500 | 700 | 1 in 70 | 160 | 25 | 90.0 | 61 | into pond 2 |
| Pond 2 | 1485 | 200 | 500 | 700 | 1 in 100 | 160 | 26.5 | 95.4 | 47 | into pond 3 |
| Pond 3 | 2014 | 200 | 500 | 700 | 1 in 150 | 160 | 18 | 64.8 | 16 | into pond 4 |
| Pond 4 | 3962 | 200 | 500 | 700 | 1 in 150 | 160 | 12.4 | 44.6 | 13 | into pond 5 |
| Pond 5 | 3430 | 200 | 500 | 700 | 1 in 70 | 160 | 25 | 90.0 | 35433 | into recycle sump |
| Recycle sump | 2.54 | 2200 | 800 | 3000 | 1 in 100 | 160 | 23 | 82.8 | n/a | into lagoon |

With a standard 160mm pipe connecting each pond, and the final discharge from pond 5 to the lagoon, the pass forward flow is limited to between 18 and 26 l/s by the capacity of the gravity pipe connection.

The table shows the corresponding equivalent in mm/hr rise in the next pond, varying from 13 mm/hr from pond 4 to pond 5 (i.e. pond 5 rises by 13 mm/hr), to 61 mm/hr from pond 1B to pond 2 (the smallest pond). Practically, once the outflow level is reached, flow will commence to the next pond and the rise in level will slow and eventually drop as rainfall and flows reduce. The restrictions on outflow are beneficial in terms of treatment retention and flow balancing across the system.

The worst case scenario concerns the 100 year event discharging through the pond system at maximum capacity. Each pond has a freeboard of 500mm, and calculations show that one day rainfall of 100mm and 1 hour rainfall are within the storage capacity. In a scenario where pond 5 outflow is throttled, a simple calculation with no account for rainfall profile gives a maximum input to pond 5 of 100mm rainfall falling on all ponds plus 200 m3 of diluted leachate, inputting at 19 mm/hr (18 l/s) from pond 4 plus direct rainfall, and assuming a worst case of 5 mm/hr (5 l/s) outflow presuming some restriction/blockage (actual is 23 l/s). The maximum rise at pond 5 would theoretically be 290mm, within freeboard. In reality, the event profile and characteristics of the ponds outlets would cause each pond to rise and discharge more slowly than this simple model allows, and therefore the actual rise in level would be less.

It is notable that the pond 3 to pond 4 connection showed an apparent maximum flow of 6.5 l/s during flow monitoring in 2011-12, as presented in Section 4. There possible that the flat section of this pipe along pond 4 could cause this low maximum capacity, and this could possibly cause flooding problems in extreme events at pond 3. However results are as yet limited, in the interim the pond will be monitored closely and further flowmeter data will be analysed.

Thus the tank, ponds, and discharge pipework, together with the ponds freeboard, are designed adequately to cope with the envisaged flows, including severe rainfall events.



## 3.11 TREATMENT PROCESS

### 3.11.1 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.

### 3.11.2 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.

### 3.11.3 Pollutant loadings and removal

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 within the landfill over the last three years are indicated in the table below.

**Table 3.4: Pre-Treatment Leachate Analysis Data**

| Parameter | Leachate | Sump | RC8A | Typical Leachate Analysis (EPA, 1997) |
|---|---|---|---|---|
| Ammonium mg/l N | 490 - 3900 | 10 - 1465 | 10 - 280 | 453 |
| BOD mg/l $O_2$ | 200 - 320 | n/a | 0 - 23 | 270 |
| COD mg/l $O_2$ | 900 - 2900 | 30 - 1235 | 30 - 365 | 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 is extremely difficult to give a treatment efficiency at this stage.

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.

As discussed, initial assumptions are that the first wetland cell, pond 1A, receives diluted leachate at 100 mg/l, and that hydraulic flow is limited to 186 m3/d. This may be adjusted based on treatment system response over time.

### 3.11.4 Other ICW systems

Within the Annestown-Dunhill catchment area (25km$^2$) 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 diary 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 3.5: Summary of results from ICW systems In Annestown - Dunhill**

| | | BOD (mg/l) | | SS (mg/l) | | $NH_4^+$-N (mg/l) | | $PO_4^{3-}$-P (mg/l) | |
|---|---|---|---|---|---|---|---|---|---|
| | ICW | 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].

## 3.12 DISCHARGE TO RIVER

The treated leachate is monitored in the sump before recycle or discharge. The control system may be set so that the majority or all treated effluent is recycled as dilution water or back to pond 1B, and thus little or no discharge occurs, or to recycle a minimum and allow discharge, provided the effluent meets standards. Heavy rainfall events will first result in a level rise and retention within the ponds, together with increased recycle flows to pond 1B if so set, and then finally discharge to the leachate lagoon (which is hydraulically connected to the river). In the event of an emergency whereby the effluent is above standards, and the retention and balancing of the ponds and recycle pumping system is exceeded, there is provision to allow manual adjustment of the pond outlets to further retain effluent, thus brining into effect significant additional storage volume using the available freeboard, and further recycle and dilution can occur to bring the effluent to standard, or in exceptional cases the effluent can be sent to a local wastewater treatment plant.

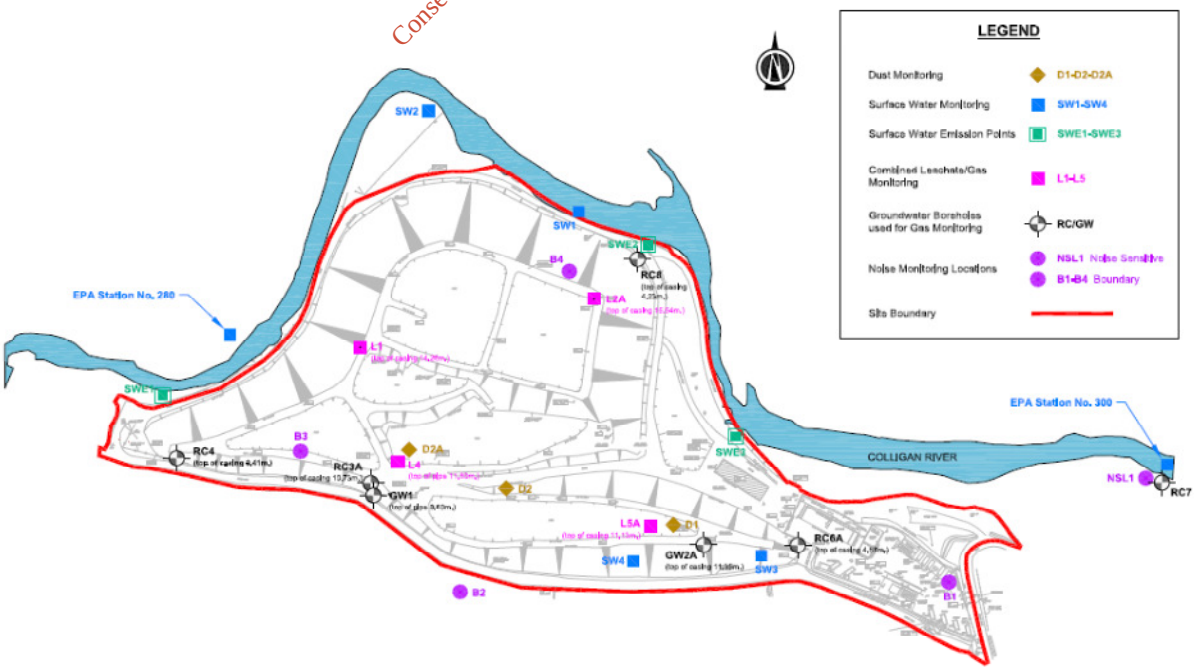
The following sections summarise the assessment that was carried out during design in 2008 as submitted to the EPA in *'Report on Response to EPA on Request for Information on Leachate Treatment' (August 2008),* together with updated analysis based on quality results from 2010-2012.

### 3.12.1 Receiving water body quality

Historical flow measurements for the River Colligan are available from the Poulnaskeha Hydrometric Station; given that this station is 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.

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. Not all relevant parameters are monitored at each station consistently from the period first analysed in 2006-2007 through to the most recent results in 2010-2012, and as such, results from Station 250 upstream at Killadangan Bridge are also included for comparison (not shown on graphic below).





During design of the system, the following results were used. The average of the highest result, for each parameter, from each monitoring event in 2007, has been calculated and is shown in the table below. Orthophosphate results were taken from 2006, the last period from which results are available.

| Parameter | Average of sampling stations | | |
|---|---|---|---|
| | 2006/07 | 2007-2009 | 2010-2012 |
| Total Ammonia (mg/l N) | 0.05 | 0.01 | 0.02 |
| O-Phosphate (mg/l P) | <0.006 | 0.02 | 0.02 |
| BOD (mg/l $O_2$) | 1 | 0.9 | 0.8 |
| Dissolved Oxygen (%) | 117 | 106 | 113 |
| COD | 20 | n/a | 37 |
| Conductivity (µS/cm) | 281 | 139 | n/a |
| PH | 7.8 | 7.8 | n/a |
| Suspended Solids (mg/l) | 7 | n/a | <5 |
| Chloride (mg/l Cl) | 43 | 13 | n/a |

**Table 3.10: Monitoring Results from the Colligan River**



The above results have been assessed as consistent with good water quality and a nominal Q rating of 3-4. See Section 3.14.1 for further details regarding good water quality and a nominal Q rating of 3-4.

### 3.12.2 Assimilative Capacity

The EPA has proposed Environmental Quality standards for BOD of 5mg/l in Rivers in Ireland (EPA 1997), with a desirable maximum of 4 mg/l to support fish life. According to the EU-Salmonid regulations (SI No 293 of 1988) the concentration of $NH_4$ 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 2009 and 2011 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 2010 to 2012 at 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:

$C_a = (Q_i C_i + Q_s C_s)/(Q_i + Q_s)$; 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 0.02 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 the table below.

**Table 3.7 Maximum allowable concentrations of P, $NH_4$, BOD and Suspended Solids**

| Daily Discharge | | Allowable Maximum Concentrations in Discharge | | | |
|---|---|---|---|---|---|
| ($m^3$/day) | (L/s) | O-Phosphate (mg/l P) | NH4 (mg/l) | BOD (mg/l O2) | Suspended Solids (mg/l) |
| 40 | 0.46 | 9.0 | 676 | 2,195 | 13849 |
| 60 | 0.69 | 6.0 | 451 | 1,465 | 9241 |
| 80 | 0.93 | 4.5 | 339 | 1,100 | 6937 |
| 100 | 1.16 | 3.6 | 271 | 880 | 5555 |
| 120 | 1.39 | 3.0 | 226 | 734 | 4633 |
| 140 | 1.62 | 2.6 | 194 | 630 | 3975 |
| 160 | 1.85 | 2.3 | 170 | 552 | 3481 |
| **186**[1] | 2.15 | 2.0 | 146 | 475 | 2998 |

[1] maximum design flow – discharge in excess of this figure would arise from heavy rainfall events



This analysis was carried out both in 2008 based on 2006-2007 river water quality values, and the 2010-2012 values shown above. There is no significant change in water quality over the period and thus no significant change in the assimilative capacity, except for ortho-P. For ortho-P, the results from 2006-2007 were lower, and based on current results, the allowable concentration in the effluent would decrease from the original assessment of 3.6 mg/l to 2.0 mg/l at maximum design flow.

### 3.12.3 Proposed Emission Limits

As can be seen from the table above the Colligan River has ample assimilative capacity to receive large volumes of treated effluent from the ICW, but with some restriction based on allowable ortho-phosphate limits.

The table 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 | 5 - 9 |
| BOD | 45 |
| Suspended Solids | 50 |
| Orthophosphate (mg/l P) | 2 |
| Total Ammonium (as N) | 15 |

**Table 3.8:** Proposed Emission Limits

The discharge standards above are updated from the previous submission *'Report on Response to EPA on Request for Information on Leachate Treatment' (August 2008):*

- A change to the previous submission pH standard from 6-9 changing to 5-9, reflecting the acidic nature of the wetlands system observed in results to date, which is currently showing pH values less than 6. There is no adverse effect predicted on the receiving water, as discharge volumes are less than 1% of DWF.
- A change to the total ammonium standard from the previous proposal of 5 mg/l to 15 mg/l, since the assimilative capacity allows over 100 mg/l with no adverse effects predicted



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, and the treatment system discharges at its design flow of 186 m3/d. The table 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 | 1.1 | 5 | 0.03 | 0.12 |
| Statutory Limits | 5 | 25 | 0.03 | 1 |

**Table 3.9:** 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 the previous section as well as the assimilative capacity of the Colligan River, aside from ortho-P, which is at the limit.

It is not anticipated that the treatment system will operate at the maximum design flow and maximum allowable ortho-P value, the averages of both will be less, and thus the analysis above takes the worst case scenario.

## 3.13 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.

## 3.14 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 Licence 32-02.

According to the reports the site and its surrounding environs continue to support a diversity of wildlife due to the variety of habitats present. Dungarvan Landfill Site lies in close proximity to Dungarvan Bay, a designated SPA on account of its importance for feeding and roosting areas for migratory wintering wading birds and wildfowl such as Brent Goose, Black-tailed Godwit and Bar-tailed Godwit. The SPA extends along the River Colligan estuary as far upstream as Ballyneety Bridge. Dungarvan Harbour is also a Ramsar site and recognised as an Important Bird Area (Birdlife International). Review of I-WeBs data indicates continuing favourable conservation status of Dungarvan Bay SPA for qualifying interests including Brent Geese and Bar-tailed Godwits. Annex 1 bird species such as the Little Egret and Kingfisher are known to use the stretch of River Colligan near the landfill site.

With regard to mammal surveys of the area the River Colligan is an important habitat for Otters. Numerous sprainting sites, some of which are obviously in long-term use, indicate that otters are resident and successful there. The high level of otter activity from previous surveys indicates that the River Colligan contains a healthy and reliable population of fish, highlighting the biological health of the River Colligan. The abundance of frogspawn in wetlands on the landfill provides a food source for Otter along the River Colligan. Surveys of Otter activity along the Colligan commissioned by the MISE project in 2011 and 2012 indicate active use along this waterway corridor.



Bat species such as Daubentons also probably use the river corridor as a feeding habitat.

Habitats occurring in the Dungarvan landfill site can be categorised as either semi-natural (e.g. scrub (WS1); wet grassland (GS4); reed and large sedge swamps, (FS1) or artificial and modified e.g. amenity grassland (GA2) recolonising bare ground (ED3), spoil and bare ground, ED2; artificial lakes and ponds (Fl8); buildings and artificial surfaces (BL3). These habitats initially had relatively low ecological value, as they were subject to intermittent disturbance. However, since 2008 with succession of habitats including establishment of 6 wetland cells, grassland and increasing scrub cover it is apparent that the site is demonstrating increased biodiversity value providing good feeding grounds for a variety of birds and some mammal and invertebrate species along with amphibians. The 2013 site visit observed an abundance of frogspawn in the wetland cells and 8 Snipe and 5 Moor Hen were noted whilst walking the site.

The development of wetlands and grassland on the landfill also serves to enhance the ecological network of natural habitats surrounding the landfill including the River Colligan and adjacent areas of wet grassland, marsh, brackishwater and estuarine habitats.

The majority of plant species recorded on the landfill site is considered abundant and widespread throughout Ireland. However one of the recorded plant species is listed on the Flora Protection) Order, 1999- Opposite-leaved Pondweed (Groenlandia densa) which is only known to occur in a couple of places in the county.

### 3.14.1 Biological assessment of the River Colligan

It is notable that a review of EPA 2011 Water Quality data for the Colligan River indicates that water quality is of satisfactory quality ranging from Q4- Q4-5 with no change from 2010. Biological assessment of the River Colligan at the location of the landfill was most recently carried out in 2009 and 2011, and suggested a fair to good water quality sampling sites. Both stations SW1 and SW2 are subject to tidal influences and may at times be brackish, depending on river flow and tidal range, and this may have an influence on relatively lower Q-value scores for the river location at the landfill compared to the EPA stations upstream.

**2009 Assessment**

Limosa Environmental was commissioned by Waterford County Council to conduct a biological monitoring survey at selected sites. The licence requirements for ecological / biological monitoring were amended in 2009 from the former broader monitoring requirements to that of aquatic biological quality Q rating at three locations, two on the River Colligan and one in a drainage ditch which runs along the southern boundary of the site.

The results of the 2009 biological assessment of the River Colligan sites indicated good water quality status at both river sampling sites following analysis of the surface water quality and biological water quality data recorded. As in previous years the diversity of invertebrates decreased moving downstream in the brackish water reaches of the river from sites SW2 to SW1. An increase in the macroinvertebrate diversity was noted at site SW2 compared with 2008, whereas a slight decrease in the species diversity was recorded at site SW1 compared to 2008. However, this decrease is due to the absence of two species found in 2008, that of eels and stickleback. Other than this the macro-invertebrates recorded in the current survey remained very similar to those recorded in 2008 and thus it is considered that there has been no change in water quality.



These findings coupled with the review of water quality measurements taken on site and EPA chemical water quality data between 2008 and 2009, show continued good water quality indicating that Dungarvan Landfill site is not negatively impacting the River Colligan.

Although the European Eel was not recorded within in the current survey it has been recorded previously and it is likely that they are still present in the river in the tidal reaches of the River Colligan.

**2011 Assessment**

Sampling of macro invertebrates was carried out at River Colligan sites SW1 and SW2 adjacent to Dungarvan Landfill on 16/1/12. Identification and counting of biota, using various freshwater macro invertebrate identification keys, was carried out on 17/1/12. The EPA Q-rating scheme was applied to the results in order to get a Q value for each site. However, it should be noted that both stations are subject to tidal influences and may at times be brackish, depending on flow of freshwater and extent of tide.

Both stations SW1 and SW2 are subject to tidal influences and may at times be brackish, depending on river flow and tidal range. A small Flounder fish, common to shallow water areas such as estuaries and tidal areas, was caught in the sample at SW1. Nominal Q-scores of Q3-4 for SW1 and Q3 for SW2 are assigned for this survey in order to comply with licence requirements, aid interpretation of the species count and to allow trends to be tracked. However, as the Q index system is designed for freshwaters, standard interpretation of the Q score is not possible for these tidal and possibly brackish stations. Therefore, Q Score should be removed from the licence requirements as such biological indices are not appropriate for these tidally influenced brackish stations.

Comparison with previous surveys and between stations is possible and it is seen that the species list of this survey in January 2012 was similar to that found sampled by Dr Lewis of Limosa Environmental

Ltd in Oct 2009. Taxon richness was higher at SW1 in January 2012 compared to the Oct 2009 survey. In this survey here was a slight increase in taxon richness and nominal Q score between the upstream station SW2 and the downstream station SW1. Taxon richness and species present at both stations indicate good water quality. Results were similar to the previous survey of 2009.

### 3.14.2 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 was required under previous Waste License 32-01, but not under the current licence. 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:

- 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 3.11: 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**<br>[2.5]<br>(5.2) | **5.5** | **5.9**<br>[6.1]<br>(7.4) | **4.5**<br>[17.1]<br>(13) | **23.8**<br>[38.6]<br>(43) |
| S2 | **1.4**<br>[2.7]<br>(6.5) | **5.9** | **6.2**<br>[5.7]<br>(9.3) | **5.7**<br>[5.7]<br>(23) | **48.8**<br>[40.8]<br>(49) |
| S3 | **1.9**<br>[2.1]<br>(3.7) | **9.6** | **9.5**<br>[6.6]<br>(7.2) | **8.2**<br>[6.9]<br>(10) | **35.7**<br>[31.5]<br>(88) |
| S4 | **1.3**<br>[3.5]<br>(3.5) | **5.9** | **5.1**<br>[8.7]<br>(6.4) | **7.2**<br>[35.2]<br>(10) | **27.9**<br>[38.8]<br>(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 seem 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.

### 3.14.3 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. Twelve individual mussels, of 6 cm average length, yielding approximately 30 grams 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 3.12 below.



**Table 3.12: 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.

## 3.15 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 this report. Once these limits are not breached the impact of the effluent on the surrounding waters and flora and fauna will be minimal.

## 3.16 PROPOSED MONITORING REQUIREMENTS

The following monitoring requirements are proposed, updated from the submission *'Report on Response to EPA on Request for Information on Leachate Treatment' (August 2008):*

1. Total ammonium: fortnightly – at least 26 samples per annum
2. pH, BOD, SS, Ortho-P: monthly – at least 12 samples per annum
3. A full suite of parameters monitored once per annum as listed below
4. System control monitoring using online sensors for total ammonium, pH, and conductivity. These online sensors are to be used only for system control and not for emission limit compliance.
5. An outlet autosampler allowing 24 hour composite sampling and flow proportional sampling techniques to be used. A 24 hour composite sample will be taken from the effluent each day and stored on site. Once a week/month one of the composite samples will be chosen at random and tested for the appropriate parameters.



The following are the proposed changes compared to the 2008 submission:

- A change in the monitoring frequency for grab sampling and testing the parameters BOD, suspended solids and Orthophosphate from once per week to once per month, following successful performance of the treatment system in the first 9 months.
- A change in the monitoring frequency for grab sampling and testing the parameter ammonium from once per week to once per fortnight, following successful performance of the treatment system in the first 9 months. It is also notable that the online ammonium sensor built into the system monitors continuously, as thus would give early warning of any performance issues in between grab sample tests.
- It is <u>not</u> proposed that the online ammonium sensor at the outlet of the treatment system is used for emission limits compliance purposes. This sensor is intended for system treatment control purposes. It needs to be regularly cleaned and re-calibrated, and accuracy will drift between inspections. The process of calibration and cleaning will also produce inconsistencies at the time, which could be misinterpreted as non-compliances.

It is proposed that compliance is based on the following sampling-compliance schedule:

- 8-16 samples taken; maximum number of samples which fail to conform = 2
- 17-28 samples taken; maximum number of samples which fail to conform = 3
- 29-40 samples taken; maximum number of samples which fail to conform = 4

Annual grab monitoring parameters:

- BOD
- COD
- Chloride
- Ammoniacal Nitrogen
- Electrical Conductivity
- pH
- Metals / non-metals[1]
- 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

# 4 PARTIAL LEACHATE ABSTRACTION-TREATMENT SYSTEM 2010-2012

In order to assess the treatment efficiency of the ICWs, it was decided that only part of the leachate extraction and control system would be setup initially so as to test the viability of the ICW to treat the landfill leachate before implementing the full scale leachate extraction and control system. This assessment was carried out from June 2010 to March 2012. The following sections outline details of this partial system and presents results of the assessment of the effectiveness of the ICW to treat the landfill leachate.

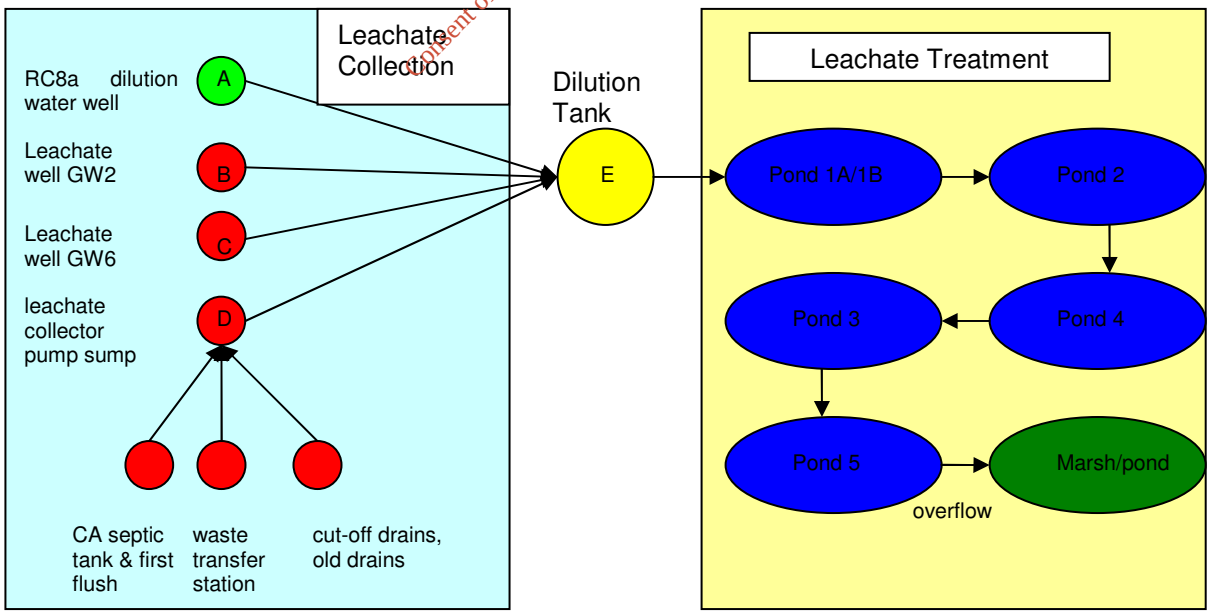
## 4.1 DESCRIPTION OF PARTIAL LEACHATE SYSTEM

Two wells, GW2 and GW6 were selected to extract leachate, based on leachate level monitoring and pump testing of selected wells (see Section 2). Leachate from these wells discharges into the Dilution Tank. A new groundwater well, RC8a, was installed to provide dilution water. The ICWs can handle an ammonium level of approximately 200mg/l for short periods but work best when ammonium concentrations do not exceed 100mg/l. Therefore, as much higher concentrations of ammonium are found in the landfill leachate, it requires dilution prior to treatment by the ICW. However, it should be noted that as RC8a is adjacent to the main body of waste, it has an ammonium concentration ranging from 50-150 mg/l. Therefore, prior to treatment, the extracted leachate and the dilution well water are tested for ammonium and levels are set up so that a dilution of ammonium is achieved in the tank. A pump then discharges the diluted leachate to pond 1A (via a rising main).

Leachate from the cut-off drain around the landfill, leachate from the old leachate drains beneath the landfill, leachate from the leachate cut-off drain at the toe of Pond 4 and leachate and washings from the waste transfer station drain, the septic tank and first flush storm system in the civic amenity area are collected in a new pump sump, which is also directed to the ICW for treatment via the dilution tank.



A process diagram below illustrates the leachate system operation. It is divided into three stages, leachate collection, leachate dilution and leachate treatment:



In summary, the partial leachate extraction system was setup as follows:

- Approximately 2 $m^3$/day total (1 $m^3$/day each), was extracted from leachate boreholes GW2 and GW6 and discharged to the Dilution Tank (timer based, consistent daily volume)
- the new leachate collector pump sump was float switch based, with variable daily volume
- Dilution water was extracted from groundwater borehole RC8a, intended to dilute water in the tank to less than 100 mg/l ammonium depending on concentration of leachate.

It should be noted that the temporary dilution system was not always adequate to dilute landfill leachate to less than 100 mg/l ammonium. Testing during the initial 6 month period showed ammonium levels in RC8a at an average of 160 mg/l, and therefore ammonium levels in the tank were at 200 mg/l and higher than recommended. However, results post November 2010 showed an improvement in both dilution water and tank ammonium levels. A transfer-to-wetlands concentration of 100 mg/l is recommended, however the relatively small volumes and loadings produced in the partial system were presumed to be easily treated by the ICW.

Sampling and testing was carried out at least twice monthly at ponds 1-5, and as required at the other elements of the leachate collection system for monitoring and adjustment.

The main objective of monitoring was to ensure that the discharge quality from pond 5 was within the proposed emission limits. A second objective was to monitor ammonium levels in each pond in order to analyse treatment efficiency in each pond. In addition, each input was sampled (leachate, dilution water, etc.) and should ammonium concentrations in the tank be found to be over 200 mg/l, then the dilution well is adjusted to add dilution water. In the event that final discharge concentrations were found not to be within required limits, then the outlet pipework at each pond and the final outlet could be adjusted to temporarily stop flows until the cause was ascertained and the system adjusted or rectified. In an exceptional case, the system could be shut down completely and a temporary pump or tanker used to re-circulate diluted leachate until the system was adjusted or rectified.



## 4.2 TREATMENT EFFICIENCY OF THE ICW

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 dilution of leachate containing high concentrations of ammonia-N.

As the main focus of the ICW 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 difficult to assess the treatment efficiency without testing the system first, hence the decision to extract and treat a smaller volume of leachate initially.

### 4.2.1 Leachate Collection – Flows & Quality (Ammonium) Prior to Treatment

The leachate pumping and treatment system commenced treating leachate in June 2010, and elements of the current system were gradually commissioned between June & October 2010, when the system was operating fully and consistently. The leachate pumping system flows and wetland pond monitoring results were monitored and tested during the period May 2010 to December 2011 and July 2010 to December 2011, respectively. A full set of results is available in the project files. The results of flow monitoring are summarised as follows:

- **GW2** - pumped 306 m3 from 20/05/2010 to 21/06/2011. It is likely that GW2 had effectively malfunctioned since March 2011, and the flow issues were noted at that time, but the well collapse wasn't confirmed until August. It is estimated that GW2 pumped an average of 1 m3/d to March 2011

- **GW6** – pumped 811 m3 from 14/10/2010 to 14/12/2011, average 1.4 m3/d

- **Leachate Collector Pump Sump** - pumped 5411 $m^3$ from 21/06/2010 to 14/12/2011, average 9.4 m3/d

- **RC8a dilution water well** - pumped 8888 $m^3$ from 20/05/2010 to 14/12/2011, average 15.5 $m^3/d$

- **Dilution tank** - pumped 11514 $m^3$ from 20/05/2010 to 14/12/2011, an average of 20.1 m3/d.

The total sum of the inputs to the tank was 33% higher than the tank pump flows, and should be approximately equal. There were limitations to the flow monitoring regime installed, and the figures do not need to be very accurate at this relatively modest loading level.

Ammonium concentrations in GW2 vary from 2,500 to almost 4,000 mg/l . At GW6, only one result of 470 mg/l was available.

Initial concentrations at RC8a (dilution water source) were in the 100-300 mg/l range during system setup in June to September 2010, but levels reduced to average 90 mg/l following continual pumping.

Similarly, ammonium concentrations at the leachate collector pump sump ranged from 500-1500 mg/l during system setup in June to September 2010, but reduced to average 110 mg/l thereafter.

Ammonium concentrations in the dilution tank were all above 200 mg/l during system setup from June to September 2010, but the result in November 2010 showed 69 mg/l , much reduced from previous results, and reflecting the lower concentrations in all inputs since steady conditions were reached, with the much improved dilution water concentration assisting matters considerably. There was no further testing after this time.

The estimated average ammonium loading during the period was 7.2 kg/d.

### 4.2.2 Leachate Treatment – Quality (Ammonium) after Treatment

Figure 4.1 summarises the ammonium concentrations found at the outlet of each of the ponds in the ICW.

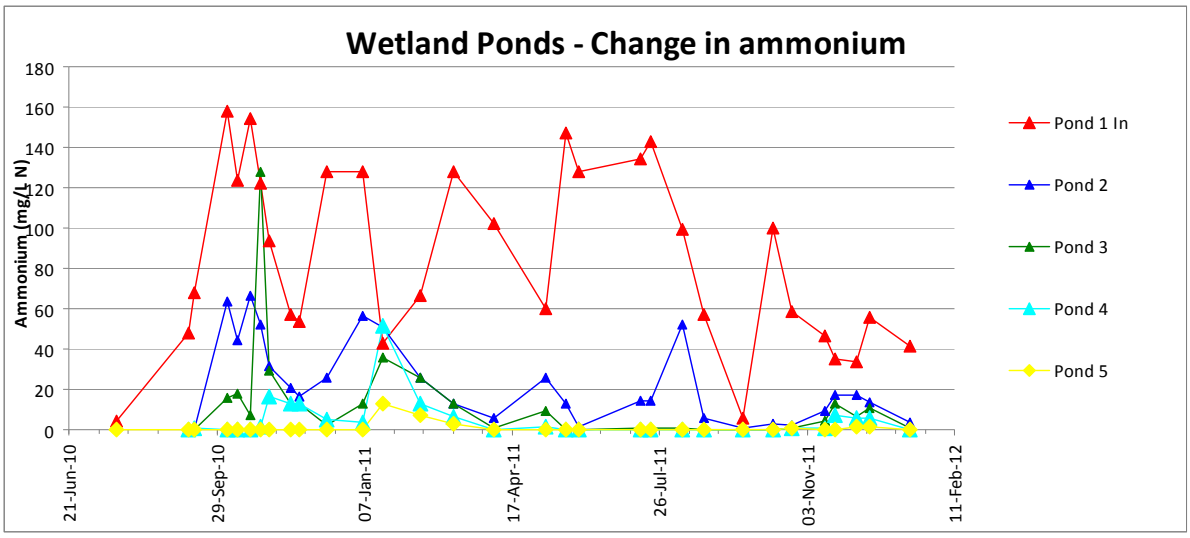



**Figure 4.1:** Ammonium Concentrations recorded from July 2010 to January 2012 at Ponds 1 -5

As discussed above, the dilution tank pumps diluted leachate into pond 1 at strength of approximately 100 - 200 mg/l. The effect on pond 1 can be seen from the graph above, with ammonium concentrations rising to over 150 mg/l during Sept-Oct 2010, but then falling back to below 100 mg/l as the pumping system flows settled post commissioning.

Pond 2 remained reasonably steady at an average of around 22 mg/l and a maximum of 66 mg/l. Pond 3 has an average of 12 mg/l apart from one spike in October 2010 reaching 128 mg/l. Pond 4 showed initially very low levels of ammonium until late 2010 to early 2011, with a maximum recorded of 51 mg/l at that time, thereafter reducing, and had an overall average of 5 mg/l.

Ammonium results in January and February 2011 were higher than normal due to system problems at the time, caused by tripped and blocked pumps exacerbated by a flow shortcut from pond 1 to pond 5 caused by a blockage and overflow. The latter issue was resolved and is unlikely to re-occur as the outlet MH and flowmeter configuration was changed thereafter



Pond 5, the final pond before discharge from the wetlands treatment system, has an average input of ammonium from the previous ponds of just under 2 mg/l (not shown on graph), and an average outlet concentration of just under 1 mg/l. There were two instances, in January and February 2011 where the results were 12.8 mg/l due to the systems problems described above.

#### 4.2.2.1 Leachate Treatment – Quality (Other Parameters) after Treatment

The following concentrations were recorded at pond 5 outlet

- pH varies from 7.3 to 7.9, well within the proposed range of 6 – 9.
- BOD averages 3 mg/l with a maximum of 18 mg/l, well within the proposed standard of 45 mg/l
- Suspended Solids results are in the range 0-30 mg/l, well within the proposed standard of 50 mg/l

- Orthophosphate (mg/l P) averages 0.014 mg/l with a maximum of 0.13 mg/l, well within the proposed standard of 2 mg/l

In summary, the wetlands treatment system performed well during the proving period, with discharge concentrations lower than the proposed emission limits.

There is also an annual monitoring proposal for additional parameters included in the waste licence review application which will be adhered to.

## 4.3 POND FLOW MONITORING

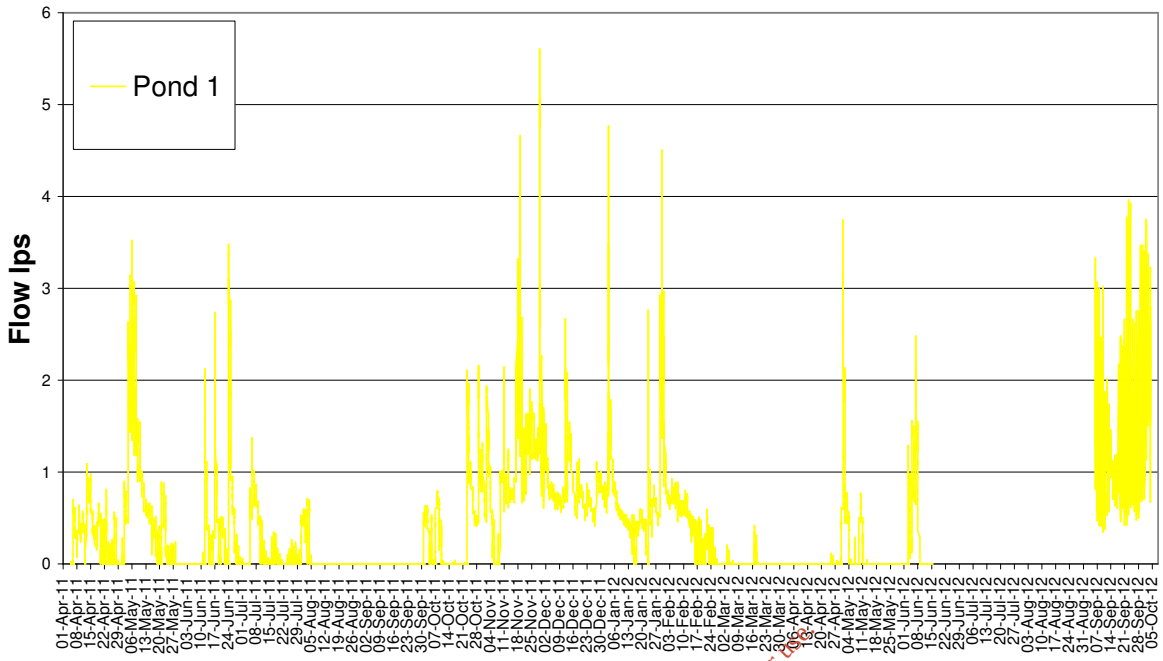
Five (5) No. inter-pond flowmeters were utilised to measure pond flows during 2011-2012. The data availability varies as the commencement time varies and also there were battery problems from April 2012 resulting in some missing data.

The following summarises the results, presenting the June-11 to April-12 period when all flowmeters had full data, and also a note on maximums from all available data (where this differs):

- Pond 1 had an average flow of 1.4 m3/hr, maximum 20.2, minimum 0, median 0.2. The peak flow recorded was 5.6 l/s in Nov-11.
- Pond 2 had an average flow of 1.5 m3/hr, maximum 39.5, minimum 0, median 0.5. The peak flow recorded was 26.5 l/s in June-12.
- Pond 3 had an average flow of 1.8 m3/hr, maximum 23.2, minimum 0, median 0.3. The peak flow recorded was 6.5 l/s in June-11. The level in the pipe and chamber is rising above the top of pipe into the chamber, but since there is no weir, this must be due to the flat nature of the pipe.
- Pond 4 had an average flow of 1.5 m3/hr, maximum 21.7, minimum 0, median 0. The peak flow recorded was 12.4 l/s in Sept-12. The level in the pipe and chamber is rising above the top of pipe into the chamber, and there is a weir in the pipe, however, it appears preferable to retain this weir as it improves low flow characteristics.
- Pond 5 had an average flow of 2.2 m3/hr, maximum 56.5, minimum 0, median 0.6. The peak flow recorded was 15.7 l/s in Nov-11.
- The data shows that pond 1 has a more regular outflow than pond 5 (given the regular input of diluted leachate), and that ponds 2 and 5 have a more flashy nature.
- Note the following on data availability:
    - pond 1: commenced April 2011, no data from Mid Jun-12 to early Sept-12
    - pond 2: commenced June 2011, no data from early Aug-12 to early Sept-12
    - pond 3: commenced June 2011, no data from late May-12 to Oct-12 (not yet re-commenced, awaiting replacement battery)
    - pond 4: commenced April 2011, no data from late Apr-12 to early Sept-12
    - pond 5: commenced April 2011, no data from early Apr-12 onwards (decommissioned, however, June-12 onwards data is available from SCADA flowmeter)

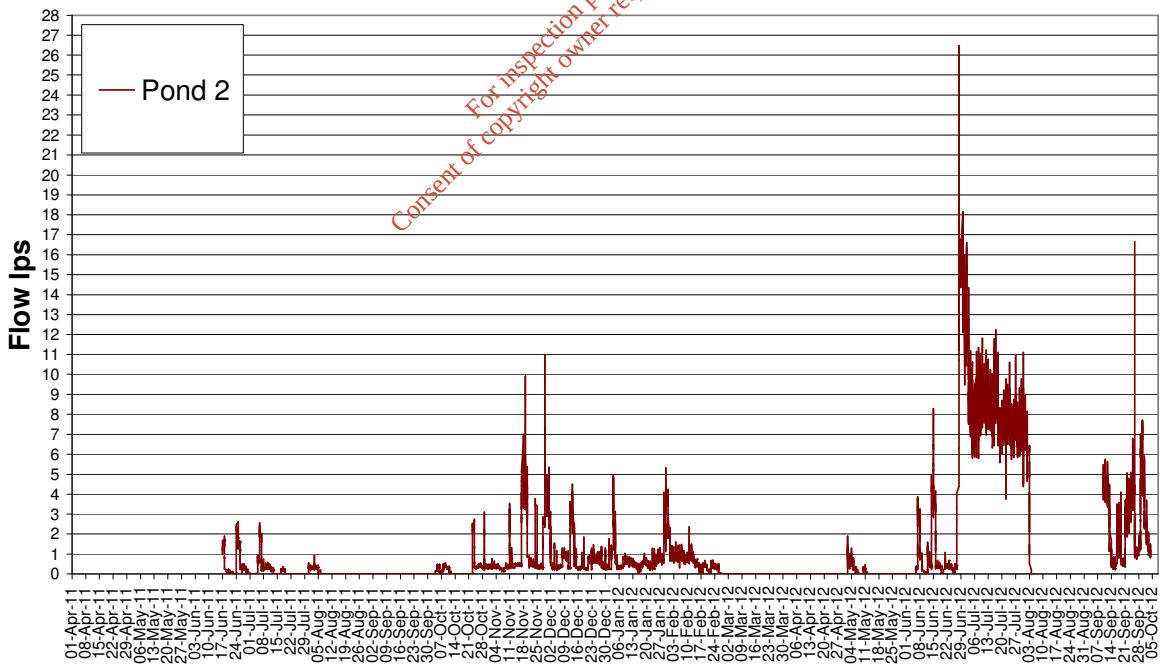
The graphs following illustrate the results from April 2011 to October 2012.

## Dungarvan Landfill Pond 1 flowmeter

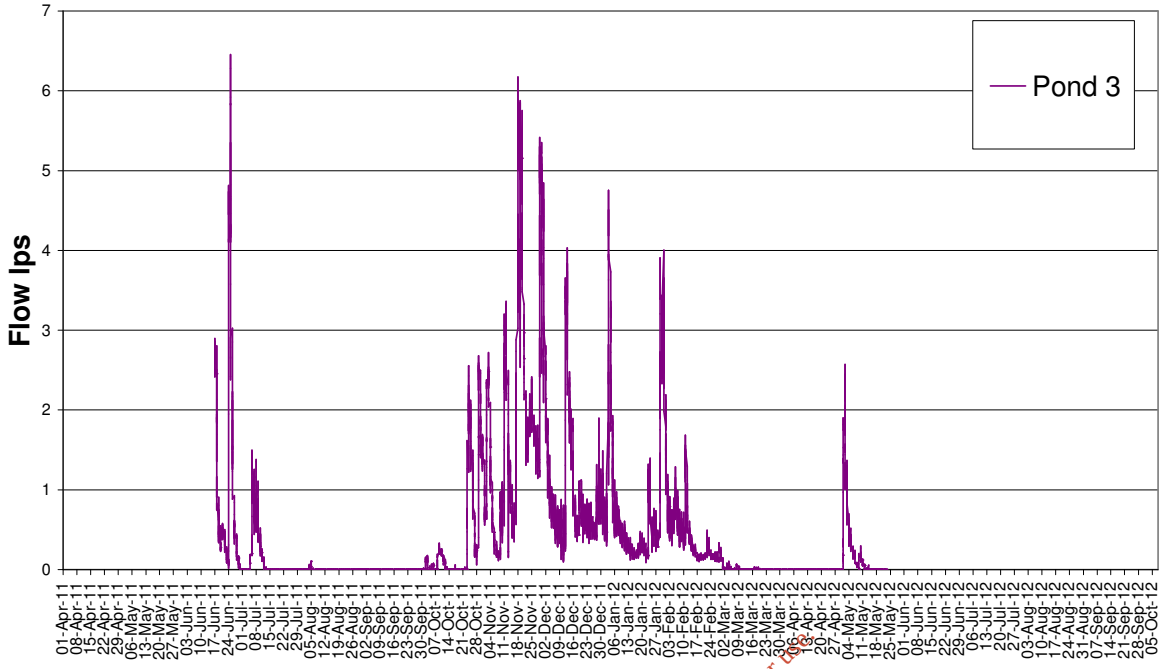





## Dungarvan Landfill Pond 2 flowmeter

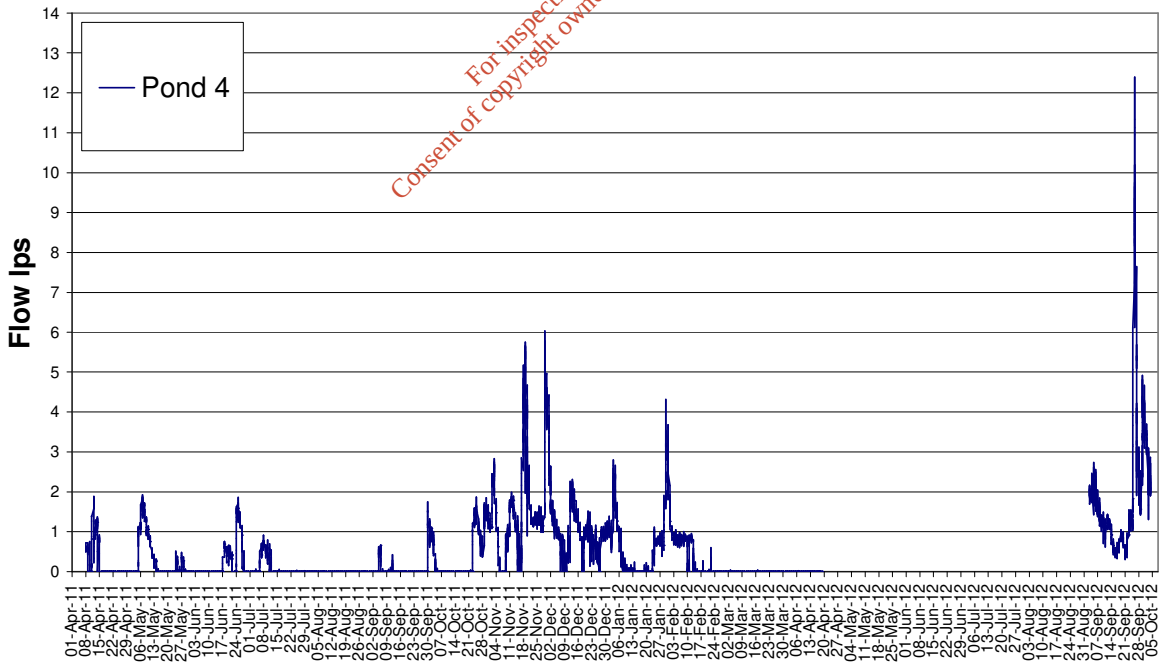


**Dungarvan Landfill Pond 3 flowmeter**

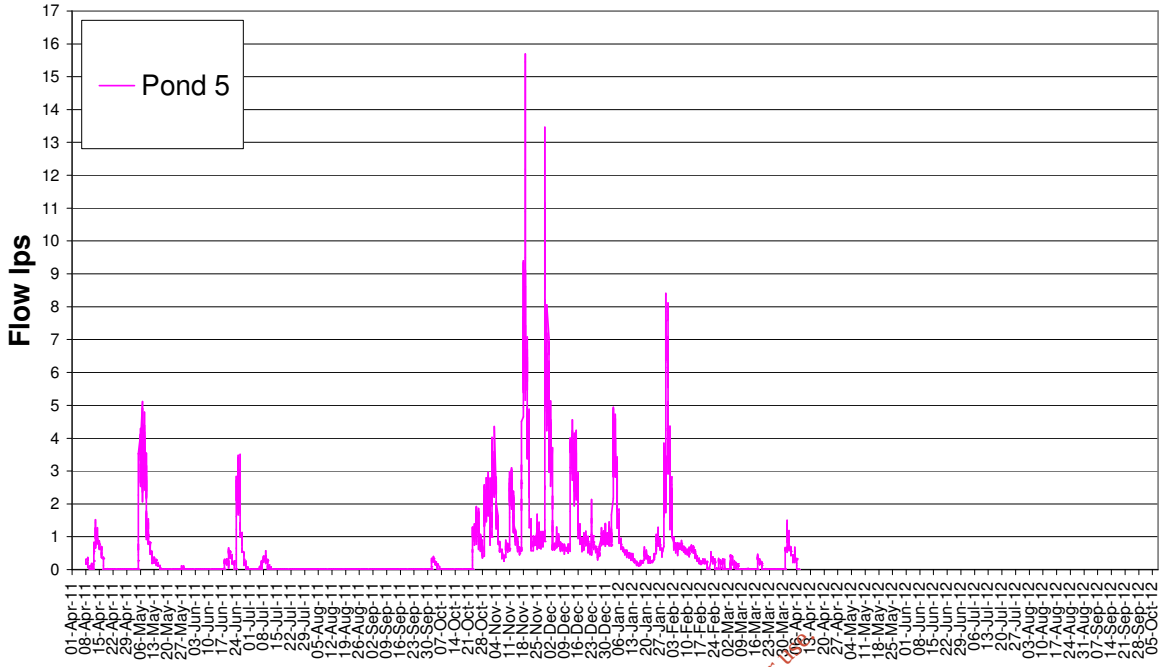




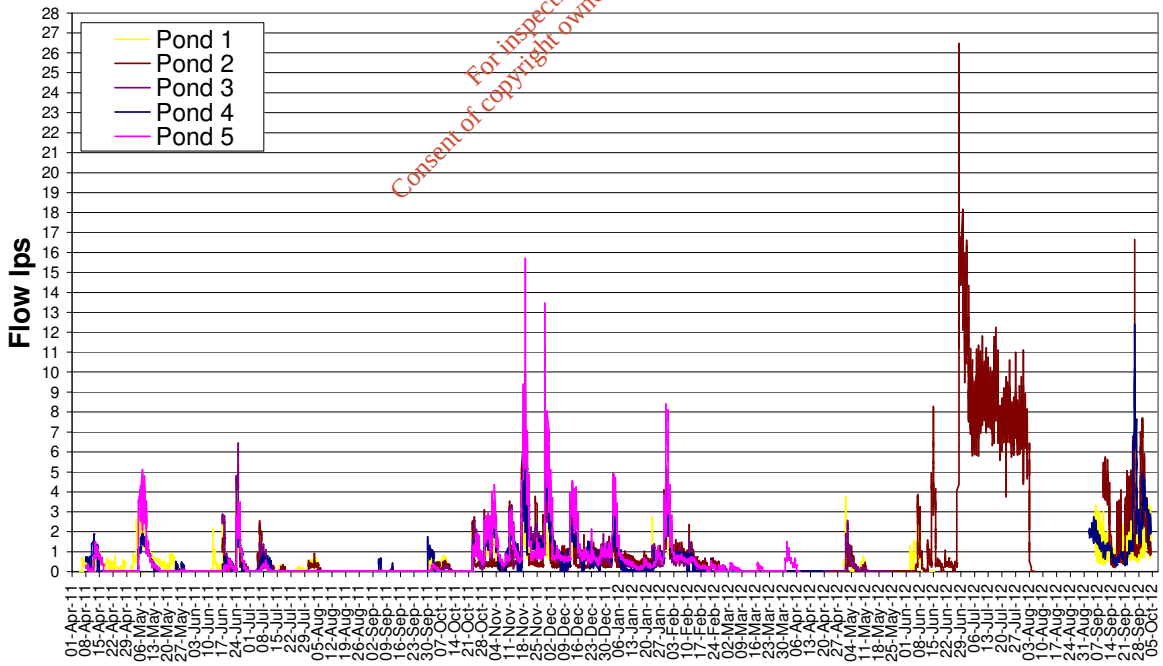

**Dungarvan Landfill Pond 4 flowmeter**



**Dungarvan Landfill Pond 5 flowmeter**




**Dungarvan Landfill Pond flowmeters**






The data available is intended to allow detailed analysis of the response of the ponds to rainfall and leachate inputs over time. Meteorological data (and new onsite weather station data from Oct-12) together with available pumping flows into the wetlands can be combined with pond catchment areas to analyse detailed pond response. This is not carried out in this report; rather, it is to form part of a future analysis.

## 4.4 DILUTION WATER SOURCE

It was understood during system design that WCC and the EPA considered it preferable to extract dilution water from wells located on the periphery of the site, as a more environmentally sustainable water source than the originally designed river water alternative. A dilution well, RC8A, was installed during the partial abstraction works, and supplies dilution water for this system. This well was yield tested to ascertain its possible suitability for larger scale abstraction of dilution water for the full leachate abstraction system, but was not adequate on its own for this purpose, and was augmented by an additional well.

The second issue arising during the partial abstraction works concerned contamination of the RC8A dilution water source. RC8A exhibited ammonium concentrations averaging 90 mg/l, making it practically impossible to dilute raw leachate down to 100 mg/l ammonium or less. The new clean water well drilled overcame this issue, with further details in following sections.

# 5 FULL SCALE LEACHATE ABSTRACTION AND TREATMENT SYSTEM - INFRASTRUCTURE & EQUIPMENT, OPERATIONS

## 5.1 OVERVIEW

This section presents summary details of the infrastructure and equipment for the full scale leachate abstraction and treatment system. Further details on landfill infrastructure can be found in the *Dungarvan Landfill Remediation Works Final Construction Report – December 2012* and drawings.

The following summarily describes the leachate abstraction and treatment system, as shown on Drawing DG0606:

1. 9 no. leachate abstraction boreholes equipped with 2m3/hr pumps
2. a network of leachate collection pipework all discharging to a dilution tank
3. a leachate collector pump sump as described in Section 2, with 1 m3/hr pump
4. groundwater abstraction well RC8A, equipped with 1 m3/hr pump
5. a 'clean water' dilution well, pump capacity 25 m3/hr
6. a dilution tank, nominal capacity 25 m3, effective working volume 20 m3 (maximum, user adjustable), with 2 pumps, capacity 20 m3/hr each, pumping to wetland pond 1A via a 90mm RM
7. six no. wetland ponds (ICW's) in series, pond 1A, 1B, 2, 3, 4, 5, approximately 18,650m$^2$, with a normal capacity of 3,700m$^3$ and a maximum capacity of 13,000m$^3$
8. a recycle sump at pond 5 outlet, nominal capacity 5 m3, effective working volume 3 m3 (maximum, user adjustable), with 2 pumps, capacity 20 m3/hr each, pumping to either wetland pond 1B or the dilution tank via 90mm RM's
9. monitoring equipment: online ammonium sensors at the dilution tank, pond 4 outlet, and pond 5 outlet; pH and conductivity sensors at pond 5 outlet; flow monitoring at tank pumps, dilution well, all pond outlets, and recycle sump pumps, and an flow proportional automatic sampler at pond 5 outlet
10. A motor control centre, PLC, Supervisory Control and Data Acquisition system (SCADA) is provided, with a control hut located near pond 5 outlet, and a SCADA computer in the Civic Amenity building. Remote weblink access and alarm text-out is also provided.



## 5.2 LEACHATE ABSTRACTION BOREHOLES

The following wells were equipped with pumps and associated requirements for leachate abstraction: GW1, GW2, GW4, GW5, GW6, GW7, GW13, CW1, and CW2.

The bore-log details of each well are provided in the Final Construction Report, December 2012. Each pump has a capacity of 2 m3/hr, and is equipped with a level sensor to control pump operations.

The operation of each pump is controlled using the system HMI, by setting the number of abstraction cycles per day, the pumps to be used in each cycle, and the minutes run per cycle. This allows a volume of leachate abstracted per day to be set and adjusted.

## 5.3 LEACHATE COLLECTOR DRAIN PUMP SUMP

The leachate collector drain pump sump collects contaminated water from the leachate interceptor drain laid along the northern boundary, leachate from the old leachate drains beneath the landfill, leachate from the leachate cut-off drain at the toe of Pond 4, and leachate and washings from the waste transfer station drain, including those from the septic tank and first flush storm system in the civic amenity area, as shown on Drawing DG0606. The leachate collector drain pump sump operates on a float switch automatically and pumps to the leachate collector pipework and on to the dilution tank.

## 5.4 GROUNDWATER ABSTRACTION WELL RC8A

RC8A is a 160mm diameter 9m deep groundwater abstraction well that is contaminated from landfill leachate, on average containing 90 mg/l ammonium (and has shown up to 276 mg/l), and other pollutants. Its original purpose was to provide dilution water for the partial system in 2010-2012, but is unsuitable as a dilution source given the ammonium content and requirement to dilute leachate to less than 100 mg/l. It is now operated to abstract polluted groundwater from beneath the landfill and is well located in this regard, being on the edge of the downstream end of the landfill body..

The operation of this pump is controlled using the system HMI, and was initially set to 3 runs for 2 hours, total 6 hours, approximately 9 m3/d. The well can pump up to 36-48 m3/d.



## 5.5 DILUTION WELL

The dilution well provides clean well water for dilution of leachate in the tank, and is equipped with a 25 m3/hr borehole pump. The operation of the pump is controlled automatically by the dilution logic and marshalled by the level setpoints on the system HMI. It is notable that there is an enable/disable setting on the HMI which controls whether this is the primary source of dilution water (or not). Disabling this will mean that dilution water is drawn from the recycle sump if available and to standard, and if these conditions are not met, dilution water will be drawn from the well irrespective of the disabled setting.

The dilution well is located just west of the dilution tank and is outside the waste body and upstream of groundwater flow which is towards the river. A test well was drilled through 6m of boulder clay and silty clay and 66m of fractured limestone to a total of 72m (based on water ingress observations). The test well was yield tested, and simultaneously the public water supply boreholes at Ballynamuck were monitored to ensure there was no drawdown effect. Having established the yield, the test well was grouted. The final well was drilled to 72m, comprising 6m bentonite lined steel casing, and 66m depth of screen. The final yield test gave 17-18 m3/hr, adequate for leachate system dilution requirements.

## 5.6 DILUTION TANK

The dilution tank receives all polluted arising from the landfill via leachate collector pipework connected to the tank. Dilution water is automatically pumped into the tank from either the recycle sump or dilution well to dilute the contents of the tank to the required value (operator variable, normally 100 mg/l). Once the required dilution has been achieved, the diluted leachate is pumped to Wetland cell 1A via a transfer pump.

*Dilution tank*

The specifications of the dilution tank and equipment are as follows:

| | |
|---|---|
| Size: | Nominally 3415mm diameter, 2900mm high |
| Relevant levels:<br>tank bottom<br>overflow IL<br>top of tank | <br>2.75 mOD<br>5.20 mOD<br>5.50 mOD |
| Operational limits:<br>Bottom limit<br>Top limit | 2 m<br>3.10 mOD<br>5.10 mOD |
| Operational volume | 20 m3 maximum, limits are operator adjustable |
| Inlet pipework | 315mm HDPE, TOP 2.85 mOD (through wall of tank at bottom) |
| Outlet pipework | 90mm HDPE, IL 2.87 mOD (through wall of tank at bottom) |
| Level control | Ultrasonic level sensor, limits are operator adjustable |
| Mixing | Submersible mixer operating off tank level sensor, limits are operator adjustable |
| Monitoring | Online ammonium sensor<br>Flowmeter on outlet RM |
| Transfer pumps | Two no. dry mounted 25 m3/hr duty/standby |
| Control Panel | Local control panel as per O&M manual details, summarily with isolators, status and on/off/auto controls for dilution and transfer pumps, flowmeter loggers, hours run |

The operation of the pumps is controlled by the level setpoints on the system HMI, and the volume pumped per batch is thereby controlled. An ammonium sensor together with a level sensor at the tank allows this operation to be monitored and controlled. In the event that ammonium concentrations in the tank exceed setpoints, an emergency logic actuates to add dilution water and incrementally lower the tank while continually adding dilution water until the system returns to normal parameters. There is a dilution well enable/disable setting on the HMI which controls whether this is the primary source of dilution water (or not). Disabling this will mean that dilution water is drawn from the recycle sump if available and to standard, and if these conditions are not met, dilution water will be drawn from the well irrespective of the disabled setting.

## 5.7 WETLAND PONDS

The six wetland ponds, 1A, 1B, 2, 3, 4, and 5 receive diluted leachate from the dilution tank, initially into pond 1A, and the diluted leachate flows sequentially through each of the six ponds by gravity. The inlet at pond 1A consist of a 110mm flat pipe with adjustable T-pieces that allow manual adjustment of the incoming flow and ensure dispersion across the width of the pond to avoid short circuiting and local overload. 160mm pipework connects each pond, and an upturned bend at the outlet of each pond can be adjusted to alter the depth of water in the pond, or to increase storage temporarily.

Flow from the last wetland cell (pond 5) discharges to a recycle sump. The treated leachate is monitored in the sump before recycle or discharge. The control system may be set so that the majority or all treated effluent is recycled as dilution water or back to pond 1B, and thus little or no discharge occurs, or to recycle a minimum and allow discharge, provided the effluent meets standards. Heavy rainfall events will first result in a level rise and retention within the ponds, together with increased recycle flows to pond 1B if so set, and then finally discharges to the leachate lagoon (which is hydraulically connected to the river).



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 tank or Wetland Cell 1B. In this case, all leachate abstraction is ceased until the outlet sample comes back within standards, and the actuated valve and pond 5 storage maximises retention.

In the event of an emergency whereby the effluent is above standards, and the retention and balancing of the ponds and recycle pumping system is exceeded, there is provision to allow manual adjustment of the pond outlets to further retain effluent, thus bringing into effect significant additional storage volume using the available freeboard.

## 5.8 RECYCLE SUMP

The recycle sump receives treated effluent from pond 5 and normally pumps back to either the dilution tank (when called by the dilution logic) or else to pond 1B. In the event that effluent exceeds a setpoint standard that is unsuitable for dilution water, pumping is to pond 1B only (this is variable by operator). When inflow exceeds pumping capacity and the level in the sump rises, an actuated valve gradually opens and controls outlet flows until either the level/flow returns to normal parameters, or a high level is reached in the sump, in which case flow discharges through the overflow to the lagoon. In the event that effluent standards exceed allowable setpoints, the actuated valve automatically closes and pumping continues to attempt to retain effluent insofar as possible, with excess flows discharging through the overflow to the lagoon.

The specifications of the sump and equipment are as follows:

| | |
|---|---|
| Size: | Nominally 1800mm diameter, 2000mm high |
| Relevant levels:<br>tank bottom<br>overflow IL<br><br>Pond 5 Outlet<br>top of tank | <br>8.84 mOD<br>10.67 mOD minimum, operator adjustable bend to approx maximum of 10.90 mOD<br>10.66 mOD operator adjustable bend, min -300mm, max +300mm<br>11.10 mOD |
| Operational limits:<br>Bottom limit<br>Top limit | 1.5 m<br>9.34 mOD (bottom +500mm)<br>10.90 mOD (top slab invert level) |
| Operational volume | 3.8 m3 maximum, limits are operator adjustable |
| Inlet pipework | 160mm PVC, IL 9.13 mOD (through wall of tank at bottom)<br>(note that inlet flow is effectively set by level of pond 5 outlet) |
| Outlet pipework | Bottom outlet: 160mm PVC, IL 8.84 mOD (discharges to actuated valve chamber and onwards to main outlet pipe into lagoon)<br>Overflow outlet: 160mm PVC, 10.67 to 10.90 mOD adjustable (discharges to main outlet pipe into lagoon) |
| Level control | Ultrasonic level sensor, limits are operator adjustable |
| Valvework | Valve chamber with automatic valves directing to pond 1B or dilution tank |
| Monitoring | For chemical monitoring see following sections<br>Flowmeter in chamber on 160mm outlet pipework to lagoon |
| Recycle pumps | Two no. submersible 20 m3/hr duty/standby |
| Control Panel | Main control house panel as per O&M manual details, summarily with isolators, status and on/off/auto controls for pumps and valves, flowmeter loggers, hours run, etc. |



The operation of the pumps is controlled by the level setpoints on the system HMI. The 'Ammonia High level Stop Pond 5 Outlet' setpoint is normally set to 5 mg/l, well below the proposed discharge standard of 15 mg/l.

## 5.9 MONITORING

The following monitoring is in effect and logged:

- Online ammonium sensors at the dilution tank, pond 4 outlet, and pond 5 outlet (recycle sump)
- Conductivity and pH at pond 5 outlet
- Flowmeters: online at the dilution well, dilution tank outlet, discharge pipe to lagoon (after pond 5 and recycle sump), recycle pumping to dilution tank or pond 1 B

- Indirect flow measurement via pump run hours is available and logged for: RC8A, leachate collector sump, leachate wells, and condensate pumps 1 and 2

- Hours run is available and logged for all pumps

- All control system events are logged on the SCADA, ranging from normal events such as pump runs, to failures such as pump trips or ammonium warnings

A flow actuated autosampler is setup sampling from the recycle sump and actuated by the outlet flowmeter (and thus only samples actual discharges from the system). This sampler may also be set to timed sampling in which case it will sample at set intervals irrespective of whether discharge or recycle is occurring.

There is no discharge standard proposed for conductivity, rather the more normal SS is specified (50 mg/l). It is proposed to develop a correlation between conductivity and SS over time, and then set a warning on the SCADA system when high conductivity levels indicate a possible SS problem.

Ammonium sensors are calibrated utilising an onsite spectrometer to ensure accurate onsite readings.

## 5.10 CONTROL SYSTEM, HMI, AND SCADA

A main control house is located near the outlet from pond 5 to the lagoon, and houses the main control panel, PLC, HMI (Human Machine Interface), together with monitoring facilities as referred to in earlier sections. This facility allows control of all aspects of the system, aside from certain tank/dilution local control panel functions.



The main control panel contains the power isolators, allows selection of auto/hand/off for all pumps and equipment, together with visual display of run, trip, hours run, ammeters for pumps, and open/closed status for valves. The tank/dilution local control panel is located at the dilution tank and provides the same controls for the tank and dilution well, including the pumps and mixer.

The HMI allows selection of all control settings and setpoints via an LCD touch screen.

The SCADA computer is located in the CA area main building and allows viewing and adjustment of a significant proportion of the HMI functions as described below. The SCADA computer also allows trending and download of system data. Remote access is available to the SCADA computer by means weblink program ‘logmein’ (with appropriate passwords).

### 5.10.1 Alarms and text alert set-up

All events, operational and fault/alarms are logged on the system, and can be sent by text if enabled. No text alarms are sent at present until the proving period is well established (to avoid repetitive and snag issue alarms).

Alarms to be activated are:

1. Text for ANY pump trip/fail

2. Text for ammonium sensors failure

3. Text for w/l in dilution tank > HWL

4. Text Pond 4 monitoring ammonium = warning

5. Text Pond 5 monitoring ammonium > setpoint (normally 5 mg/)

6. Power loss

## 5.11 WEATHER STATION

A 'Davis Vantage Pro 2' weather station is installed adjacent the flare in the CA area, with the data logger and display located in the main CA building. The system measures and logs rainfall, wind-speed, wind direction, temperature, and humidity.

This weather station is not connected to the SCADA system and must be downloaded manually on a regular basis to ensure data security, e.g. once per month.

## 5.12 CARETAKING AND MAINTENANCE

A caretaking schedule is in effect onsite by the Landfill Manager, and includes a weekly and monthly set of tasks, checks, and records. System maintenance is carried out by the installation contractor (EPS) during their maintenance period (post construction), and thereafter will be continued by contract.

# 6 PERFORMANCE OF FULL LEACHATE ABSTRACTION-TREATMENT SYSTEM – INITIAL 9 MONTHS

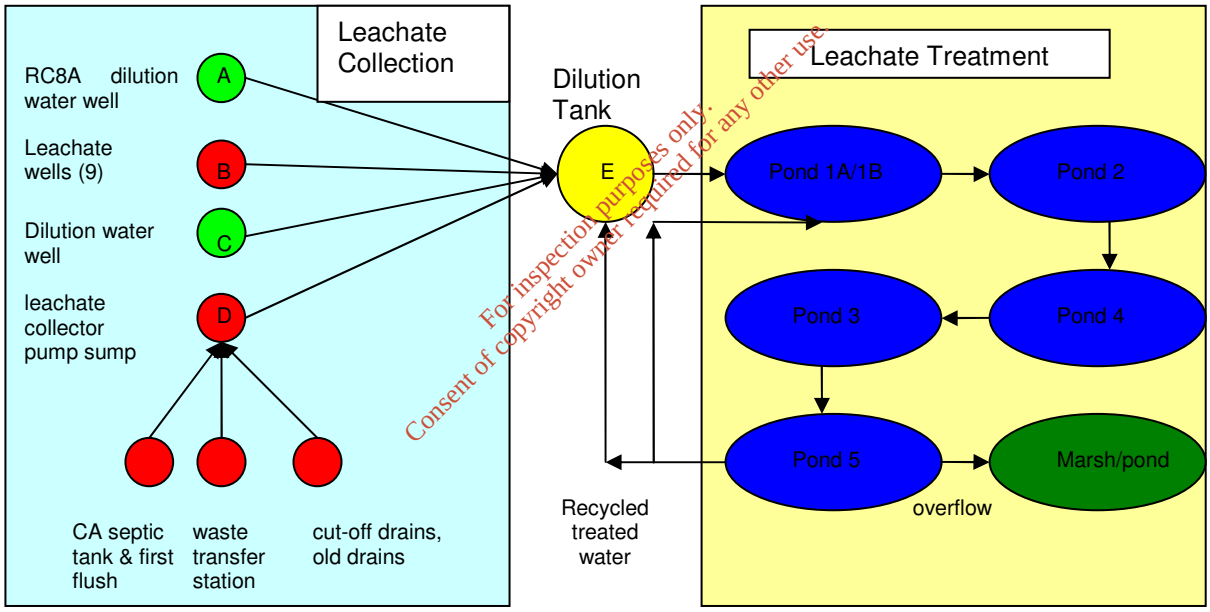
This section presents analysis of the performance of the full leachate abstraction and treatment system for the initial 9 month proving period from September 2012 to June 2012. The system was substantially completed in late June 2012, and the proving period commenced on 24/09/2012.

Treatment process proving commenced on 24/09/2012 albeit still with some snags still affecting the operation and/or monitoring of the system, but nonetheless allowing for ramp-up of loadings to the treatment system and monitoring thereof. All significant snags were completed by mid-October.

## 6.1 PROCESS DESCRIPTION

The leachate abstraction and treatment system at Dungarvan landfill is shown in the process diagram below, comprising 9 No. leachate abstraction wells, and the ICW's (wetlands).

The process can be divided into three stages, leachate collection, leachate dilution and leachate treatment:






## 6.2 TREATMENT EFFICIENCY OF THE ICW

The main objective of monitoring was to ensure that the discharge quality from pond 5 was within the proposed emission limits and therefore that the treatment system was performing as intended.

As discussed in the section on the partial system, the threshold parameter, ammonia-N concentration, is known to be the factor limiting vegetation growth and this will be managed through dilution of leachate containing high concentrations of ammonia-N. The main focus of the ICW is the removal of ammonia-N and the capture of other pollutants, particularly heavy metals.

The wetlands are designed to accept up to 186 m3/d of diluted leachate at 100 mg/l $NH_4$. The estimated leachate and polluted arising loadings are 11 kg/d ammonium (average) and 18.6 kg/d maximum.

The system is currently setup to dilute leachate to 100 mg/l ammonium or less before transfer to wetlands pond 1, and it is expected to treat this diluted leachate to better than 5 mg/l at the outlet of pond 5 (the proposed standard is 15 mg/l). There are also ortho-P, BOD, and SS standards as discussed following.

### 6.2.1 Leachate Collection – Flows & Quality (Ammonium) Prior to Treatment

The following loadings were in effect during the period from 24th September 2012 to June 2013.

1. leachate: initially set at 1 m3/d on 24th September, ramped up to 3 m3/d on 18th October, and to 5 m3/d on the 3rd of December. However, looking at the meter readings from the pumps, an estimated 2.7 m3/d was actually pumped, as the pumps only operate when there is a certain minimum head of leachate. The current setting gives an estimated 4 to 7 kg/d of ammonium, and is below the anticipated medium to long term leachate abstraction volume, but is of course subject to change according to conditions.

2. leachate collector pump sump: operating at an average of 26 m3/d, with an estimated strength of 105 mg/l, and a loading of 2.7 kg/d ammonium

3. well RC8A – set to 8 runs for 1 hour, total 8 hours, approximately 12 m3/d, a loading of 1.1 kg/d ammonium



There is no facile method to accurately measure raw leachate abstraction volumes and strength due to the nature of the system, however the above estimates are based on pump run times and historical leachate concentration measurements. Thus the current total loading is estimated at 8 to 10 kg/d, using this method. As a check, the volume transferred from the dilution tank to pond 1 was on average 71 m3/d, at 99 mg/l, which is 7 kg/d, lower than the estimated medium to long term average loading, 38% of the estimated maximum capacity, and similar to the 7 kg/d loading during the partial leachate system operation in 2010-12.

### 6.2.2 Leachate Treatment – Quality (Ammonium) after Treatment

Figure 6.1 summarises the ammonium concentrations found at the outlet of pond 5.

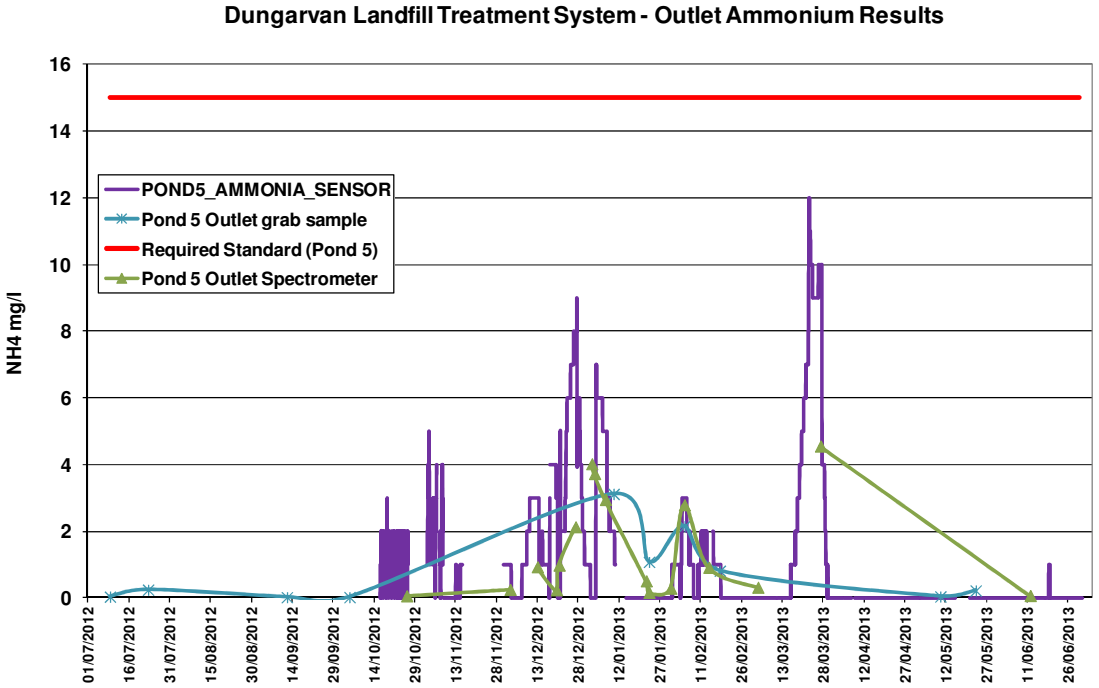



**Figure 6.1:** Ammonium Concentrations recorded from July 2012 to June 2013 at Pond 5



As discussed above, the dilution tank pumped diluted leachate into pond 1 at an average strength of 99 mg/l.

The graph above shows pond 5 grab sample results for the period from July 2012 to June 2013 and online ammonium sensor readings and onsite spectrometer tests from mid-October onwards (when these were functioning correctly). The proposed standard is 15 mg/l ammonium.

Pond 5, the final pond before discharge from the wetlands treatment system, had an average outlet concentration of 1.2 mg/l, and a maximum recorded of 12 mg/l, from the online sensor. There were 7 grab samples analysed in the period, all below5 mg/l. There were 16 spectrometer tests during the period, again all of these were below 5 mg/l.

The above results are similar to those during the partial leachate system in 2010-12, with an average ammonium concentration of less than 1 mg/l at pond 5.

Grab sample type monitoring is the designated method for testing the system adherence to standards, and as such the system is compliant for all samples. The spectrometer is designed to allow onsite calibration of the online ammonium sensors, and provides a frequent validation of outlet ammonium concentrations. The online ammonium sensors should not be used to determine adherence to standards, as these sensors are for process control purposes only, and are subject to drift and correction.

#### 6.2.2.1 Leachate Treatment – Quality (Other Parameters) after Treatment

The following concentrations were recorded at pond 5 outlet:

- pH varies from 5.7 to 7.9, within the proposed range of 5 – 9

- Only one BOD result was available in the period; 3 mg/l, well within the proposed standard of 45 mg/l

- Suspended Solids results are all at 1 mg/l or less, except one result at 45 mg/l. It is assumed that this was a sampling/testing issue, as no other parameters were elevated, and no issues evident onsite at the time. The proposed standard is 50 mg/l.

- Orthophosphate (mg/l P) averages 0.02 mg/l with a maximum of 0.04 mg/l, well within the proposed standard of 2 mg/l

In summary, the wetlands treatment system performed well during the proving period, with discharge concentrations well within the proposed emission limits.

There is also an annual monitoring proposal for additional parameters included in the waste licence review application which will be adhered to.

### 6.2.3 System flows

Flows are measured online at the dilution well, dilution tank outlet, discharge pipe to lagoon (after pond 5 and recycle sump), recycle pumping to dilution tank or pond 1B, and inter-pond flows. Full data is available in the project files and SCADA system, and this section concentrates on outlet (discharge) flows since full system commencement in September 2012.

Pond 5 outlet flows are influenced by the pond outlet pipe and recycle sump, including the recycle pump settings and actuated valve. The recycle settings were varied during the period, initially set to recycle as much as possible (up to 480 m3/d), and then gradually reduced as the system treatment results proved acceptable, and currently set at 20 m3/d (i.e. minimal recycle to pond 1B, used primarily as a dilution water source to tank). The average recycle flow during the period was 86.5 m3/d.

Pond 5 had an average flow of 70 m3/d, a maximum of 99 **m3/hr**, and a minimum of 0.

This compares to the partial leachate system during 2010-12 which showed an average flow of 53 m3/d, maximum 56.5 m3/hr, and a minimum of 0.



## 6.3 CONCLUSION

The full leachate abstraction and treatment system has been operational from late September 2012 to date, a period of 9 months. The current total loading is 7 kg/d ammonium, which is somewhat under the estimated medium to long term average loading of 11 kg/d, and 38% of the estimated maximum capacity. There was a degree of ramp-up of loadings in the period, and thus the medium to long term loadings may increase.

The system has been performing well, with an average outlet concentration of 1.2 mg/l for the key parameter ammonium, and a maximum recorded of 4.6 mg/l from the grab samples. The other monitoring parameters, BOD, SS, pH, and Ortho-P are all well within standards, both on average and maximum.

# REFERENCES

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Scholz M., Harrington, R., Carroll, P., Mustafa, A., 2007, The Integrated Constructed Wetland (ICW) Concept, WETLANDS, Volume 27, No. 2, June 2007.

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# APPENDIX A DRAWING LIST

**List of Drawings**

| Drawing No. | Title | Status / comments |
|---|---|---|
| MDR0350 FG001 R02 | Leachate Extraction and Treatment System – Partial System 2010-2012 | Final |
| MDR0350 FG002 R01 | Leachate Extraction and Treatment System – Summary | Final |
| MDR0350 FG0010 F01 | Leachate Head Years 2008-2011 | Final |
| MDR0350 DG0706 R01 | Leachate Abstraction and Treatment System | Final |

# APPENDIX 4

# TABLES E.2(I) AND E.2(II)

**TABLE E.2(i): EMISSIONS TO SURFACE WATERS**
(One page for each emission)

**Emission Point: SWE1**

| | |
|---|---|
| Emission Point Ref. N$^{o}$: | SWE1 |
| Source of Emission: | Surface Water Drainage pipe from landfill cap |
| Location : | River bank west side of landfill |
| Grid Ref. (10 digit, 5E,5N): | E24156 N94716 |
| Name of receiving waters: | Colligan River |
| Flow rate in receiving waters: | 0.32 $m^3.sec^{-1}$ Dry Weather Flow<br>0.5 $m^3.sec^{-1}$ 95%ile flow |
| Available waste assimilative capacity: | Ortho-Phosphate 0.36 kg/day<br>Ammonia 27 kg/day<br>BOD 87.6 kg/day<br>Suspended Solids 553 kg/day |

**Emission Details:**

| (i) Volume to be emitted | | | |
|---|---|---|---|
| Normal/day | 13.2 $m^3$ | Maximum/day | 640 $m^3$ |
| Maximum rate/hour | 90 $m^3$ | | |

(ii) 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) | As per rainfall_____min/hr<br>As per rainfall_____hr/day<br>As per rainfall_____day/yr |
|---|---|

**TABLE E.2(ii): EMISSIONS TO SURFACE WATERS - Characteristics of the emission** (1 table per emission point)

***Emission point reference number :*** ***SWE1***

| Parameter | Prior to treatment | | | | As discharged | | | | % Efficiency |
|---|---|---|---|---|---|---|---|---|---|
| | Max. hourly average (mg/l) | Max. daily average (mg/l) | kg/day | kg/year | Max. hourly average (mg/l) | Max. daily average (mg/l) | kg/day | kg/year | |
| TSS | | | | | 50* | 50* | 0.66 | 241 | |



* This will only occur during prolonged periods of rainfall, and kg/year will depend on yearly rainfall

**TABLE E.2(i): EMISSIONS TO SURFACE WATERS**
(One page for each emission)

**Emission Point: SWE2**

| | |
|---|---|
| Emission Point Ref. N$^{o}$: | SWE2 |
| Source of Emission: | Surface Water Drainage pipe from landfill cap |
| Location : | Bank of lagoon |
| Grid Ref. (10 digit, 5E,5N): | E24499 N94772 |
| Name of receiving waters: | Colligan River |
| Flow rate in receiving waters: | 0.32 $m^3.sec^{-1}$ Dry Weather Flow<br>0.5 $m^3.sec^{-1}$ 95%ile flow |
| Available waste assimilative capacity: | Ortho-Phosphate 0.36 kg/day<br>Ammonia 27 kg/day<br>BOD 87.6 kg/day<br>Suspended Solids 553 kg/day |

**Emission Details:**

| (i) Volume to be emitted | | | |
|---|---|---|---|
| Normal/day | 9.9 $m^3$ | Maximum/day | 480 $m^3$ |
| Maximum rate/hour | 90 $m^3$ | | |

(ii) 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) | As per rainfall_____min/hr<br>As per rainfall_____hr/day<br>As per rainfall_____day/yr |
|---|---|

**TABLE E.2(ii): EMISSIONS TO SURFACE WATERS - Characteristics of the emission** (1 table per emission point)

***Emission point reference number :*** ***SWE2***

| Parameter | Prior to treatment | | | | As discharged | | | | % Efficiency |
|---|---|---|---|---|---|---|---|---|---|
| | Max. hourly average (mg/l) | Max. daily average (mg/l) | kg/day | kg/year | Max. hourly average (mg/l) | Max. daily average (mg/l) | kg/day | kg/year | |
| TSS | | | | | 50* | 50* | 0.49 | 180 | |



* This will only occur during prolonged periods of rainfall, and kg/year will depend on yearly rainfall

**TABLE E.2(i): EMISSIONS TO SURFACE WATERS**
(One page for each emission)

**Emission Point: SWE3**

| | |
|---|---|
| Emission Point Ref. N$^{o}$: | SWE3 |
| Source of Emission: | Surface Water Drainage pipe from Civic Amenity Area |
| Location : | River bank close to transfer station entrance |
| Grid Ref. (10 digit, 5E,5N): | E24582 N94649 |
| Name of receiving waters: | Colligan River |
| Flow rate in receiving waters: | 0.32 $m^3.sec^{-1}$ Dry Weather Flow<br>0.5 $m^3.sec^{-1}$ 95%ile flow |
| Available waste assimilative capacity: | Ortho-Phosphate 0.36 kg/day<br>Ammonia 27 kg/day<br>BOD 87.6 kg/day<br>Suspended Solids 553 kg/day |

**Emission Details:**

| (i) Volume to be emitted | | | |
|---|---|---|---|
| Normal/day | 9 $m^3$ | Maximum/day | 440 $m^3$ |
| Maximum rate/hour | 90 $m^3$ | | |

(ii) 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) | As per rainfall_____min/hr<br>As per rainfall_____hr/day<br>As per rainfall_____day/yr |

**TABLE E.2(ii): EMISSIONS TO SURFACE WATERS - Characteristics of the emission** (1 table per emission point)

***Emission point reference number :*** ***SWE3***

| Parameter | Prior to treatment | | | | As discharged | | | | % Efficiency |
|---|---|---|---|---|---|---|---|---|---|
| | Max. hourly average (mg/l) | Max. daily average (mg/l) | kg/day | kg/year | Max. hourly average (mg/l) | Max. daily average (mg/l) | kg/day | kg/year | |
| TSS | 500 | 100 | 0.9 | 329 | 200 | 50 | 0.45 | 165 | 50% |
| OFG | 20 | 5 | 0.05 | 18 | 10 | 2 | 0.02 | 66 | 60% |



Note: there exists a first flush system that directs initial stormwater flows to the foul sewer and onwards to the wetlands treatment system, and an oil interceptor, prior to discharge.

**TABLE E.2(i): EMISSIONS TO SURFACE WATERS**
(One page for each emission)

**Emission Point: SWE4**

| | |
|---|---|
| Emission Point Ref. N$^{o}$: | SWE4 |
| Source of Emission: | Surface Water Drainage pipe from landfill cap |
| Location : | River bank north side of landfill |
| Grid Ref. (10 digit, 5E,5N): | E24344 N94862 |
| Name of receiving waters: | Colligan River |
| Flow rate in receiving waters: | 0.32 $m^3.sec^{-1}$ Dry Weather Flow<br>0.5 $m^3.sec^{-1}$ 95%ile flow |
| Available waste assimilative capacity: | Ortho-Phosphate 0.36 kg/day<br>Ammonia 27 kg/day<br>BOD 87.6 kg/day<br>Suspended Solids 553 kg/day |

**Emission Details:**

| (i) Volume to be emitted | | | |
|---|---|---|---|
| Normal/day | 2.6 $m^3$ | Maximum/day | 128 $m^3$ |
| Maximum rate/hour | 27 $m^3$ | | |

(ii) 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) | As per rainfall_____min/hr<br>As per rainfall_____hr/day<br>As per rainfall_____day/yr |
|---|---|

**TABLE E.2(ii): EMISSIONS TO SURFACE WATERS - Characteristics of the emission** (1 table per emission point)

***Emission point reference number :*** ***SWE4***

| Parameter | Prior to treatment | | | | As discharged | | | | % Efficiency |
|---|---|---|---|---|---|---|---|---|---|
| | Max. hourly average (mg/l) | Max. daily average (mg/l) | kg/day | kg/year | Max. hourly average (mg/l) | Max. daily average (mg/l) | kg/day | kg/year | |
| TSS | | | | | 50* | 50* | 0.13 | 48 | |



* This will only occur during prolonged periods of rainfall, and kg/year will depend on yearly rainfall

**TABLE E.2(i): EMISSIONS TO SURFACE WATERS**
(One page for each emission)

**Emission Point: SWE5**

| | |
|---|---|
| Emission Point Ref. N$^{o}$: | SWE5 |
| Source of Emission: | Surface Water Drainage pipe from landfill cap |
| Location : | River bank north side of landfill |
| Grid Ref. (10 digit, 5E,5N): | E24400 N94854 |
| Name of receiving waters: | Colligan River |
| Flow rate in receiving waters: | 0.32 $m^3.sec^{-1}$ Dry Weather Flow<br>0.5 $m^3.sec^{-1}$ 95%ile flow |
| Available waste assimilative capacity: | Ortho-Phosphate 0.36 kg/day<br>Ammonia 27 kg/day<br>BOD 87.6 kg/day<br>Suspended Solids 553 kg/day |

**Emission Details:**

| (i) Volume to be emitted | | | |
|---|---|---|---|
| Normal/day | 5.9 $m^3$ | Maximum/day | 288 $m^3$ |
| Maximum rate/hour | 60 $m^3$ | | |

(ii) 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) | As per rainfall_____min/hr<br>As per rainfall_____hr/day<br>As per rainfall_____day/yr |
|---|---|

**TABLE E.2(ii): EMISSIONS TO SURFACE WATERS - Characteristics of the emission** (1 table per emission point)

***Emission point reference number :*** ***SWE5***

| Parameter | Prior to treatment | | | | As discharged | | | | % Efficiency |
|---|---|---|---|---|---|---|---|---|---|
| | Max. hourly average (mg/l) | Max. daily average (mg/l) | kg/day | kg/year | Max. hourly average (mg/l) | Max. daily average (mg/l) | kg/day | kg/year | |
| TSS | | | | | 50* | 50* | 0.3 | 108 | |



* This will only occur during prolonged periods of rainfall, and kg/year will depend on yearly rainfall

**TABLE E.2(i): EMISSIONS TO SURFACE WATERS**
(One page for each emission)

**Emission Point: SWE6**

| | |
|---|---|
| Emission Point Ref. N$^{o}$: | SWE6 |
| Source of Emission: | Discharge pipe from wetlands treatment system |
| Location : | Bank of lagoon |
| Grid Ref. (10 digit, 5E,5N): | E24495 N94682 |
| Name of receiving waters: | Colligan River |
| Flow rate in receiving waters: | 0.32 $m^3.sec^{-1}$ Dry Weather Flow<br>0.5 $m^3.sec^{-1}$ 95%ile flow |
| Available waste assimilative capacity: | Ortho-Phosphate 0.36 kg/day<br>Ammonia 27 kg/day<br>BOD 87.6 kg/day<br>Suspended Solids 553 kg/day |

**Emission Details:**

| (i) Volume to be emitted | | | |
|---|---|---|---|
| Normal/day | 140 $m^3$ | Maximum/day | 186 $m^3$ |
| Maximum rate/hour | 99 $m^3$ | | |

(ii) 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)* | 60 min/hr<br>24 hr/day<br>365 day/yr |



***note: See attached report *Leachate Abstraction and Treatment System – Description and Performance (2013)* detailing expected flowrates, including averages and maximums. The average discharge without recycle is estimated at 140 m3/d, but the treatment system has capability to recycle some or all of the maximum process flow, depending on circumstances, and as such average discharges are normally less than the 140 m3/d specified above. Maximum volume per day indicated in above table is calculated at maximum process flow. Heavy rainfall will produce larger maximum discharge volumes per day.**

**TABLE E.2(ii): EMISSIONS TO SURFACE WATERS - Characteristics of the emission** (1 table per emission point)

***Emission point reference number :*** ***SWE6***

| Parameter | Prior to treatment | | | | As discharged | | | | % Efficiency |
|---|---|---|---|---|---|---|---|---|---|
| | Max. hourly average (mg/l) | Max. daily average (mg/l) | kg/day | kg/year | Max. hourly average (mg/l) | Max. daily average (mg/l) | kg/day | kg/year | |
| Ortho-Phosphate | 50 | 50 | 0.4 | 159 | 2 | 2 | 0.36 | 131 | 10% |
| Ammonia | 2500 | 411 | 18.6 | 6789 | 15 | 15 | 2.79 | 1018 | 99% |
| BOD | 2000 | 890 | 40 | 14600 | 45 | 45 | 8.37 | 3055 | 79% |
| Total Suspended Solids | 1000 | 490 | 22 | 8030 | 50 | 50 | 9.3 | 3395 | 58% |

**TABLE E.2(i): EMISSIONS TO SURFACE WATERS**
(One page for each emission)

**Emission Point: SWE7**

| | |
|---|---|
| Emission Point Ref. N$^{o}$: | SWE7 |
| Source of Emission: | Surface Water Drainage pipe from landfill cap |
| Location : | Bank of lagoon |
| Grid Ref. (10 digit, 5E,5N): | E24497 N94668 |
| Name of receiving waters: | Colligan River |
| Flow rate in receiving waters: | 0.32 $m^3.sec^{-1}$ Dry Weather Flow<br>0.5 $m^3.sec^{-1}$ 95%ile flow |
| Available waste assimilative capacity: | Ortho-Phosphate 0.36 kg/day<br>Ammonia 27 kg/day<br>BOD 87.6 kg/day<br>Suspended Solids 553 kg/day |

**Emission Details:**

| (i) Volume to be emitted | | | |
|---|---|---|---|
| Normal/day | 13.2 $m^3$ | Maximum/day | 640 $m^3$ |
| Maximum rate/hour | 90 $m^3$ | | |

(ii) 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) | As per rainfall_____min/hr<br>As per rainfall_____hr/day<br>As per rainfall_____day/yr |

**TABLE E.2(ii): EMISSIONS TO SURFACE WATERS - Characteristics of the emission** (1 table per emission point)

***Emission point reference number :*** ***SWE7***

| Parameter | Prior to treatment | | | | As discharged | | | | % Efficiency |
|---|---|---|---|---|---|---|---|---|---|
| | Max. hourly average (mg/l) | Max. daily average (mg/l) | kg/day | kg/year | Max. hourly average (mg/l) | Max. daily average (mg/l) | kg/day | kg/year | |
| TSS | | | | | 50* | 50* | 0.62 | 225 | |



* This will only occur during prolonged periods of rainfall, and kg/year will depend on yearly rainfall

# APPENDIX 5

# REGISTER OF DRAWINGS

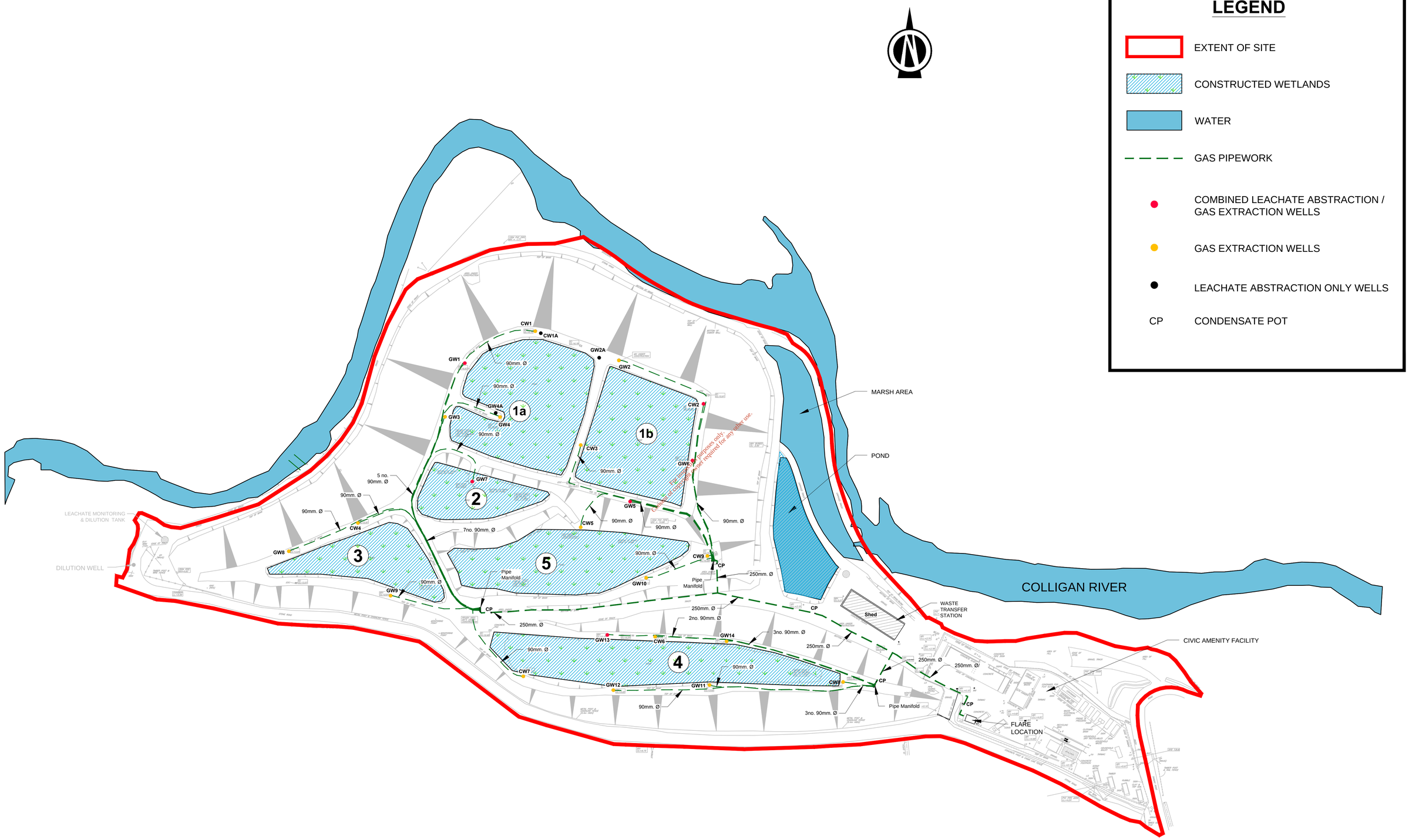
**List of Drawings associated with this response:**

| Current Drawing No. | Revision No. | Previous Drawing No. as submitted to EPA | Title |
|---|---|---|---|
| MDR0350DG0607 | R02 | MDR0350DG0606 Revision R01 | Gas collection system |
| MDR0350DG0505 | R02 | DG0505 Revision F02 | Monitoring Locations |
| MDR0350DG0714 | R02 | Related to DG0007 Revision A01 (Drainage Layout for Civic Amenity and Green Waste Area) | Landfill Surface Water Drainage System |
| MDR0350FG002 | R01 | none | Leachate Abstraction and Treatment System Summary |
| MDR0350DG0706 | R01 | Related to MDR0350DG0607 Revision R01 | Leachate Abstraction and Treatment System |
| MDR0350DG0506 | R01 | MDR0350DG0506 Revision F01 (no changes) | Retaining Berm Construction Details |
| MDR0350DG0103(a) | R01 | | Standard Detail (Sheet 1 of 2) |



**List of Drawings associated with Appendix 3 Report**

| Current Drawing No. | Revision No. | Previous Drawing No. as submitted to EPA | Title |
|---|---|---|---|
| MDR0350FG001 | R02 | none | Leachate Extraction and Treatment System – Partial System 2010-2012 |
| MDR0350FG0010 | F01 | none | Leachate Head Years 2008-2011 |




## LEGEND

- EXTENT OF SITE
- CONSTRUCTED WETLANDS
- WATER
- GAS PIPEWORK
- COMBINED LEACHATE ABSTRACTION / GAS EXTRACTION WELLS
- GAS EXTRACTION WELLS
- LEACHATE ABSTRACTION ONLY WELLS
- CP — CONDENSATE POT

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| No. | Date | Drn. / Chk. | Amendment / Issue | App |
|---|---|---|---|---|
| R02 | Nov '12 | RH / JB | As Built Issue | JB |
| R01 | Nov '10 | RH / JB | As Built Issue | JB |
| C01 | Aug '08 | RH / BO'K | Issue for Construction | PM |

Client: **WATERFORD COUNTY COUNCIL**
**Comhairle Chontae Phort Láirge**
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| Drawn By | Checked By | Approved By | Date |
|---|---|---|---|
| RH | BO'K | PM | Aug 2008 |

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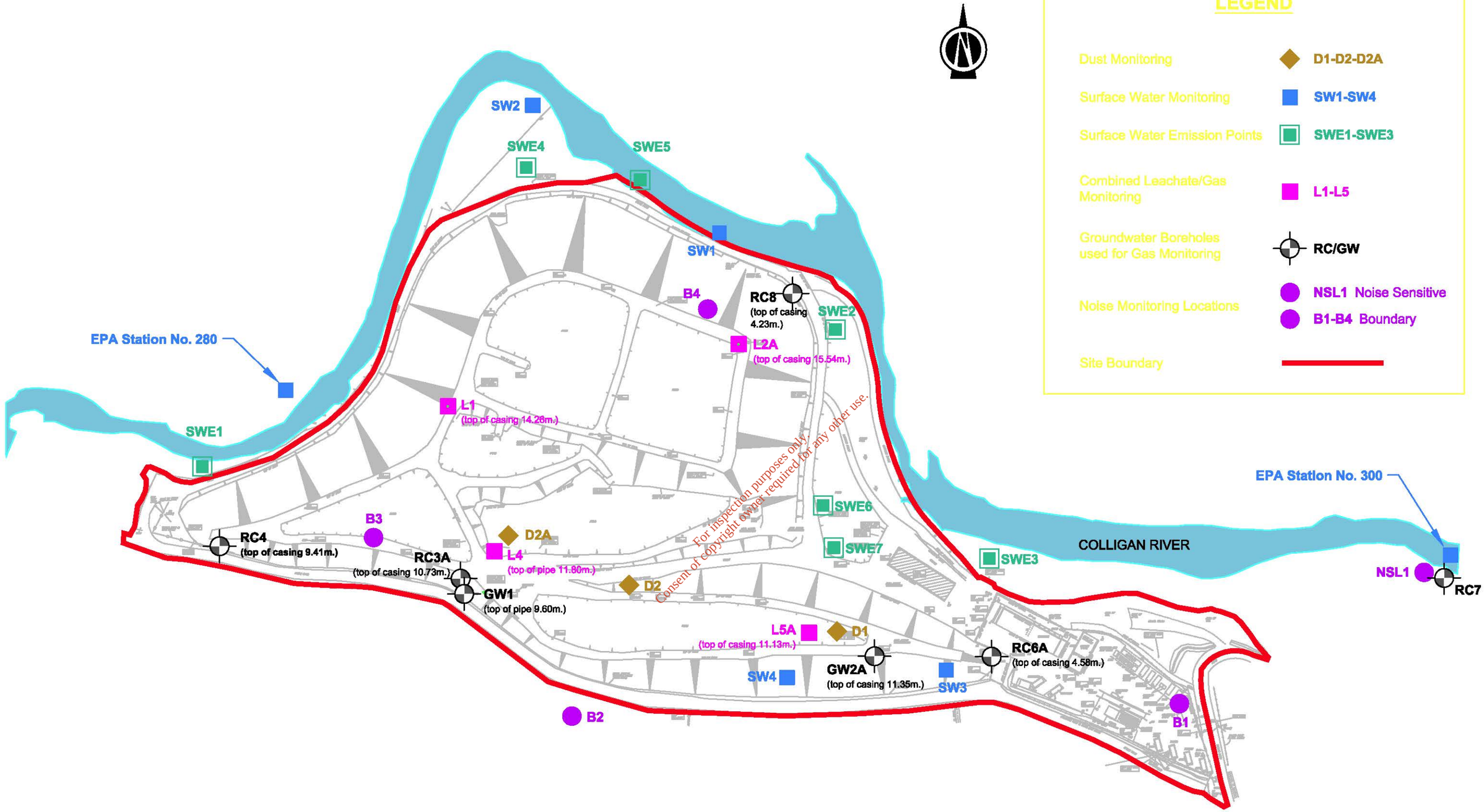
Drawing Number: MDR0350/DG0607
Rev: R02

Project: DUNGARVAN LANDFILL REMEDIATION

Title: LANDFILL GAS COLLECTION SYSTEM

| Drawing Status | Scale / Sheet Size | |
|---|---|---|
| As Built | 1:1000 @ A1 | 1:2000 @ A3 |



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| No. | Date | | Amendment / Issue | App |
|---|---|---|---|---|
| R02 | Jul '13 | RH JP | As Built Issue | JP |
| R01 | Nov '10 | RH JP | As Built Issue | JP |
| F01 | Dec '08 | RH EB | Final Issue | EB |
| D01 | Apr.08 | RH BOK | Draft Issue | MS |

Client: WATERFORD COUNTY COUNCIL
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| Drawn By | Checked By | Approved By | Date |
|---|---|---|---|
| RH | BOK | MS | April 2008 |

Project: DUNGARVAN LANDFILL
Drawing Status: As Built
Scale / Sheet Size: 1:1000 @ A1 1:2000 @ A3

Drawing Number: MDR0350/DG0505
Rev: R02
Title: MONITORING LOCATIONS

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## LEGEND

- CONSTRUCTED WETLANDS
- WATER
- FRENCH DRAIN WITH 225MM PERFORATED PIPE
- 160MM FOUL SEWER
- 300MM STORMWATER PIPE

NOTE — FRENCH DRAIN ON E-N-W BOUNDARY HAS 160MM OUTLETS TO RIVER/LAGOON AT LOCATIONS SHOWN

SWE4
160mm. Ø outlet
E224344 N94862
IL 1.77

SWE5
160mm. Ø outlet
E224400 N94854
IL 1.56

SWE2
160mm. Ø outlet
E224499 N94772
IL 2.17

SWE1
160mm. Ø outlet
E224156 N94716
IL 2.47

SWE3
300mm. Ø outlet
E224582 N94649
IL 1.92 MOD

SWE6
160mm. Ø outlet
E 224495 N94682
IL 2.24

SWE7
225mm. Ø outlet
E224497
N94668
IL 2.01

MARSH AREA

NEW LEACHATE COLLECTOR PUMP SUMP

LAGOON MARSH

OLD LEACHATE COLLECTOR SUMP

WETLANDS SYSTEM OUTLET

OIL/PETROL INTERCEPTOR SYSTEM

LEACHATE AND DIRTY WATER FROM STATION

STORMWATER FROM CA AREA DISCHARGES TO FIRST FLUSH CHAMBER CONNECTED TO FOUL SEWER, WITH STORMWATER OUTLET TO RIVER

LEACHATE MONITORING & DILUTION TANK

DILUTION WELL

RECYCLE SUMP

MAIN CONTROL HUT

WASTE TRANSFER STATION

CIVIC AMENITY FACILITY

GAS FLARE

COLLIGAN RIVER

THERE EXISTS AN OLD STONE/FRENCH DRAIN ON THIS BOUNDARY, OBSCURED, DISCHARGING TO THE RIVER AND STREAM



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| No. | Date | Drn. / Chk. | Amendment / Issue | App |
|---|---|---|---|---|
| R02 | Jul '13 | RH / JB | As Built Issue | JB |
| R01 | Nov '12 | RH / JB | As Built Issue | JB |

Client: **WATERFORD COUNTY COUNCIL**
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| Drawn By | Checked By | Approved By | Date |
|---|---|---|---|
| JB | RH | JB | Nov 2012 |

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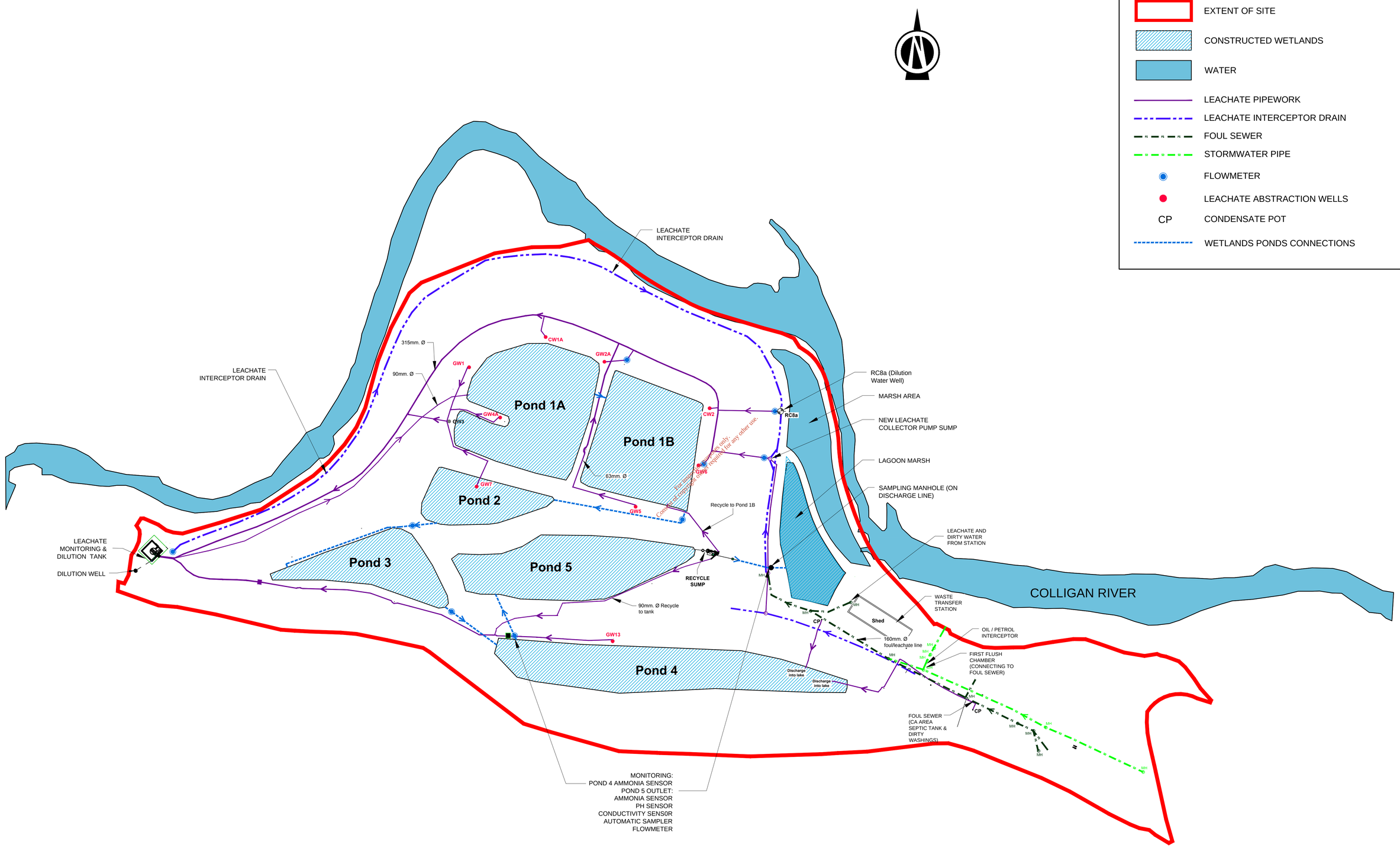
Drawing Number: MDR0350/DG0714
Rev: R02

Project: DUNGARVAN LANDFILL REMEDIATION

Title: LANDFILL SURFACE WATER DRAINAGE SYSTEM

| Drawing Status | Scale / Sheet Size | |
|---|---|---|
| As Built | 1:1000 @ A1 | 1:2000 @ A3 |



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|---|---|---|---|---|
| R01 | Nov '12 | RH / JB | As Built Issue | JB |

Client: **WATERFORD COUNTY COUNCIL**
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| Drawn By | Checked By | Approved By | Date |
|---|---|---|---|
| RH | JB | JB | Nov 2012 |

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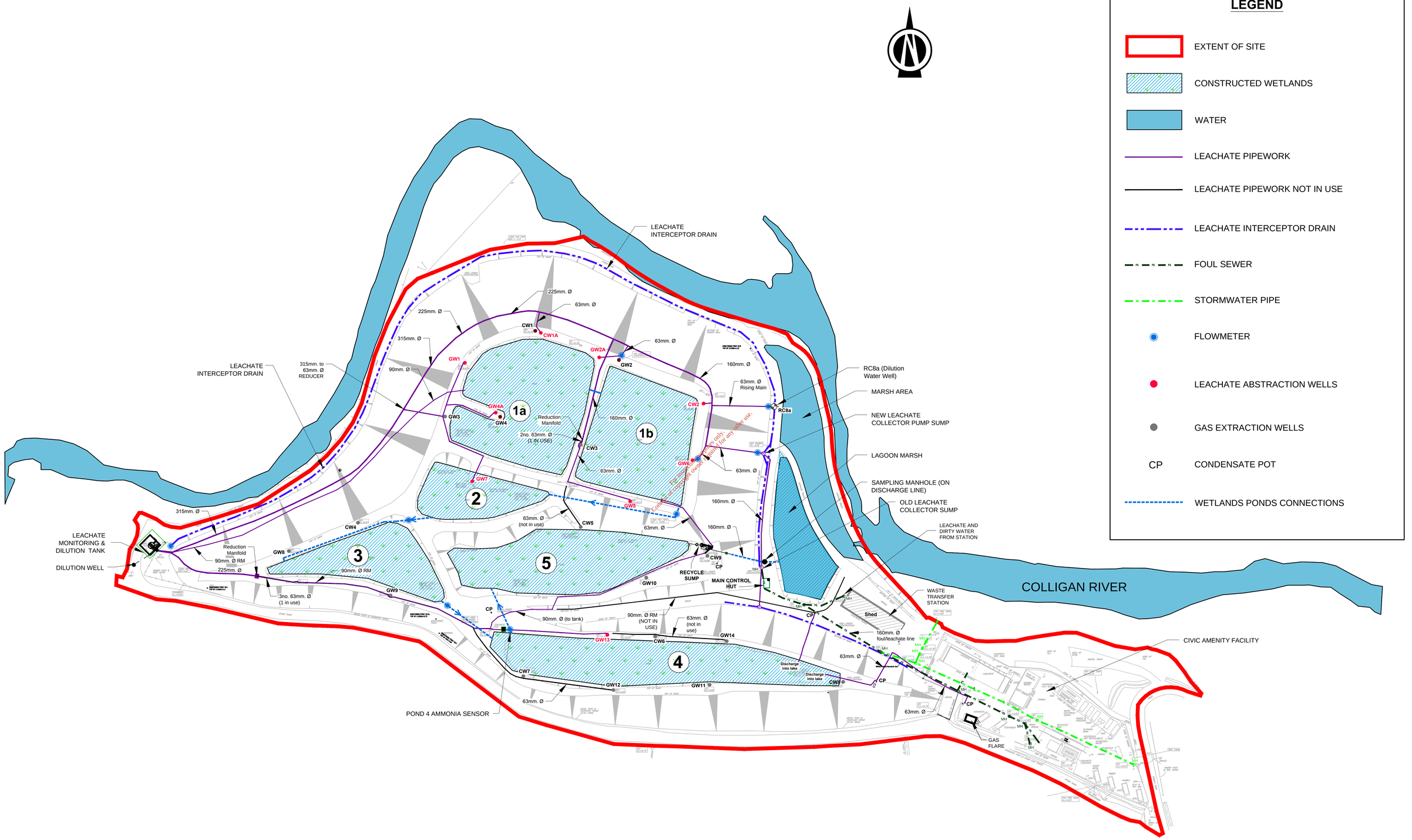
Drawing Number: MDR0350/FG002
Rev: R01

Project: DUNGARVAN LANDFILL REMEDIATION

Drawing Status: As Built
Scale / Sheet Size: 1:1000 @ A1 | 1:2000 @ A3

Title: LEACHATE ABSTRACTION AND TREATMENT SYSTEM SUMMARY




## LEGEND

- EXTENT OF SITE
- CONSTRUCTED WETLANDS
- WATER
- LEACHATE PIPEWORK
- LEACHATE PIPEWORK NOT IN USE
- LEACHATE INTERCEPTOR DRAIN
- FOUL SEWER
- STORMWATER PIPE
- FLOWMETER
- LEACHATE ABSTRACTION WELLS
- GAS EXTRACTION WELLS
- CP — CONDENSATE POT
- WETLANDS PONDS CONNECTIONS



R:\MDR0350\DG\AS-BUILT DRGS - DEC 2012\mdr0350DG0706R01 - LEACHATE LAYOUT.dwg

### NOTES

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| No. | Date | Drn. Chk. | Amendment / Issue | App |
|---|---|---|---|---|
| R01 | Nov. '12 | RH JB | As Built Issue | JB |
| C01 | Oct.'11 | RH JB | Issue for Construction | JB |
| B01 | June '11 | RH JB | Issue for Tender | JB |

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

| Drawn By | Checked By | Approved By | Date |
|---|---|---|---|
| RH | JB | JB | June 2011 |

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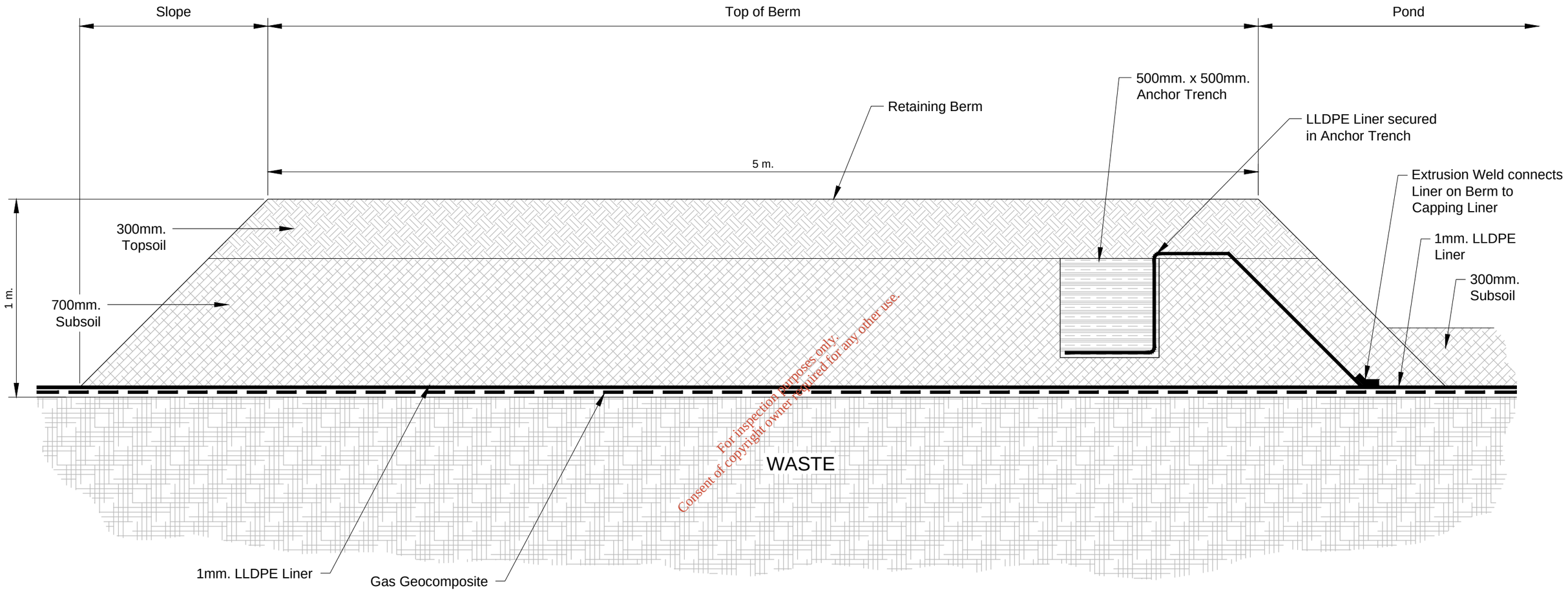
Drawing Number: MDR0350/DG0706
Rev: R01

Project: DUNGARVAN LANDFILL REMEDIATION

Title: LEACHATE ABSTRACTION AND TREATMENT SYSTEM

| Drawing Status | Scale / Sheet Size | |
|---|---|---|
| As Built | 1:1000 @ A1 | 1:2000 @ A3 |






# RETAINING BERM CONSTRUCTION DETAILS

Scale 1:20

R:\MDR0350\D\gAS-BUILT DRGS - DEC 2012\mdr0350DG0506R01 - RETAINING BERM DETAILS.dwg

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| No. | Date | Drn / Chk | Amendment / Issue | App |
|---|---|---|---|---|
| R01 | Nov '12 | RH / JB | As Built | JB |
| F01 | Dec '08 | RH / EB | Final Issue | EB |
| A01 | Aug '08 | RH / BO'K | Issue for Approval | PM |

Client: **WATERFORD COUNTY COUNCIL**
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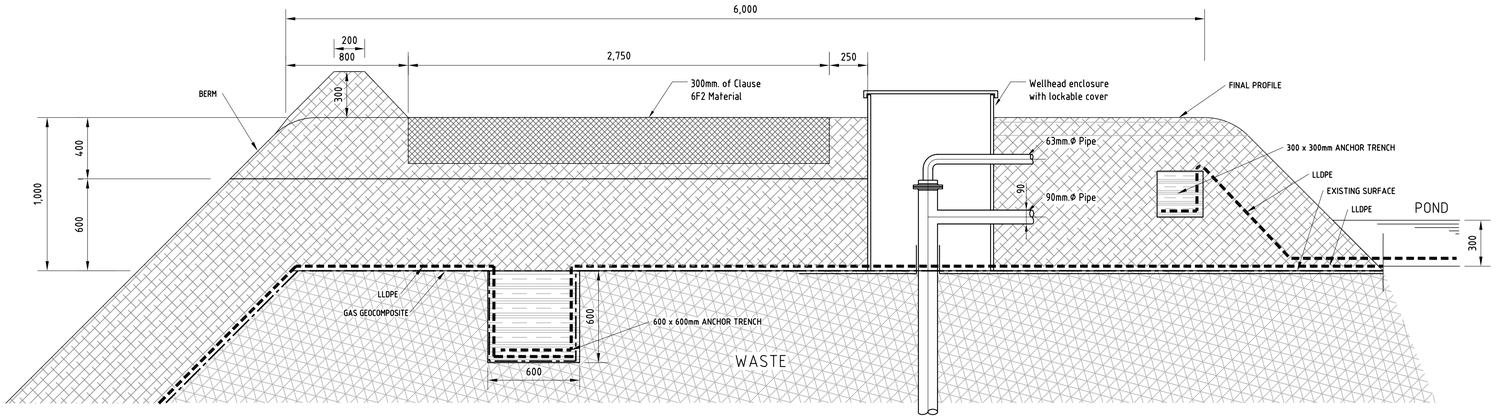
| Drawn By | Checked By | Approved By | Date |
|---|---|---|---|
| RH | BO'K | PM | Aug. 2008 |

| Drawing Status | Scale / Sheet Size | |
|---|---|---|
| As Built | NTS @ A1 | 1:20 @ A3 |

Project: DUNGARVAN LANDFILL REMEDIATION

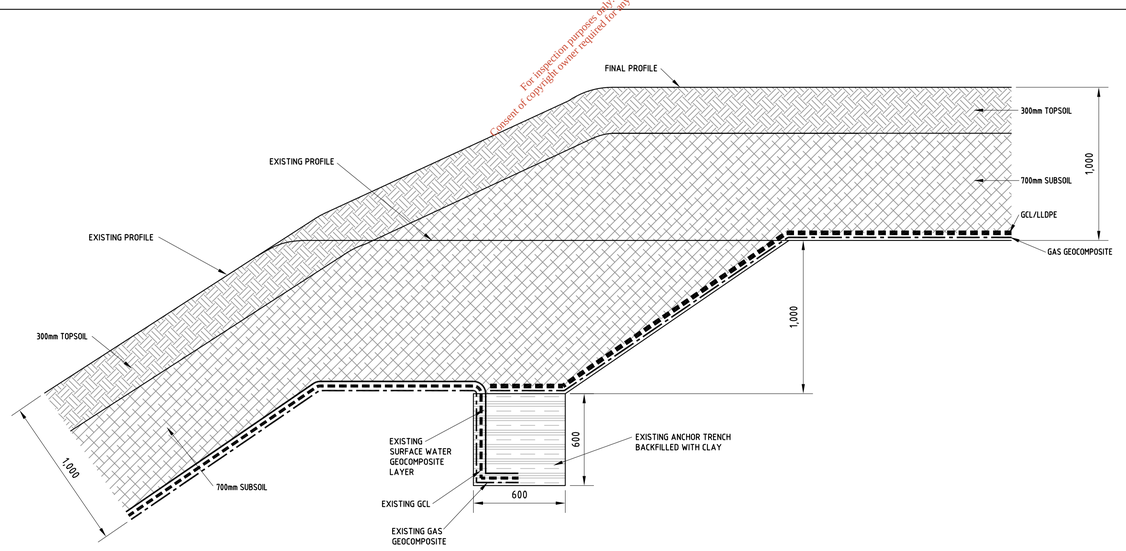
Drawing Number: MDR0350/DG0506
Rev: R01

Title: RETAINING BERM CONSTRUCTION DETAILS




SD0001 - BERM CROSS SECTION






SD0002 - EXISTING CAP / NEW CAP INTERFACE

Client:

**WATERFORD COUNTY COUNCIL**
**Comhairle Chontae Phort Láirge**
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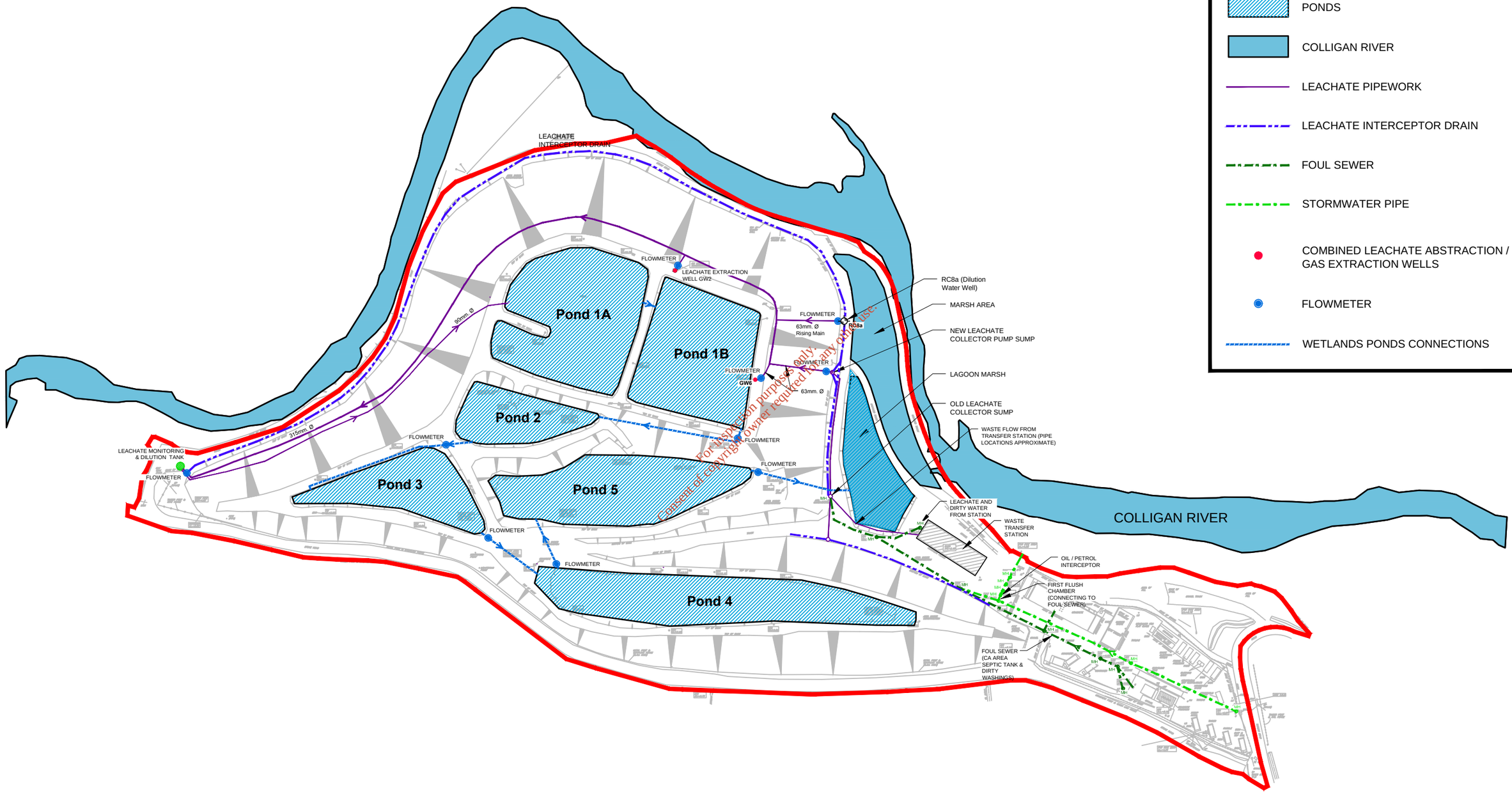
| No. | Date | Dft. / Chk. | Amendment / Issue | App. |
|---|---|---|---|---|
| R01 | Oct'10 | HF / JB | As Built Issue | LO'T |
| C01 | Jul'07 | HF / CC | Issue for Construction | LO'T |
| A01 | Jun'05 | HF / CC | Issue for Approval | LO'T |

Project:
DUNGARVAN LANDFILL
CAPPING WORKS

Title:
STANDARD DETAIL
(Sheet 1 of 2)

| | | | |
|---|---|---|---|
| Drawn by: | HF | Job No: mdr0350 | |
| Checked by: | CC | File No: mdr0350DG0103R01 | |
| Approved by: | LO'T | Drg. No: DG0103a | Rev: R01 |
| Scale: 1:20@A1 | | | |
| Date: June '05 | | | |



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| No. | Date | Drn. Chk | Amendment / Issue | App |
|---|---|---|---|---|
| R02 | Nov '12 | RH JB | As Built Issue | JB |
| R01 | Nov '10 | HF JB | As Built Issue | JB |

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

| Drawn By | Checked By | Approved By | Date |
|---|---|---|---|
| HF | JB | JB | Oct 2010 |

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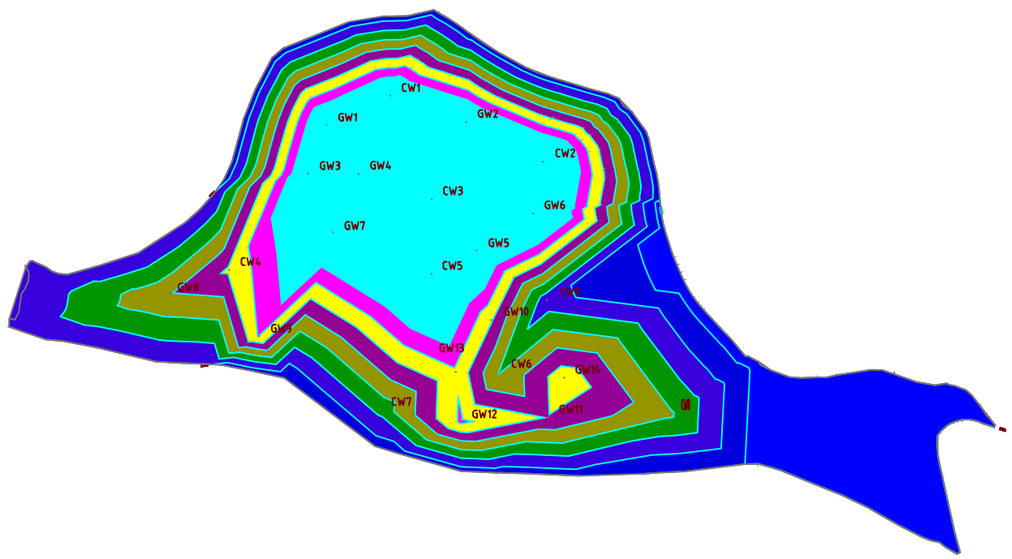
Project: DUNGARVAN LANDFILL

Drawing Status: As Built
Scale / Sheet Size: 1:1000 @ A1 | 1:2000 @ A3

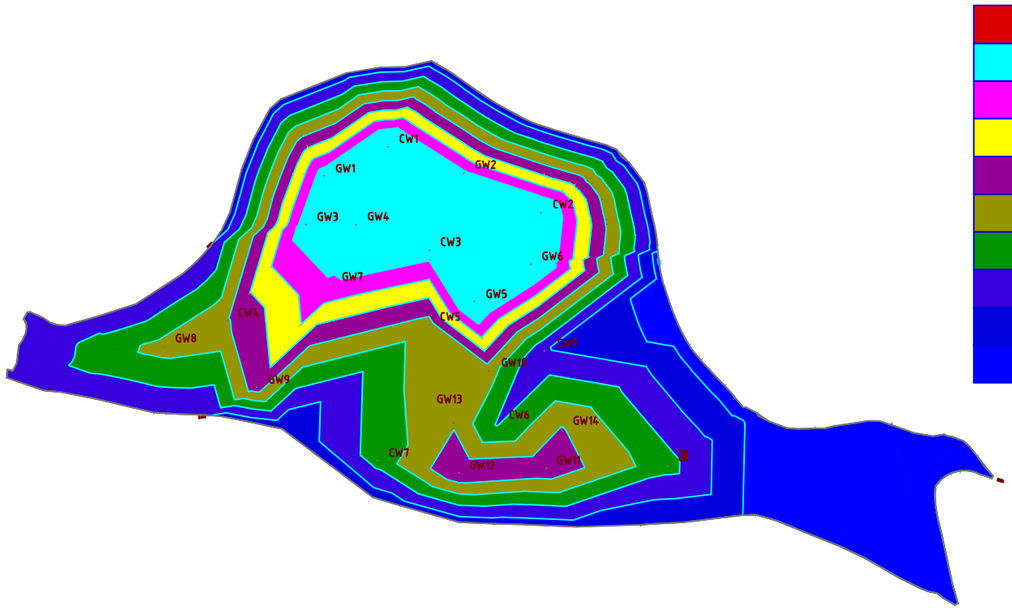
Drawing Number: MDR0350/FG0001
Rev: R02

Title: LEACHATE EXTRACTION AND TREATMENT SYSTEM - PARTIAL SYSTEM 2010-2012

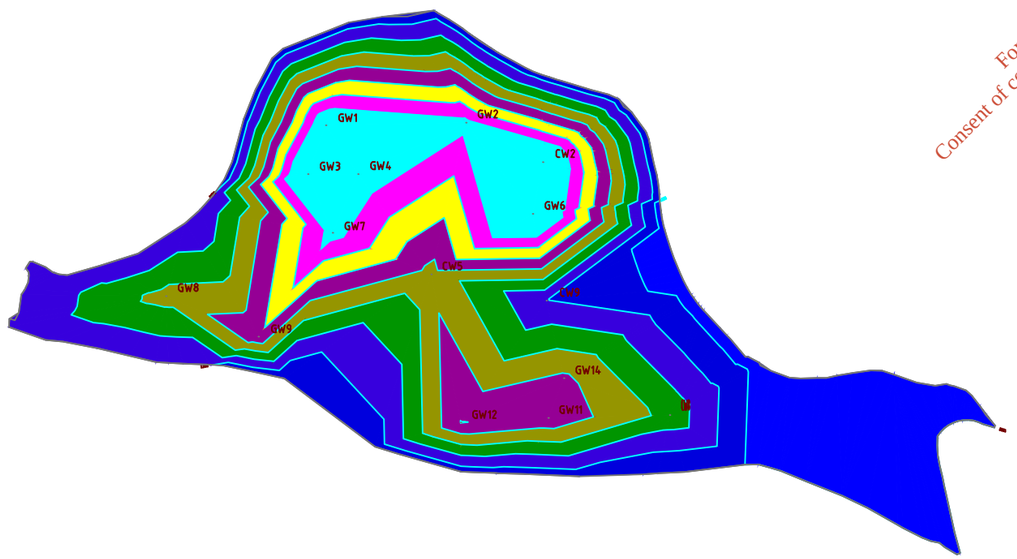
R:\MDR0350\DWGS_BUILT\DRGS_DEC 2012\mdr0350fg0001r02_LEACHATE SYSTEM 2010_12.dwg



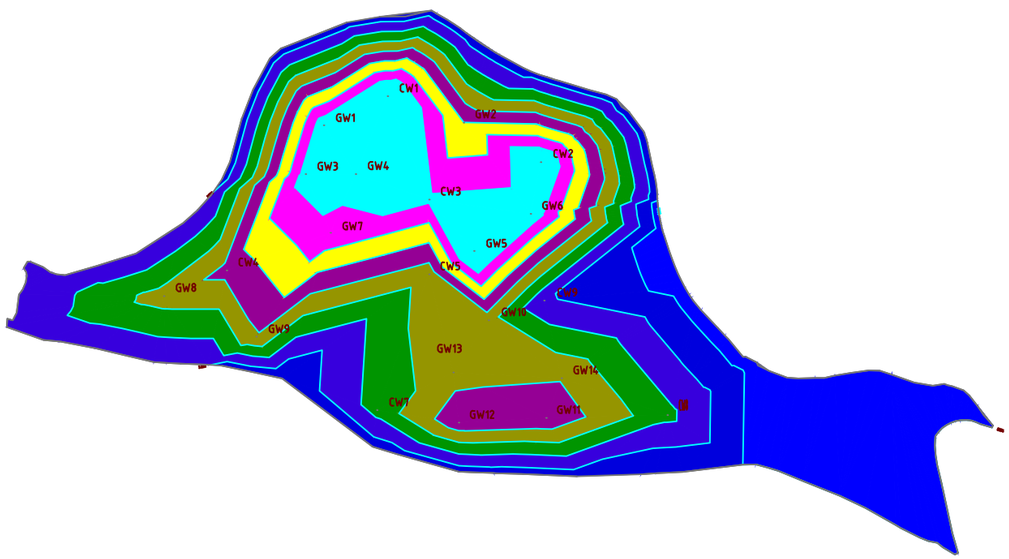

## Year 2008




## Year 2010




## Year 2009




## Year 2011



R:\MDR0350\Dgt\AS-BUILT DRGS - DEC 2012\mdr\0350FG0010F01 LEACHATE HEAD PLANS 2008-2011.dwg

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| No. | Date | Chk'd | Amendment / Issue | App |
|---|---|---|---|---|
| F01 | Nov '12 | RH | Final | JB |
| A01 | Apr.'11 | RH | Issue for Approval | JB |
| D01 | Feb.'11 | RH | Draft Issue | CC |

Client: WATERFORD COUNTY COUNCIL
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| Drawn By | Checked By | Approved By | Date |
|---|---|---|---|
| RH | CC | CC | Feb.2011 |

Drawing Number: MDR0350/FG0010
Rev: F01
Project: DUNGARVAN LANDFILL REMEDIATION
Drawing Status: Final
Scale / Sheet Size: NTS @ A1 NTS @ A3
Title: LEACHATE HEAD YEARS 2008 - 2011

# APPENDIX 6

# CORRESPONDENCE FROM EPA

Environmental Protection Agency

Headquarters, PO Box 3000
Johnstown Castle Estate
County Wexford, Ireland

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Mr. Gabriel Hynes
Senior Engineer
Waterford County Council
Environment Section
Civic Offices
Dungarvan
Co. Waterford



21 June 2013

Reg. No. W0032-03

re: Notice in accordance with Article 14(2)(b)(ii) of the Waste Management (Licensing) Regulations

Dear Mr. Hynes,

I am to refer to the above referenced application for a waste licence relating to a facility at Dungarvan Waste Disposal Site, Ballynamuck Middle, Dungarvan, Co. Waterford.

Having examined the documentation submitted, I am to advise that the Agency is of the view that the documentation does not comply with Article 12 of the Waste Management (Licensing) Regulations. You are therefore requested, in accordance with Article 14(2)(b)(ii) of the regulations, to take the steps and supply the information detailed below:



**ARTICLE 12 COMPLIANCE REQUIREMENTS**

1. Submit a response to the Agency's Article 14(2)(b)(ii) notice issued on 29 August 2011.

2. Undertake a screening for Appropriate Assessment and state whether the activity, individually or in combination with other plans or projects is likely to have a significant effect on a European Sites, in view of best scientific knowledge and the conservation objectives of the site(s).

   Where it cannot be excluded, on the basis of objective scientific information, following screening for Appropriate Assessment, that an activity, either individually or in combination with other plans or projects, will have a significant effect on a European Site, provide a Natura Impact Statement, as defined in Regulation 2(1) of the European Communities (Birds and Natural Habitats) Regulations (S.I. No. 477 of 2011). Where based on the screening it is considered that an Appropriate Assessment is not required, provide a reasoned response.

   You are furthermore advised to refer to the document *'Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities'*, issued in 2009 by the Department of the Environment, Heritage and Local Government, and revised in 2010. This document is available at:
   http://www.npws.ie/publications/archive/NPWS_2009_AA_Guidance.pdf.

3. Provide an impact assessment of the proposed water abstraction on the Colligan River. State whether this abstraction requires planning permission and provide a copy if obtained.

4. Complete Section E.2 of the application form and the associated Tables E.2(i) and E.2(ii).

5. Provide details and an assessment of the impact of the discharge(s) on receiving waters.

6. Provide details of the lining of the integrated constructed wetlands.

7. Having regard to Table H.1(c) of the information dated 6 August 2010, clarify the total amount of inert waste for restoration purposes to be accepted over the facility's lifetime.

8. Provide a report on the status of all on-site landfill gas wells (abstraction and monitoring) and propose actions to be taken in relation to any wells that are not fit for purpose. Include a drawing showing the wells.



Your reply to this notice should include a **revised non-technical summary** which reflects the information you supply in compliance with the notice, insofar as that information impinges on the non-technical summary.

In the case where any drawings already submitted are subject to revision consequent on this request, a revised drawing should be prepared in each case. It is not sufficient to annotate the original drawing with a textual correction. Where such revised drawings are submitted, provide a list of drawing titles, drawing numbers and revision status, which correlates the revised drawings with the superseded versions.

Please supply the information in the form of a one original plus one copy in hardcopy format within ***eight weeks*** of the date of this notice. In addition please submit two copies of the requested information in electronic searchable PDF format on a CD-ROM to the Agency. Please note that all maps/drawings should not exceed A3 in size.

Please note that the application's register number is **W0032-03**. Please direct all correspondence in relation to this matter to Administration, *Licensing Unit, Office of Climate, Licensing & Resource Use, Environmental Protection Agency, Headquarters, PO Box 3000, Johnstown Castle Estate, County Wexford* quoting the register number.

Yours sincerely,

Ewa Babiarczyk
Inspector
Office of Climate, Licensing & Resource Use