

ANNUAL ENVIRONMENTAL REPORT 2012

For Kilbarry Landfill and Civic Amenity Site

**Compiled by : Facility Manager,
Vincent O'Shea.**
Date : May 2013

Table of Contents

1.0 Introduction

- 1.1 Management and staffing structure of the facility

2.0 Site Description

- 2.1 Waste management activities at the facility
- 2.2 Waste quantities and composition
- 2.3 Methods of waste deposition
- 2.4 Site Capacity

3.0 Site Development Works

- 3.1 Development Schedule
- 3.2 Report on Development Works Undertaken During Year
 - 3.2.1 Landscaping
- 3.3 Restoration & Aftercare Schedule
- 3.4 Environmental Liability and Risk Assessment

4.0 Emissions

- 4.1 Management of emissions
- 4.2 Leachate
 - 4.2.1 Interpretation of results
- 4.3 Groundwater
 - 4.3.1 Interpretation of results
- 4.4 Surface water
 - 4.4.1 Interpretation of results
- 4.5 Air emissions
 - 4.5.1 Dust emissions
 - 4.5.1.1 Interpretation of results
 - 4.5.2 Odour emissions
 - 4.5.2.1 Interpretation of results
 - 4.5.3 Aerosols
- 4.6 Landfill gas

- 4.6.1 Interpretation of results
- 4.6.2 Landfill gas flare monitoring
- 4.7 Noise
 - 4.7.1 Interpretation of results
- 4.8 Ecology survey
- 4.9 Leachate volumes
- 4.10 Emissions to groundwater

5.0 Energy Consumption/Generation

- 5.1 Resource and energy consumption summary

6.0 Environmental Incidents and Complaints

- 6.1 Non-conformances/Incidents
- 6.2 Review of nuisance controls
 - 6.2.1 Birds
 - 6.2.2 Vermin
 - 6.2.3 Flying insects
 - 6.2.4 Fires
 - 6.2.5 Odour control
 - 6.2.6 Dust control
- 6.3 Programme for public information

7.0 Objectives and Targets

- 7.1 Schedule of environmental objectives and targets for the forthcoming year
- 7.2 Financial provisions

LIST OF APPENDICES

Appendix I	Landfill Gas Perimeter Borehole Data and Gas Flare Survey
Appendix II	Ecological Assessment
Appendix III	Environmental Management System and E.L.R.A.
Appendix IV	PRTR 2012
Appendix V	AER Templates

LIST OF DRAWINGS

Drawing No. 1	Site Location Plan
Drawing No. 2	Civic Amenity Site Plan
Drawing No. 3	Gas Abstraction Network
Drawing No. 4	Landscaping Concept Design
Drawing No. 5	Map of Monitoring Points
Drawing No. 6	Leachate Collection System

Kilbarry Landfill Site

Annual Environmental Report

1.0 Introduction

Kilbarry Landfill site is located (National Grid Reference 2598E 1103N) on the outskirts of Waterford City on the Dunhill Road, approximately 300m of the N25.

The site occupies an area of 20.1 hectares. Land use in the vicinity of the site is a mixture of open flat farmland with wetland to the south-east. The area to the north and west of the site is a mixture of residential and commercial properties.

The landfilling of waste at the site has resulted in the formation of a mound of waste above ground level. The waste body has a maximum height of 20mOD in the centre of the site. The remainder of the site has a maximum height of 17.5mOD on top of the waste body and a base level of 2m to 3mOD on the edge of the site.

The site was in operation for approximately 40 years. The landfilling of waste has occurred on a former area of wetland known as Kilbarry Bog. A series of drains or channels are found on the entire western, southern and eastern perimeter of the landfill.

The waste license for the site was issued on the 19th of October 2001. Condition 2.4 of the Waste License (18-1) requires the preparation of an Annual Environmental Report within thirteen months from the date of grant of the license, and within one month of the end of each year thereafter.

This report has been prepared in accordance with Schedule C of Waste License 18-1 and the EPA "Draft Guidance on Environmental Management Systems and reporting to the Agency". This report covers the reporting period 1st January 2012 to 31st December 2012.

1.1 Management and Staffing Structure of the Facility

The site is operated by Waterford City Council (Environmental Services and Planning, Waterford City Council, Menapia Building, The Mall, Waterford).

The site is under the overall control of Mr. Richard Walsh, Acting Director of Services, Environmental Services and Planning. John Nolan, Senior Executive Engineer, is responsible for the overall operation of the site. Mr. Vincent O'Shea, Civil Technician, is responsible for reporting to the E.P.A. and compliancy with the licence. Pauric McGarrigle, Executive Engineer, is responsible for the day to day supervision and management of the Civic Amenity Site and is assisted by the Facility Supervisor, Mr. James Flavin. Details of the additional site staff are provided in Table 1.

Table 1: Operational Staff (Currently on Site)

Employee	Duties and Responsibilities
Mr. James Flavin	Collection of charges. Maintenance of on site records. Implementation of waste acceptance procedures. Site inspections. Monthly monitoring of gas boreholes. Any other duties as required by site manager.
Mr. Ferdy Ozturk	Daily litter patrols. Maintenance of metals recovery compound. Any other duties as required by the site manager/supervisor.

The Facility Supervisor maintains regular contact with the Executive Engineer. Table 2 shows the current management structure of Kilbarry Landfill.

Table 2: Management Structure for Kilbarry Landfill

Position	Employee Contact Details
Director of Services Mr. Richard Walsh	Waterford City Council, Environmental Services and Planning, Menapia Building, The Mall, Waterford. Tel: 051 309900 Fax: 051 849763
Senior Executive Engineer Mr. John Nolan	Waterford City Council, Environmental Services and Planning, Menapia Building, The Mall, Waterford. Tel: 051 309900 Fax: 051 849763
Executive Engineer (C.A.S.) Mr. Pauric McGarrigle	Waterford City Council, Environmental Services and Planning, Menapia Building, The Mall, Waterford. Tel: 051 309900 Fax: 051 849763
Civil Technician (Landfill/E.P.A.) Mr. Vincent O'Shea	Waterford City Council, Environmental Services and Planning, Menapia Building, The Mall, Waterford. Tel: 051 849534 Fax: 051 849763

Any changes to this structure will be submitted to the EPA by the Civil Technician. It shall be the responsibility of the Civic Amenity Site Manager to organise staff in the absence of the named persons from the facility.

2.0 SITE DESCRIPTION

2.1 Waste Management Activities at the Facility

The waste categories and quantities that may be accepted for disposal and recovery, as outlined in Table A.1 of the Waste License, are shown below in Table 3.

Table 3: Waste Categories & Quantities for Disposal and Recovery

Waste Type	Maximum Tonnes Per Annum
Household	17,000
Commercial	12,500
Industrial Non Hazardous	28,500
Treated Sewage Sludges	2,500
Treated Industrial Non Hazardous Sludges	7,500
Construction & Demolition Waste	2,000
Wastes for Recycling & Recovery at the Civic Waste Facility	3,000
Waste for Recycling & Recovery at the Metal Recovery Area	2,000
Total	75,000

As of the 19th January 2003 commercial waste hauliers were stopped from disposing of waste at Kilbarry Landfill. As of 26th August 2005 Kilbarry Landfill ceased accepting domestic waste for landfill disposal and all landfilling activities ceased. From August 2005 to July 2009 all domestic waste collected by Waterford City Council was being deposited at Veolia's waste facility in Six Cross Roads Business Park before being brought to Powerstown Landfill in Carlow. Since July 2009 all domestic waste collected by Waterford City Council is deposited at Veolia's waste facility in Six Cross Roads Business Park before being hauled to Homestown Landfill in Wexford.

The landfill is closed to the public and remediation has taken place between 2005 and 2009 which included the installation of the final cap over the area of the waste body and installation of a gas abstraction system consisting of 82no. wells and a 500m³ permanent, enclosed gas flarestack. A surface water management system was installed in 2010. It was proposed that the site become a public amenity in the form of a park and an entrance and carpark were constructed in the North East area of the site during 2010. Landscaping for the park began in 2011 and completed in May 2012. The Kilbarry Nature Park opened to the public in June 2012 and its opening was officiated by Ireland's President Michael D. Higgins.

A Civic Amenity Site is located adjacent to the old landfill entrance. The following range of goods are accepted for recycling or disposal:

- W.E.E.E.
- Scrap Metal
- Timber
- Cardboard
- Car and Household Batteries
- Engine Oil
- Cooking Oil
- Glass Bottles
- Aluminium Cans
- Clothes and Textiles
- Fluorescent Tubes

- Energy Saving Light Bulbs
- Aerosols
- Paint Tins

The opening hours at the C.A.S. are 11am to 4pm Monday to Friday and 10am to 2pm on Saturdays.

2.2 Waste Quantities and Composition

The categories and quantities for the C.A.S. in 2012 are presented in Table 4 below:

Table 4: Breakdown of Waste Categories & Quantities for Civic Amenity Site

EWC Code	Description	Total Quantity 1/1/12 to 31/12/12 (tonnes)
13 02 --	Waste Engine, Gear & Lubricating Oils	2.50
14 06 --	Aerosols	0.00
16 06 01	Lead Batteries	0.07
16 06 04	Alkaline Batteries	0.20
20 01 01	Cardboard	21.56
20 01 02	Glass	1,042.48
20 01 11	Textiles	1.76
20 01 21	Flourescent Tubes	0.329
20 01 25	Edible Oil & Fat	1.60
20 01 27	Paint Tins	0.50
20 01 36	W.E.E.E.	181.38
20 01 38	Wood	5.00(Estimated)
20 01 40	Metals	13.18
20 02 01	Biodegradable Waste	428.66
20 03 01	Mixed Municipal Waste	249.82

The specific categories of W.E.E.E. materials collected at the Civic Amenity Site are now reported by WEEE Ireland and ERP.

2.3 Methods of Waste Deposition

Currently all waste for landfilling weighed at Kilbarry is transported to Greenstar's local depot for haulage to Homestown Landfill in Wexford.

2.4 Site Capacity

The site was in operation in the region of 40 years. The total volume of waste deposited to date is estimated to be 1,094,513m³.

The last area of landfilling was located in a lined cell constructed in 2002/2003 located at the northern end of the landfill. The site closed on 26th August 2005.

3.0 SITE DEVELOPMENT WORKS

3.1 Development Schedule

The following section describes works undertaken during 2012. A description of the existing situation for each component is provided below together with the details of the proposed works and a timescale for completion of the future work.

3.2 Report on Development Works Undertaken During Year

The following works have been completed at Kilbarry Landfill during the period January 2012 to December 2012:

3.2.1 Landscaping

A landscape architect, Mitchell and Associates, was awarded the design contract in early 2010 and the design and contract documents were drawn up and agreed with WCC. The design of the landscaping at Kilbarry incorporates signage, information boards and pathways as well as specification of planting etc. The tendering process began in September 2010 with a prequalification stage. In November 2010 a letter of intent to award the contract to Grangemore Landscapes was sent out and this contract was signed in early 2011 and works began in March 2011. The schedule of works throughout 2012:

January 2012

- Landscaping of grass verges around newly laid tar paths
- Planting of tree areas in the north of park.

February 2012

- Works at entrance to park and carpark. Landscaping, planting, gabions, planting of slopes either side of concrete path to plateau.

March 2012

- Erection of park signage
- Construction of park seating and marker posts
- Construction stepped access in north and south of park
- Construction of viewing areas

April 2012

- Finished off peripheral planting
- Finished off drainage in various locations
- Landscaping around arrivals plaza

May 2012

- Installation of fitness stations
- Finishing of landscaping to Plateau
- Erection of fencing to carpark
- Completion of snag list

Drawing 4 shows a plan of the landscaped park at Kilbarry

3.3 Restoration & Aftercare Schedule

The following is the phasing of the remediation works to date:

Table 5: Phasing of the remediation works

Component	Commencement	Completion
Completion of liner and final capping	October 2005	June 2008
Completion of gas abstraction system	November 2006	April 2008
Installation 3 new leachate wells	January 2008	April 2008
Installation of Permanent Flare	October 2009	October 2009
Entrance,carpark and bridge Works	June 2010	November 2010
Surface Water Management	September 2010	January 2011
Landscaping	March 2011	May 2012

3.4 Environmental Liability and Risk Assessment

An Environmental Liability Risk Assessment (ELRA) was performed by Golders Associates early in 2009 on behalf of Waterford City Council for the Kilbarry site. This is included in the Appendix III.

4.0 EMISSIONS

4.1 Management of Emissions

Waterford City Council is committed to ensuring that any emissions at Kilbarry Landfill will not result in the contravention of any relevant standard, including any standard for an environmental medium or any relevant emission limit value, prescribed under any other enactment.

The council is committed that activities at Kilbarry Landfill and C.A.S. are carried on in accordance with such conditions as may be attached to the license and will not cause environmental pollution.

The council will also use the best available technology not entailing excessive costs to prevent or eliminate or, where that is not practicable, to limit, abate or reduce an emission from the activity concerned.

The potential emissions from the site include leachate, groundwater, surface water, air and noise.

Drawing 5 shows the positions of all monitoring points at the facility.

4.2 Leachate

A total of six boreholes were originally installed at the landfill, LM1 – LM6. However over time landfilling operations damaged a number of the boreholes. The damaged boreholes were replaced and an extra two were also installed. However a further two, LM2 and LM3 were damaged at some point prior to the commencement of final capping. During the capping works LM7 and LM8 were buried due to their low levels. For all of the year there was only one operational leachate monitoring borehole, LM1. LM4, LM5 and LM6 are now accessible again by jeep but remain under the final capping ground level, surrounded by manhole rings for protection. LM5 and LM6's manhole rings are full of water. A proposal is to be submitted

to the EPA to abandon monitoring from these points as they are located in areas that will be wildflower meadows when the park is constructed. Future leachate monitoring will be proposed to be directly from the leachate storage lagoon in the form of grab samples.

Monitoring of the composition of leachate is undertaken on a quarterly basis, with analysis of a wider range of parameters on an annual basis. In addition leachate levels are also taken on a weekly basis.

4.2.1 Interpretation of Results

Monitoring point LM1 is located on the north-western edge of the landfill. The results indicate that the composition of leachate at LM1 is of a very low strength. Ammonia levels vary from 0.04mg/l N in the first quarter to 0.16mg/l N in the fourth quarter. Chlorine and pH levels are within normal, stable ranges.

Monitoring at LM1 indicates that this borehole is more likely to be a groundwater.

4.3 Groundwater

There are currently seven boreholes operational around the perimeter of the site, GW2, GW4, GW5, GW6, GW15, GW16 and GW17. There were a further two boreholes, GW1 and GW18 located off-site. These boreholes are now gone due to works in the areas. GW7 and GW9 are currently inaccessible for groundwater sampling due to final capping levels but are situated inside the waste body and would yield leachate samples rather than true groundwater. GW5 and GW17 are also situated within the waste body. GW3, GW10, GW11, GW12, GW14 and GW15 were irreparably damaged or lost during remediation. A set of new boreholes, GW22 to GW29 were installed for gas migration monitoring along the Western perimeter between the landfill and the nearest residential properties. Two of these boreholes, GW25 and GW29 were used from the second quarter of 2012 to provide monitoring coverage on the western side as replacements for GW14 and GW15. Monitoring occurs on a quarterly basis.

Monitoring location GW2 is located on the north of the landfill site. Results show that the borehole is not polluted. In 2012 Ammonia ranged from 0.26mg/l N to 0.04mg/l N.

GW4 is located on the eastern boundary along the Tramore Road. Historically results have shown gross pollution with ammonia levels reaching a high of 61mg/l N in 2011. However Ammonia levels for 2012 ranged from 9.5 down to 4.8mg/l N showing a huge improvement.

Monitoring point GW5 is located towards the south-eastern corner of the site and is within the boundary of the waste body. Results show a grossly polluted borehole with Ammonia levels as high as 540mg/l N. It would be better considered as leachate given the position of the borehole.

Monitoring point GW6 is located on the southern tip of the landfill and is upgradient of the landfill. Ammonia levels fluctuated between 0.41mg/l N in quarter 1 to 22mg/l N in quarter 4, showing a marked decrease in quality.

Monitoring station GW16 is located along the eastern boundary of the site. Levels have stabilised at this point with Ammonia ranging from 19 to 26mg/l N throughout the year. Conductivity levels remain elevated and this point would be considered polluted.

Monitoring point GW25 was sampled from quarter 2 in 2012, is located on the western perimeter and showed results of gross contamination with Ammonia levels as high as 210mg/l N.

Monitoring Point GW29 was also introduced to the groundwater sampling schedule from quarter 2 of 2012 and also showed poor quality with Ammonia levels at 77mg/l N and falling to 48mg/l N throughout the year.

4.3.1 Interpretation of Results

Results show that GW4, GW5 and GW16 are polluted. However GW5 is better considered as leachate from within the waste body. GW6 to the south showed a decrease in quality in the last quarter. GW4 has again shown improvement on previous years' results and GW2 remains unpolluted. New sampling points GW25 and GW29 show gross pollution.

4.4 Surface Water

The landfill is surrounded on its western, southern and eastern sides by a perimeter drain, which receives several flows from the west and south as well as water from the landfill itself. This drain flows from the western side of the landfill around its southern end before flowing northward along the eastern side of the landfill and entering the Lisduggan Stream. The Lisduggan stream flows along the northern edges of the site before exiting along the eastern perimeter and joining up with St. Johns River. The waste license requires the monitoring of surface water quality at nine locations around the landfill, S1-S9.

There is also a tidal influence at the site, which results in water flowing from the Lisduggan stream into the perimeter drain.

Levels at monitoring point S1 remained stable in 2012 with Ammonia peaking at 0.73mg/l N in quarter 3, there is no evidence of widespread pollution at his point.

Monitoring point S2 is located on the western boundary of the site. This sampling station is no longer available as the boundary drain has been diverted through a conduit pipe.

Ammonia at monitoring station S3 continues to fluctuate from 1.4 to 0.3 mg/l N in 2012. The results indicate poor quality in terms of salmonid waters however it does not breach parameter levels for A3 surface waters.

Ammonia and Chloride levels continued to improve throughout 2012 at S4. The last monitoring event shows 0.12mg/l N and 26 mg/l C indicating improvement in quality at this point. S4 is located along the southern boundary of the landfill.

S5 is located along the south-eastern boundary of the landfill and continues to be inaccessible due to overgrowth in the pNHA bog which surrounds that edge of the landfill. Despite access paths to all monitoring points having been installed this sampling point remains dangerous to access.

S6 is also located along the south-eastern boundary. Ammonia and Chloride levels are slightly elevated but B.O.D. at 2.6mg/l O₂ at the last sampling event is at an acceptable level for salmonid waters.

Results from station S7 remain stable with good Dissolved Oxygen and B.O.D. levels. Ammonia levels have improved in 2012 from 3.8 to 2.3mg/l N over the four monitoring events. Chloride ranged from 25 to 36mg/l Cl. In general water quality is good.

Monitoring station S8 is much the same as S7 with favourable Dissolved Oxygen levels and B.O.D. There is slight contamination here with Ammonia ranging from 1.2mg/l N in quarter 1 down to 0.62mg/l N in quarter 4.

Ammonia levels at station S9 reached a high of 0.93mg/l N in quarter 2 and then remained lower than guideline trigger levels for the rest of the year. There is no indication of contamination here and Dissolved Oxygen levels and B.O.D. also show good quality at this point.

4.4.1 Interpretation of Results

S3 remains poor in quality slightly due to B.O.D. levels. S4, S7 and S8 all have shown improvement in quality. The readings are more or less stable and B.O.D. at these points indicate good quality water. S5 remains inaccessible. S1 and S9 continue to show good quality sample results.

4.5 Air Emissions

These include the following:

- Dust
- Odours
- Aerosols and airborne particulates (PM10)
- Landfill Gas

4.5.1 Dust Emissions

The main sources of dust on the landfill site are due to vehicle movement and control is effected by a mobile sprayer. Dust monitoring is required at seven locations in the vicinity of the site (D1, D2, B1, B2, S2, B6, and GW5). Dust monitoring is required three times per annum.

There were no dust limit breaches in 2012. All monitoring was carried out by Dixon.Brosnan.

4.5.1.1 Interpretation of Results

All results were well below the 350mg/m²/day limit for dust deposition.

4.5.2 Odours

Odour monitoring is required at a total of seven locations around the outskirts of the facility. Odour Ireland carried out all odour monitoring.

According to schedule F.3 of the waste license, Waterford City Council is required to monitor odour emissions from seven monitoring locations. Four of the locations are stipulated in the license as NSL2 to NSL5. The other three locations have not been given exact grid coordinates but, according to schedule F.3, the chosen locations should be as follows:

Location 1: at the nearest noise sensitive location (NSL) on the western boundary between NSL3 and NSL5,

Location 2: at the nearest NSL in a residential area to the north east of the facility boundary and

Location 3: at the nearest NSL in a residential area to the south east of the facility boundary.

These locations have been given the identification numbers NSL6 – NSL8.

Odour monitoring was carried out on 09th August and 11th November 2012.

4.5.2.1 Interpretation of Results

Odour monitoring carried out at Kilbarry show results with a maximum value of 62 ou/m³ (odour units per cubic metre) at NSL2. There was no distinct odour from any of the samples.

The chemical analysis shows that the hydrogen sulphide and total volatile organic compounds (TVOCs) were indicative of ambient background. Minimum numbers of organic acids and mercaptans were detected also.

Hydrogen sulphide and the mercaptan concentrations are all below limits that would be needed to cause a nuisance. The organic acids were also only present in low concentrations. Levels are indicative of traffic based emissions with the highest TVOCs being recorded at NSL6 which is offsite and located in an adjacent housing estate and NSL5 at the North Western boundary.

As can be seen from these results odour is not a major problem at the site and this would be attributed to the fact that the site is closed and no longer operational.

4.5.3 Aerosols

Aerosols are defined as fine particulate material water droplets and microbial emissions from activities carried out at the landfill. On site sources include re-suspension of fine material by wheel action of vehicles and fugitive emissions from tipping and distribution of waste. Since the closure of the site aerosols are no longer an issue.

4.6 Landfill Gas

It is estimated that 1,094,513 tonnes of waste has been landfilled over the lifetime of the site. Assuming that each tonne of waste will have a typical yield of 200m³ of gas, it is estimated that the facility will produce in the order of 220Mm³ of gas in its lifetime. In October 2009 a 500m³ permanent, enclosed flarestack was connected to the completed gas abstraction system and ignited. The flare is connected to 82no. gas wells bored into the main waste body controlled by 5 manifolds housing valves for the separate pipe branches to the wells. There are 20 wells at the southern tip of the site all connected to Manifold 1, which are controlled at that manifold rather than individually due to low levels of methane. The manifold valve connected to the main header pipe is closed down 95% or more to allow what little gas building up in these southern wells to be drawn off without too much oxygen getting in also.

The waste license requires the monitoring of the composition of the gas within the landfill site. However with the gas abstraction system now fully operational this monitoring is redundant and flare monitoring or field balancing data can be used instead.

Perimeter gas monitoring locations include LM1, GW2, GW4, GW5, GW6, GW7, GW9, GW12, GW15, GW17, GW19, GW22, GW23, GW24, GW25, GW26, GW27 and GW28. Boreholes GW22 to GW28 were installed to provide extra monitoring of any possible migratory gas between the landfill and the nearest residential houses in Lacken Wood Estate and are outside the main waste body as are LM1, GW2, GW4, GW6, GW12, GW15 and GW19. Boreholes GW5, GW7, GW9 and GW17 are all within the waste body. Works

adjacent to the landfill on a new industrial site made temporary monitoring points GW19, GW20 and GW21 obsolete. These points had been located outside the landfill boundary but the installation of GW22 – GW28 replaced them.

4.6.1 Interpretation of Results

The results from the field balancing indicate that there is limited production occurring in the southern part of the site. The different ages of the waste at the site means that there is likely to be some variability in the production of landfill gas in different parts of the site.

Results from the monitoring at perimeter boreholes, included in Appendice 1, show that there is no gas migration and the continued operation of the gas abstraction system should maintain this.

4.6.2 Landfill Gas Flare Monitoring

As per Table F.2.2 of Schedule F of waste licence 18-1 landfill gas flare monitoring is required on an annual basis for particulates, organics, hydrogen chloride and hydrogen fluoride and every six months for volumetric flow, SO₂ and NO_x. Results from both these monitoring events show emission values for all parameters to be within the limits prescribed by the licence.

In the PRTR returns sheet in Appendix IV the total volume of gas generated for 2012 is estimated from a gas generation curve produced by AFS during the gas flow trials when commissioning the enclosed gas flarestack. The volume was estimated at 753,710m³ for 2012. Using the Landfill Gas Survey template from the EPA the Total Methane Flared is calculated at 344,536m³ which gives a Net Methane Emission for 2012 of 409,174m³. This is logged as an estimate in the PRTR worksheet due to the total volume of gas being estimated from the gas curve in the first instance.

4.7 Noise

Noise monitoring is required on an annual basis. There are 14 noise monitoring locations in the vicinity of the site (B1, B2, B3, B4, B5, B6, B7, NSL2, NSL3, NSL4, NSL5, NSL6, NSL7 and NSL8). Dixon Brosnan performed the annual noise monitoring survey for the site in July 2011.

4.7.1 Interpretation of Results

Schedule G.1 of the site waste license specifies that daytime noise levels should not exceed 55 dB at any of the monitoring stations as a result of site activities. LAeq levels recorded over 30 minutes exceeded this limit at NSL4, NSL5 and NSL8, all offsite stations. Noise emissions from the landfill site were inaudible at these stations and the exceedences are attributed to road traffic at the individual locations. Audible emissions generally consisted of vehicles using the site entrance, audible only at station B1 near the site entrance.

Noise levels on the site are not considered to represent a nuisance to nearby residents. The operating hours of the Civic Amenity Site are strictly adhered to and no operations take place outside these hours. In the event of complaints about noise levels, noise impact statements will be made to investigate further techniques for keeping noise levels to a minimum.

4.8 Ecology Survey

According to condition 9.20 of the waste license an annual ecological survey must be undertaken at Kilbarry Bog. Ger Stanton Consultant Ecologist carried out the survey in 2012. The report is included in Appendix II.

4.09 Leachate Volumes

The leachate management system at the site is composed of 13 no. leachate abstraction boreholes, a perimeter leachate collection trench 1.2m depth and 1m wide and 5 no. leachate collection sumps. These boreholes and sumps pump to the leachate lagoon at the north of the site.

The leachate lagoon has a capacity of 3,670m³ (2,670m³ with a freeboard of 0.5m). The leachate is discharged to the sewer by gravity feed and a valve allows a percentage of outflow into the sump. A monitoring system has been installed on the outfall of the leachate lagoon in accordance with the waste licence. The system monitors flow, pH and dissolved methane concentration. 700m³ of leachate was discharged to sewer for treatment at the Belview Wastewater Treatment Plant.

4.10 Emissions to Groundwater

The bedrock beneath the landfill site is situated in the Campile Formation. These rocks are considered to generally form Regionally Important Aquifers with fissure flow (Rf).

To the north and north west of the site the bedrock is predominantly mudstone and shale. To the south and east the rocks are of a predominately acid volcanic unit. In addition a dolerite body has been mapped separating these units and lying immediately south and south east of the landfill site.

Depth to bedrock to the north and east of the site is between 12-14m. To the south and west the general indications are of shallow rock with one anomalous data point indicated 15m depth to bedrock. An outcrop is observed to the southern end of the site, which comprises of grey/green felsite. An outcrop to the north west of the site is described as clayey shaly ash or tuff.

Due to the nature of the bedrock fissure flow will be the dominant type of groundwater flow. The groundwater levels in the area are generally close to the surface. Groundwater flow directions are from the ground to the south and east toward the stream to the west.

The results of in-situ permeability testing carried out in 1998 indicate generally low permeabilities in the bedrock with values between 10 e-6 and 10 e-8.

Due to the low permeability of the bedrock beneath the landfill site it is considered that the preferential migration of leachate from the landfill site is likely to be occurring along the southern and western sides where depth to bedrock is shallower.

The results of groundwater monitoring to date indicate a degree of contamination due to landfill activities. Monitoring of the groundwater surrounding the site showed elevated levels of ammonia and electrical conductivity indicating that leachate is entering the groundwater system. The volumes of leachate entering the groundwater system can be seen to be reduced given the effect of final capping on the leachate volume calculations. There should be little to no new leachate generation and the continued operation of the leachate extraction system from the perimeter and waste body should further minimise leachate contamination to groundwater.

5.0 ENERGY CONSUMPTION/GENERATION

5.1 Resource and Energy Consumption Summary

Contractors are employed to supply and operate the site machinery, therefore there is no available information regarding the quantities of fuel on site at any given time. There is no fuel stored onsite.

There was approximately 5m³ of water used from the mains supply to the site throughout 2012.

In 2012 approximately €15,000 was spent on electrical supply to the site.

6.0 ENVIRONMENTAL INCIDENTS AND COMPLAINTS

6.1 Non-Conformances/Incidents and Complaints

There were no incidents reported in 2012.

There were no complaints made in 2012.

6.2 Review of Nuisance Controls

It is the responsibility of the facility manager to ensure that the control measures are implemented to prevent the spread of litter. Since the closure of the landfill a number of management practices implemented on site in order to control the spread of litter have become redundant. These include litter fencing, the application of daily cover and the spreading and compaction of waste in thin layers. Regular monitoring and site inspections are carried out to ensure site tidiness is maintained since the closure of the landfill.

The main area of concern in relation to litter at present is the Civic Amenity Site to the North of the landfill. Contractors transporting materials for recycling offsite shall be required to ensure that when transporting and discharging these loads that litter is kept to an absolute minimum. All vehicles are required to be totally sealed or covered with a net or tarpaulin to ensure that materials are not blown from the vehicles.

Routine litter patrols are carried out on a daily basis to ensure that any loose litter is collected, this shall include the area surrounding the landfill, all fences and the approach road to the site. The effectiveness of the litter control techniques are monitored on a weekly basis.

6.2.1 Birds

Since the closure of the landfill birds are no longer a nuisance on the site

6.2.2 Vermin

A contract is in place with Rentokil Ireland. A programme of baiting can be employed as required to control rat infestations with preventative baiting at regular intervals to ensure that large populations do not become established. Since closure of the landfill vermin has not been a significant issue on site

6.2.3 Flying Insects

The facility manager monitors the situation. Since closure of the landfill however there has been no issue and the materials collected at the Civic Amenity Site do not pose an issue.

6.2.4 Fires

The burning of waste or other material is not permitted at the facility. Hot or burning loads of waste arriving at the facility are rejected. In the event that a fire breaks out on the site it is treated as an emergency and dealt with immediately. The Emergency Response Procedures, containing steps for dealing with fires, is included in the appendices.

6.2.5 Odour Control

Odour problems were kept to a minimum by implementing adequate compaction, speedy disposal and burial of malodorous wastes, effective and frequent use of cover material. These provisions are no longer needed due to closure of the landfill. A gas abstraction system began flaring in January 2008. A leachate management system is installed and had 3 additional wells installed in April 2008. Odour monitoring is carried out at bi-quarterly intervals. There were no odour complaints in 2012 and based on the monitoring results odour presents no significant issue at the site.

6.2.6 Dust Control

Dust control measures will be employed during the construction/installation of specified engineering works particularly the installation of the final capping and the gas abstraction system. It is proposed that a mobile sprayer or bowser shall be employed to control fugitive dust emissions from the movement of vehicles during dry and windy weather. This is to be achieved through the spraying with water of site roads and any other areas used by vehicles. Speed restrictions shall also apply to construction vehicles within the landfill.

6.3 Programme for Public Information

Communications Programme

The purpose of the Communications Programme is to ensure that members of the public can obtain information concerning the environmental performance of the facility at all reasonable times.

Council Directive 90/313/EEC on the Freedom of Access to Information on the Environment recognises the significance of the public's access to information relating to the environment. To ensure that members of the public can obtain information concerning the environmental performance of Kilbarry Landfill the communications programme described below shall be implemented at the facility.

The purpose of this programme is to allow any local community groups, key interest groups, local residents and members of the local community access to information on matters relating to the environmental performance of Kilbarry Landfill. This in turn will address any local community concerns and allow the public the opportunity to provide feedback on the facility. The Facility Manager will be responsible for the implementation of this programme, which shall form a normal part of the routine operation and management of the facility.

Programme:

1. All requests concerning the environmental performance of the facility should be made in writing to:

Mr. Vincent O'Shea,
Facility Manager,
Environmental Services,
Floor 3 Menapia Building,

The Mall,
Waterford City.

2. The Facility Manager shall copy all requests to:

Mr. Richard Walsh,
Director of Services,
Environmental Services,
Menapia Building,
The Mall,
Waterford.

3. Each request should indicate the name, address and contact telephone number of the concerned party, an outline of the information required and the manner in which they require the information i.e. copy of record, computed disk, etc.
4. If requested, a suitable member of staff will provide a clear, unbiased explanation of the information provided.
5. The Director of Services or other authorised, nominated representative in Waterford City Council or any other nominated person will deal with replies to requests made by the media for information relating to the environmental performance of the landfill.

Record keeping

All records of requests for information regarding the environmental performance of the landfill and all minutes of meetings with concerned parties and details of site visits/ open-days shall be maintained and kept secure from loss, damage or deterioration. All of the aforementioned files shall be stored at the site office at Kilbarry Landfill and the Offices of Waterford City Council, Planning & Environment Department, 6/7 Lombard Street, Waterford.

The Facility Manager shall keep a register of all requests for information from the public on site.

7.0 OBJECTIVES AND TARGETS

7.1 Schedule of Environmental Objectives and Targets for the Forthcoming Year

The objectives and targets have been based on the conditions set by Waste License 18-1. The purpose of this section is to establish a summary of objectives and targets for the prevention of pollution and for the continual improvement of the site.

Table 10: Schedule of Objectives and Targets

2013 Schedule of Objectives and Targets				
Prepared by: Vincent O'Shea, Facility Manager			Date: March 2013	
Approved by: Mr. Richard Walsh, Director of Services, Waterford City Council				
	Target	Plan	Responsible Party	Timescale (for completion)
Objective 1 To establish site infrastructure as required by Licence Conditions	Repair all defects in the existing site gates and fences.	Regular inspections are carried out of gates and fencing.	Facility Manager	Within three working days of defect.
	Install active collection and flaring system for landfill gas.	Active gas collection system and permanent flare installed.	Facility Manager/ Consultant Contractor	Completed.
	Investigate utilisation of landfill gas	Utilisation not feasible.	Facility Manager/ Consultant	Completed.
	Surface Water Management	Install system as proposed	Facility Manager Consultant Contractor	Completed.
	Landscaping	Suitable tree and shrub planting required on the perimeter of the facility and for final capping/restoration.	Horticulturist	Completed.
	Permanent Enclosed Flarestack	Install flare and connect to gas abstraction system	Facility Manager Contractor	Completed

2013 Schedule of Objectives and Targets

Prepared by: Vincent O'Shea, Facility Manager

Date: March 2013

Approved by: Mr. Richard Walsh, Director of Services, Waterford City Council

	Target	Plan	Responsible Party	Timescale (for completion)	
Objective 2 Management & Operation of the Facility	Develop written waste acceptance procedures and ensure all staff are familiar with same.	To minimise nuisance and ensure only permitted material accepted for recycling.	Facility Manager & Compactor Operator	Reviewed annually	
	Objective 3 To Prevent Environmental Nuisance & Emissions	Implement Litter Control Measures	To maintain litter control measures	Facility Manager Site Staff	Ongoing
		Dust Control	To maintain dust control measures.	Facility Manager Site Staff	Ongoing
		Vermin Control:	Contract with Rentokil Ireland.	Facility Manager	In Place
		Continue existing gas monitoring program.	Continue with existing monitoring programme	Facility Manager	On Going
		Continue existing leachate monitoring program.	Monitor changes in the composition of the leachate with time.	Facility Manager	On Going
	Monitor dust control measures during construction works at the facility.	Dust control measures to be implemented on site during all construction works at the facility.	Facility Manager	On Going	
Objective 4 Promotion of Waste Recycling	Make public aware of recycling initiatives, techniques and current methods aswell as materials accepted at Kilbarry	Promotion through local newspapers, radio, school talks and information leaflets.	Environmental officer Facility Manager	Ongoing	

2013 Schedule of Objectives and Targets

Prepared by: Vincent O'Shea, Facility Manager

Date: March 2013

Approved by: Mr. Richard Walsh, Director of Services, Waterford City Council

	Target	Plan	Responsible Party	Timescale (for completion)
Objective 5 To improve the Environmental Performance	Establish an Environmental Management System	To monitor the facility's environmental performance.	Facility Manager	Reviewed Annually
	Prepare the Annual Environmental Report	Summarise the results of environmental monitoring programme and assess facility's progress towards achieving its objectives and targets.	Facility Manager Consultant	March 2014
	Reduce non-compliance	Carry out site inspections.	Facility Manager Site Supervisor	Ongoing
	Improve environmental monitoring programme	Continue and expand groundwater, surface-water, leachate & landfill gas monitoring to ensure complete compliance with license.	Facility Supervisor Facility Manager	Ongoing.
	Reduce risk of gas migration	Install active gas abstraction system and flare. Also gas utilisation system to be assessed.	Facility Manager Consultant Contractor	Gas abstraction system completed. Utilisation unfeasible.

2013 Schedule of Objectives and Targets

Prepared by: Vincent O'Shea, Facility Manager

Date: March 2013

Approved by: Mr. Richard Walsh, Director of Services, Waterford City Council

	Target	Plan	Responsible Party	Timescale (for completion)
Objective 5 To improve the Environmental Performance (Continued)	Reduce visual impact	Landscaping of site into a public amenity park.	Horticulturist	Completed.
	Control dust emissions	Monitoring	Contractor	Quarterly
		Spray roads during dry weather	Facility Manager	Ongoing
		Operate and maintain wheelwash	Facility Manager	Ongoing
		Enforce speed limits	Facility Manager	Ongoing
	Litter control	Daily litter inspections	Facility Supervisor	Ongoing
	Reduce emissions to surface water	Install management system	Facility Manager	Completed.
	Reduce emissions of leachate from unlined waste body	Maintain leachate collection system.	Facility Manager Contractor	Ongoing
	Reduce long-term impact	Restoration & Aftercare Plan.	Senior Engineer	After landscaping.
Objective 6 To Monitor Management of Facility	Environmental Management System	Environmental Management System developed and included in this submission.	Facility Manager	Reviewed annually
	Environmental Management Programme	Environmental Management Plan established and included in this submission.	Facility Manager	Reviewed Annually
	Establish & Maintain Corrective Action Procedures	Procedures have been developed and are included in this submission.	Facility Manager	Reviewed Annually
	Establish Awareness & Training Procedures to identify training needs.	Procedures have been developed by Waterford City Council.	Facility Manager	Reviewed Annually
	Establish Communications Programme to ensure public access to information	Details included in this submission.	Facility Manager	Reviewed Annually

2013 Schedule of Objectives and Targets

Prepared by: Vincent O'Shea, Facility Manager

Date: March 2013

Approved by: Mr. Richard Walsh, Director of Services, Waterford City Council

	Target	Plan	Responsible Party	Timescale (for completion)
Objective 6 To Monitor Management of Facility (continued)	Record keeping to ensure proper site management	Written Records to be kept.	Facility Manager	Ongoing

OBJECTIVE 1 – ESTABLISH INFRASTRUCTURE AT THE FACILITY IN ACCORDANCE WITH THE REQUIREMENTS OF WASTE LICENSE 18-1.

All remediation works were finished out in 2012 and the new Kilbarry Nature Park was opened in June 2012 by the president Mr. Michael D. Higgins. Infrastructure for control of leachate, landfill gas and surface water had already been installed. Monitoring and maintenance of the infrastructures for any upgrades or repair will be ongoing.

OBJECTIVE 2 – OPERATION & MANAGEMENT OF THE FACILITY IN ACCORDANCE WITH THE CONDITIONS OF THE WASTE LICENSE 18-1.

It is the objective of Waterford City Council to comply with the conditions of the Waste License (18-1) for Kilbarry Landfill Site.

As required by the waste license conditions, written waste acceptance procedures have been developed and ongoing training is being provided for all staff to ensure that they are familiar with them. Regular meetings are undertaken to review the performance of the facility. The meetings are attended by senior management staff and external consultants. The frequency of the meetings is reviewed as necessary. Procedures have been developed for the following:

- Waste acceptance procedures
- Emergency response procedures
- Corrective action procedure
- Communications programme
- Awareness and training

It is proposed that regular site meetings be undertaken to assess the performance of the facility and bring any potential problems to the attention of the Agency and Waterford City Council senior management staff.

OBJECTIVE 3 – TO PREVENT ENVIRONMENTAL NUISANCE & EMISSIONS.

In line with the objective of Waterford City Council to minimise environmental nuisance caused by the operation of the landfill at Kilbarry, actions have been implemented for the following:

- Litter control measures
- Dust control
- Vermin control
- Gas monitoring
- Leachate monitoring
- Groundwater monitoring
- Surface water monitoring

Litter control measures are in place as per condition 6.4 of the waste license.

The dust control measures employed have been outlined in section 6.2.5. The facility manager is responsible for the implementation of the dust control measures.

As part of the ongoing environmental monitoring at the facility the composition of surface water, groundwater and leachate is reported on a quarterly basis, with the analysis of a wider range of parameters on an annual basis. Monitoring of landfill gas is undertaken on a monthly basis with a continual monitoring system installed in the site office and weighbridge office.

In order to prevent landfill gas emissions to the environment the installation of an active gas abstraction system with permanent enclosed flare was begun in 2006 and completed in 2009. It can generally be seen from the monthly monitoring data that there are no migratory gas emissions occurring at the site.

As part of an overall surface water management system 3 existing retention ponds have been redeveloped and expanded in the form of constructed wetlands along with a fourth to be constructed at the southern end of the landfill. A collection drain for surface waters was installed at the top of the perimeter slopes also.

13 leachate abstraction boreholes are in place in the main waste body and a further 5 sumps collect leachate from the slotted pipe which surrounds the waste body at the bottom of the slopes. These all pump leachate to the lagoon at the north of the site.

OBJECTIVE 4 – PROMOTION OF WASTE RECYCLING AT SOURCE AND MINIMISE RELIANCE ON LANDFILL

It is the objective of Waterford City Council to promote recycling and thereby reduce the reliance on landfill for both commercial, household and construction and demolition waste. A three-bin collection system for household waste is operated in the city. This consists of a green bin for dry recyclables, a brown bin for organic waste and a black bin for residual waste.

In addition to this three-bin system the range of goods accepted for recycling at Kilbarry Civic Amenity site are:

- Timber
- Cardboard
- Batteries
- Engine oil
- Cooking oil
- Textiles
- Aluminium cans
- Glass bottles
- Fluorescent tubes
- Energy saving lightbulbs
- Metal
- W.E.E.E.

The services at the civic amenity site are regularly promoted in local newspapers and Waterford City Councils Environmental Officer, Ella Ryan, frequently discusses the benefits and recycling and developments within the area in a column in the local papers also.

OBJECTIVE 5 – TO DEVELOP AND IMPLEMENT PROCEDURES TO MONITOR THE MANAGEMENT OF THE FACILITY

In order to monitor the management of the facility the following procedures have been developed:

- Schedule of Environmental Objectives and Targets
- Environmental Management Programme
- Corrective Action Procedures
- Awareness and Training Procedures
- Communications Programme
- Environmental Management System

It is the objective of Waterford City Council to improve the environmental performance of the site. In order to achieve this the implementation of the following is proposed:

- Prepare an Annual Environmental Report
 - Improve record keeping
 - Prevent non-compliance
 - Continue and improve the environmental monitoring programme
 - Reduce general nuisances
 - Reduce risk of gas migration through the installation of a gas abstraction system
-

7.2 Financial Provisions

Waterford City Council have the ability to meet any financial commitments or liabilities incurred by the carrying out of the disposal activities relating to Kilbarry Landfill. These commitments include compliance with the waste management license and restoration and aftercare of the site as specified in Condition 8 of the license.

Under section 38 of the Waste Management Act, 1996, Waterford City Council “shall provide and operate, or arrange of, such facilities as may be necessary for the recovery and disposal of household waste arising within the functional area”. Compliance with section 38 and all other relevant sections of the waste management act, 1996 is a statutory obligation of Waterford City Council. Waterford City Council annually in the preparation of the “Book of Estimates” and the passing of these estimates shall make provision for any capital works and maintenance works required to fulfil conditions of the waste license for the Kilbarry Landfill.

Appendix I

Landfill Gas Perimeter Borehole Data and Landfill Gas Survey 2012

ID	DATE	CH4 %	CO2 %	O2 %	BALANCE %	CH4 %LEL %	PEAKCH4 %	BARO mb	REL.PRESSURE mb	CH4/CO2 %	Res Nitrogen %
00000LM1	31/01/2012 09:08	0	0	21.2	78.8	0	0	1025	-0.1	>>>>	0
00000GW2	31/01/2012 09:13	0	0	21.5	78.5	0	0	1025	-0.03	>>>>	0
00000GW9	31/01/2012 09:18	19	10.4	15.5	55.1	200	34.4	1025	-0.02	1.83	0
00000GW17	31/01/2012 09:20	3.3	2.3	20.6	73.8	66	19.2	1025	-0.04	1.43	0
00000GW4	31/01/2012 09:24	0	0	22.1	77.9	0	3.2	1025	-0.02	>>>>	0
00000GW5	31/01/2012 09:28	0	0	22.2	77.8	0	0.1	1025	-0.03	>>>>	0
00000GW6	31/01/2012 09:33	0	0	22.2	77.8	0	0	1026	-0.06	>>>>	0
00000GW22	31/01/2012 09:38	0	0	22.3	77.7	0	0	1026	-0.08	>>>>	0
00000GW23	31/01/2012 09:40	0	0	22.2	77.8	0	0	1026	-0.1	>>>>	0
00000GW24	31/01/2012 09:42	0	0	22.3	77.7	0	0	1026	-0.11	>>>>	0
00000GW25	31/01/2012 09:44	0	0.1	22.2	77.7	0	0	1026	-0.1	0	0
00000GW26	31/01/2012 09:46	0	0	22.2	77.8	0	0	1026	-0.12	>>>>	0
00000GW27	31/01/2012 09:49	0	0.1	22.2	77.7	0	0	1026	-0.13	0	0
00000GW28	31/01/2012 09:51	0	0.1	22.2	77.7	0	0	1026	-0.15	0	0
00000GW7	31/01/2012 09:55	3.9	2.5	20.7	72.9	78	4	1026	-0.14	1.56	0
00000LM1	29/02/2012 09:06	0	0	21.1	78.9	0	0	1022	-0.06	>>>>	0
00000GW2	29/02/2012 09:10	0	0	21.2	78.8	0	0	1022	0	>>>>	0
00000GW9	29/02/2012 09:14	28.7	16.6	10.9	43.8	200	49.3	1022	0.02	1.73	2.6
00000GW17	29/02/2012 09:17	0.8	0.2	21.1	77.9	16	30.2	1022	196.04	4	0
00000GW4	29/02/2012 09:24	0	0	21.8	78.2	0	1.2	1022	0.03	>>>>	0
00000GW5	29/02/2012 09:27	0	0	21.8	78.2	0	0.1	1023	0.01	>>>>	0
00000GW6	29/02/2012 09:32	0	0	21.9	78.1	0	0	1023	0	>>>>	0
00000GW22	29/02/2012 09:39	0	0	21.9	78.1	0	0	1023	-0.02	>>>>	0
00000GW23	29/02/2012 09:41	0	0	21.8	78.2	0	0	1023	0	>>>>	0
00000GW24	29/02/2012 09:43	0	0	21.9	78.1	0	0	1023	-0.04	>>>>	0
00000GW25	29/02/2012 09:45	0	0	21.8	78.2	0	0	1023	-0.03	>>>>	0
00000GW26	29/02/2012 09:48	0	0	21.8	78.2	0	0	1023	-0.07	>>>>	0
00000GW27	29/02/2012 09:50	0	0	21.8	78.2	0	0	1023	-0.04	>>>>	0
00000GW28	29/02/2012 09:56	0	0	21.8	78.2	0	0	1023	-0.07	>>>>	0
00000GW7	29/02/2012 10:00	1.1	0.7	21.3	76.9	22	1.2	1023	-0.07	1.57	0
00000LM1	30/03/2012 07:19	0	0	21.1	78.9	0	0	1034	-0.22	>>>>	0
00000GW2	30/03/2012 07:23	0	0	21.1	78.9	0	0	1034	-0.19	>>>>	0
00000GW9	30/03/2012 07:27	0	0	21.2	78.8	0	0	1033	-0.14	>>>>	0
00000GW17	30/03/2012 07:30	0	0	21.2	78.8	0	0	1033	-0.11	>>>>	0
00000GW4	30/03/2012 07:35	1.6	0.6	20.8	77	32	1.7	1033	-0.11	2.67	0

00000GW5	30/03/2012 07:39	0	0	21.3	78.7	0	1.6	1033	-0.12	>>>>	0
00000GW6	30/03/2012 07:45	0	0	21.3	78.7	0	0	1033	-0.11	>>>>	0
00000GW22	30/03/2012 07:49	0	0	21.3	78.7	0		1033	-0.15	>>>>	0
00000GW23	30/03/2012 07:51	0	0.3	21.1	78.6	0	0	1033	-0.14	0	0
00000GW24	30/03/2012 07:53	0	0	21.4	78.6	0	0	1033	-0.15	>>>>	0
00000GW25	30/03/2012 07:55	0	0	21.4	78.6	0	0	1033	-0.13	>>>>	0
00000GW26	30/03/2012 07:58	0	0	21.4	78.6	0	0	1033	-0.13	>>>>	0
00000GW27	30/03/2012 08:00	0	0.1	21.4	78.5	0	0	1033	-0.14	0	0
00000GW28	30/03/2012 08:02	0	0	21.4	78.6	0	0	1033	-0.14	>>>>	0
00000GW7	30/03/2012 08:06	0	0	21.4	78.6	0	0	1032	-0.14	>>>>	0
00000LM1	30/04/2012 09:20	0	0	21.4	78.6	0	0	1008	-0.22	>>>>	0
00000GW2	30/04/2012 09:23	0	0	21.5	78.5	0	0	1008	-0.17	>>>>	0
00000GW9	30/04/2012 09:26	0	0	21.6	78.4	0	0	1008	-0.12	>>>>	0
00000GW17	30/04/2012 09:29	0.1	0	21.6	78.3	2	0.1	1008	-0.12	>>>>	0
00000GW4	30/04/2012 09:31	0	0.1	21.7	78.2	0	0.1	1008	-0.09	0	0
00000GW5	30/04/2012 09:35	0	0	21.8	78.2	0	0	1008	-0.07	>>>>	0
00000GW6	30/04/2012 09:39	0	0	21.8	78.2	0	0	1008	-0.1	>>>>	0
00000GW22	30/04/2012 09:43	0	0	21.9	78.1	0	0	1008	-0.11	>>>>	0
00000GW23	30/04/2012 09:45	0	0.2	21.8	78	0	0	1008	-0.16	0	0
00000GW24	30/04/2012 09:47	0	0	21.9	78.1	0	0	1009	-0.16	>>>>	0
00000GW25	30/04/2012 09:49	0	0	22	78	0	0	1009	-0.09	>>>>	0
00000GW26	30/04/2012 09:52	0	0	22	78	0	0	1009	-0.12	>>>>	0
00000GW27	30/04/2012 09:54	0	0.1	22	77.9	0	0	1009	-0.12	0	0
00000GW28	30/04/2012 09:57	0	0	22.1	77.9	0	0	1009	-0.13	>>>>	0
00000GW7	30/04/2012 10:01	0	0	22.1	77.9	0	0	1008	-0.13	>>>>	0
00000LM1	30/05/2012 09:13	0	0	21.1	78.9	0	0	1018	-0.04	>>>>	0
00000GW2	30/05/2012 09:17	0	0	21.1	78.9	0	0	1018	0	>>>>	0
00000GW9	13/06/2012 08:11	0	0.1	21.1	78.8	0		1018	-0.19	0	0
00000LM1	30/05/2012 08:35	0	0	20.9	79.1	0	0	1017	-0.09	>>>>	0.1
00000GW2	30/05/2012 08:39	0	0	20.9	79.1	0	0	1017	-0.1	>>>>	0.1
00000GW9	30/05/2012 08:44	0	0	20.8	79.2	0	0	1017	-0.08	>>>>	0.58
00000GW17	30/05/2012 08:47	0	0	20.8	79.2	0	0	1017	-0.07	>>>>	0.58
00000GW4	30/05/2012 08:52	0	0	20.8	79.2	0	0	1017	-0.08	>>>>	0.58
00000GW5	30/05/2012 08:56	0	0	20.9	79.1	0	0	1016	-0.06	>>>>	0.1
00000GW6	30/05/2012 09:01	0	0.1	20.9	79	0	0	1016	-0.05	0	0
00000GW22	30/05/2012 09:06	0	0	21	79	0	0	1016	-0.05	>>>>	0
00000GW23	30/05/2012 09:08	0	0	21	79	0	0	1016	-0.04	>>>>	0

0000GW24	30/05/2012 09:10	0	0	21.1	78.9	0	0	1016	-0.03	>>>>	0
0000GW25	30/05/2012 09:12	0	0	21.1	78.9	0	0	1016	-0.03	>>>>	0
0000GW26	30/05/2012 09:15	0	0	21	79	0	0	1016	-0.03	>>>>	0
0000GW26	30/05/2012 09:15	0	0	21	79	0		1016	0	>>>>	0
0000GW27	30/05/2012 09:17	0	0	21	79	0	0	1016	-0.02	>>>>	0
0000GW28	30/05/2012 09:19	0	0	21	79	0	0	1016	-0.02	>>>>	0
00000GW7	30/05/2012 09:22	0	0	21.1	78.9	0	0	1015	0	>>>>	0
00000LM1	29/06/2012 08:38	0	0	20.9	79.1	0	0	998	-0.22	>>>>	0.1
00000GW2	29/06/2012 08:42	0	0	20.9	79.1	0	0	998	-0.15	>>>>	0.1
00000GW9	29/06/2012 08:47	0	0	20.9	79.1	0	0	997	-0.13	>>>>	0.1
0000GW17	29/06/2012 08:49	0	0	20.9	79.1	0	0	998	-0.1	>>>>	0.1
00000GW4	29/06/2012 08:54	0	0	20.9	79.1	0	0	997	-0.09	>>>>	0.1
00000GW5	29/06/2012 08:58	0	0	20.9	79.1	0	0	997	-0.09	>>>>	0.1
00000GW6	29/06/2012 09:03	0	0.2	20.6	79.2	0	0	997	-0.07	0	1.33
0000GW22	29/06/2012 09:07	0	0	21	79	0	0	997	-0.05	>>>>	0
0000GW23	29/06/2012 09:09	0	0	20.9	79.1	0	0	997	-0.06	>>>>	0.1
0000GW24	29/06/2012 09:11	0	0	21	79	0	0	997	-0.06	>>>>	0
0000GW25	29/06/2012 09:13	0	0	20.9	79.1	0	0	997	-0.05	>>>>	0.1
0000GW26	29/06/2012 09:15	0	0	21	79	0	0	997	-0.1	>>>>	0
0000GW27	29/06/2012 09:16	0	0	20.9	79.1	0		997	-0.03	>>>>	0.1
0000GW28	29/06/2012 09:19	0	0	20.9	79.1	0	0	997	-0.2	>>>>	0.1
00000GW7	29/06/2012 09:23	0	0	21	79	0	0	996	-0.03	>>>>	0
00000LM1	31/07/2012 09:11	0	0	20.9	79.1	0	0	1013	-0.24	>>>>	0.1
00000GW2	31/07/2012 09:15	0	0	20.9	79.1	0	0	1013	-0.2	>>>>	0.1
00000GW9	31/07/2012 09:21	0.2	0.2	20.9	78.7	4	0.4	1012	-0.14	1	0
0000GW17	31/07/2012 09:24	0	0	21	79	0	0.2	1013	-0.13	>>>>	0
00000GW4	31/07/2012 09:29	0.6	0.3	20.8	78.3	12	0.8	1013	-0.13	2	0
00000GW5	31/07/2012 09:37	0	0	21.1	78.9	0	0.6	1012	-0.11	>>>>	0
00000GW6	31/07/2012 09:40	0	0	21.1	78.9	0	0	1012	-0.11	>>>>	0
0000GW22	31/07/2012 09:44	0	0	21.1	78.9	0	0	1012	-0.19	>>>>	0
0000GW23	31/07/2012 09:46	0	0	21.2	78.8	0	0	1012	-0.11	>>>>	0
0000GW24	31/07/2012 09:50	0	0	21.2	78.8	0	0	1012	-0.13	>>>>	0
0000GW25	31/07/2012 09:52	0	0	21.2	78.8	0	0	1012	-0.11	>>>>	0
0000GW26	31/07/2012 09:54	0	0	21.2	78.8	0	0	1012	-0.11	>>>>	0
0000GW27	31/07/2012 09:57	0	0	21.2	78.8	0	0	1012	-0.11	>>>>	0

0000GW28	31/07/2012 09:58	0	0	21.2	78.8	0	0	1012	-0.12	>>>>	0
00000GW7	31/07/2012 10:02	0	0	21.2	78.8	0	0	1012	-0.12	>>>>	0
00000LM1	31/08/2012 09:05	0	0	20.9	79.1	0	0	1035	-0.29	>>>>	0.1
00000GW2	31/08/2012 09:09	0	0	20.9	79.1	0	0	1035	-0.24	>>>>	0.1
00000GW9	31/08/2012 09:14	0	0	20.9	79.1	0	0	1035	-0.2	>>>>	0.1
0000GW17	31/08/2012 09:17	0	0	20.9	79.1	0	0	1035	-0.18	>>>>	0.1
00000GW4	31/08/2012 09:23	0	0	20.9	79.1	0	0	1034	-0.14	>>>>	0.1
00000GW5	31/08/2012 09:26	0	0.2	20.8	79	0	0	1034	-0.14	0	0.38
00000GW6	31/08/2012 09:31	0	0.1	21	78.9	0	0	1034	-0.13	0	0
0000GW15	31/08/2012 09:36	0	0	21	79	0	0	1034	-0.13	>>>>	0
0000GW22	31/08/2012 09:38	0	0	21	79	0	0	1034	-0.12	>>>>	0
0000GW23	31/08/2012 09:39	0	0	21	79	0	0	1034	-0.13	>>>>	0
0000GW24	31/08/2012 09:41	0	0	21	79	0	0	1034	-0.12	>>>>	0
0000GW25	31/08/2012 09:46	0	0	21	79	0	0	1034	-0.13	>>>>	0
0000GW26	31/08/2012 09:48	0	0	21	79	0	0	1034	-0.12	>>>>	0
0000GW27	31/08/2012 09:50	0	0	21	79	0	0	1034	-0.12	>>>>	0
0000GW28	31/08/2012 09:52	0	0	21	79	0	0	1034	-0.13	>>>>	0
00000GW7	31/08/2012 09:56	0	0	21	79	0	0	1033	-0.12	>>>>	0
00000LM1	28/09/2012 09:03	0	0	20.9	79.1	0	0	1015	-0.29	>>>>	0.1
00000GW2	28/09/2012 09:08	0	0	20.9	79.1	0	0	1015	-0.26	>>>>	0.1
00000GW9	28/09/2012 09:12	0	0.1	20.9	79	0	0	1014	-0.2	0	0
0000GW17	28/09/2012 09:15	0	0	21	79	0	0	1015	-0.18	>>>>	0
00000GW4	28/09/2012 09:20	0.5	0.3	20.7	78.5	10	0.5	1015	-0.15	1.67	0.25
00000GW5	28/09/2012 09:24	0	0.1	20.9	79	0	0.5	1015	-0.18	0	0
00000GW6	28/09/2012 09:29	0	0.1	20.9	79	0	0	1015	-0.15	0	0
0000GW22	28/09/2012 09:34	0	0	21	79	0	0	1015	-0.15	>>>>	0
0000GW23	28/09/2012 09:36	0	0.3	20.6	79.1	0	0	1015	-0.15	0	1.23
0000GW24	28/09/2012 09:39	0	0	21	79	0	0	1014	-0.15	>>>>	0
0000GW25	28/09/2012 09:42	0	0	21	79	0	0	1015	-0.17	>>>>	0
0000GW26	28/09/2012 09:44	0	0	21.1	78.9	0	0	1015	-0.16	>>>>	0
0000GW27	28/09/2012 09:47	0	0.1	21	78.9	0	0	1015	-0.17	0	0

0000GW28	28/09/2012 09:49	0	0	21.1	78.9	0	0	1014	-0.18	>>>>	0
00000GW7	28/09/2012 09:52	0	0	21.1	78.9	0	0	1014	-0.16	>>>>	0
00000LM1	31/10/2012 09:59	0	0	21.1	78.9	0	0	983	-0.23	>>>>	0
00000GW2	31/10/2012 10:03	0	0.1	21.1	78.8	0	0	983	-0.21	0	0
00000GW9	31/10/2012 10:08	2.5	1.6	20.8	75.1	50	2.6	983	-0.19	1.56	0
0000GW17	31/10/2012 10:11	0	0	21.3	78.7	0	0	983	-0.19	>>>>	0
00000GW4	31/10/2012 10:15	0	0	21.4	78.6	0	0	983	-0.17	>>>>	0
00000GW5	31/10/2012 10:19	0	0.1	21.3	78.6	0	0	983	-0.17	0	0
00000GW6	31/10/2012 10:24	0	0.1	21.3	78.6	0	0	983	-0.17	0	0
0000GW22	31/10/2012 10:29	0	0.1	21.3	78.6	0	0	983	-0.16	0	0
0000GW23	31/10/2012 10:31	0.1	0.2	21.1	78.6	2	0.1	983	-0.16	0.5	0
0000GW24	31/10/2012 10:33	0.1	0.3	21.1	78.5	2	0.1	983	-0.17	0.33	0
0000GW25	31/10/2012 10:35	0	0	21.2	78.8	0	0.1	983	-0.16	>>>>	0
0000GW26	31/10/2012 10:38	0	0	21.1	78.9	0	0	983	-0.15	>>>>	0
0000GW27	31/10/2012 10:40	0	0.6	20.9	78.5	0	0	983	-0.16	0	0
0000GW28	31/10/2012 10:42	0	0	21.1	78.9	0	0	982	-0.15	>>>>	0
00000GW7	31/10/2012 10:46	1.7	1.2	20.3	76.8	34	1.8	982	-0.14	1.42	0.07
00000LM1	30/11/2012 08:54	0	0.1	20.3	79.6	0	0	1019	-0.4	0	2.87
00000GW2	30/11/2012 08:59	0	0.1	20.5	79.4	0	0	1018	-0.36	0	1.91
00000GW9	30/11/2012 09:03	0	0.1	20.7	79.2	0	0	1018	-0.33	0	0.95
0000GW17	30/11/2012 09:06	0	0.1	20.8	79.1	0	0	1018	-0.33	0	0.48
00000GW4	30/11/2012 09:10	0	0.1	20.9	79	0	0	1018	-0.3	0	0
00000GW5	30/11/2012 09:18	0	0.1	21.1	78.8	0	0	1018	-0.29	0	0
0000GW22	30/11/2012 09:23	0	0.1	21.1	78.8	0	0	1018	-0.27	0	0
0000GW23	30/11/2012 09:25	0	0.4	21	78.6	0	0	1018	-0.28	0	0
0000GW24	30/11/2012 09:27	0.1	0.6	21	78.3	2	0.1	1018	-0.27	0.17	0
0000GW25	30/11/2012 09:29	0	0.1	21.2	78.7	0	0.1	1018	-0.28	0	0
0000GW26	30/11/2012 09:32	0	0.1	21.2	78.7	0	0	1018	-0.27	0	0
0000GW27	30/11/2012 09:34	0	0.3	21.1	78.6	0	0	1018	-0.28	0	0
0000GW28	30/11/2012 09:36	0	0.1	21.2	78.7	0	0	1018	-0.28	0	0
00000GW7	30/11/2012 09:39	0	0.1	21.2	78.7	0	0	1017	-0.28	0	0

00000LM1	31/12/2012 09:22	0	0	20.5	79.5	0	0	996	-0.16	>>>>	2.01
00000GW2	31/12/2012 09:26	0	0	20.7	79.3	0	0	996	-0.13	>>>>	1.05
00000GW9	31/12/2012 09:31	0	0	20.9	79.1	0	0	996	-0.08	>>>>	0.1
0000GW17	31/12/2012 09:33	0	0	21	79	0	0	996	-0.07	>>>>	0
00000GW4	31/12/2012 09:38	0	0	21.2	78.8	0	0	996	-0.06	>>>>	0
00000GW5	31/12/2012 09:41	0	0	21.3	78.7	0	0	996	-0.07	>>>>	0
00000GW6	31/12/2012 09:46	0.2	0.6	20.5	78.7	4	0.2	997	-0.09	0.33	1.21
0000GW15	31/12/2012 09:50	0	0	21.5	78.5	0	0.3	997	-0.1	>>>>	0
0000GW22	31/12/2012 09:52	0	0	21.5	78.5	0	0	997	-0.09	>>>>	0
0000GW23	31/12/2012 09:54	0	0.1	21.5	78.4	0	0	997	-0.11	0	0
0000GW24	31/12/2012 09:56	0	0	21.5	78.5	0	0	997	-0.12	>>>>	0
0000GW25	31/12/2012 09:59	0	0	21.5	78.5	0	0	997	-0.13	>>>>	0
0000GW26	31/12/2012 10:01	0	0	21.5	78.5	0	0	997	-0.12	>>>>	0
0000GW28	31/12/2012 10:08	0	0	21.5	78.5	0	0	997	-0.14	>>>>	0
00000GW7	31/12/2012 10:05	0	0	21.5	78.5	0	0	997	-0.13	>>>>	0

A survey of landfill sites to determine the quantity of methane flared and or recovered in utilisation plants for 2012

Please choose from the drop down menu the license number for your site	W0018
Please choose from the drop down menu the name of the landfill site	Kilbarry Landfill Site
Please enter the number of flares operational at your site in 2012	1
Please enter the number of engines operational at your site in 2012	0
Total methane flared	344,356 kg/year
Total methane utilised in engines	0 kg/year

Please note that the closing date for receipt of completed surveys is 31/03/2013

Introduction

The Office of Climate Licensing and Resource Use (OCLR) of the Environmental Protection Agency acts as the inventory agency in Ireland with responsibility for compiling and reporting national greenhouse gas inventories to the European Commission and the United Nations Framework Convention on Climate Change. In addition to meeting international commitments Ireland's national greenhouse gas inventory informs national agencies and Government departments as they face the challenge to curb emissions and meet Ireland's targets under the Kyoto Protocol. The national inventory also informs data suppliers, making them aware of the importance of their contributions to the inventory process and a means of identifying areas where input data may be improved.

It is on this basis that the Environmental Protection Agency is asking landfill operators to partake in this survey so that the most up to date information on methane flaring and recovery in utilisation plants at landfill sites is used in calculating the contribution of the waste sector to national greenhouse gas emissions

The Environmental Protection Agency wishes to thank you for partaking in this survey. If you have any questions about the survey and how to complete it please view the "Help sheet" worksheet. If however, your query is not answered by viewing the "Help sheet" worksheet please contact:

LFGProject@epa.ie

Once completed please send the completed file as an attachment clearly stating the name and or license number of the landfill site (e.g. W000 Xanadu landfill_2012) to:

LFGProject@epa.ie

to be filled in by licensee calculated by spreadsheet

Flare No. 1

Flare type ? AFS HT500 If "other" enter flare description here

Is the flare an open or enclosed flare ? Enclosed Rated flare capacity ? 500 m3/hr

Month /year comissioned ? October 2009

Month decomissioned if decomissioned in 2012 ? Select

What is the function of the flare ? Extraction from capped area If "other" enter flare function here

Monthly	Method M/C/E	Runtime days/month	Runtime hrs/day	Downtime hrs	Total runtime hrs/month	Average Inlet Pressure (mbg)	Average Flow Rate (m ³ /hr)	Average CH ₄ %v/v	Average CO ₂ %v/v	Average O ₂ %v/v	Combustion efficiency (%)	Total CH ₄ m ³	Total CH ₄ kgs
January	M	0	0.5	0.0	0						98.0	0	0
February	M	0	0.5	0.0	0						98.0	0	0
March	M	20	24.0	0.0	480	-54	350	58.40	22.00	1.00	98.0	96,150	62,849
April	M	30	24.0	0.0	720	-31	234	32.90	15.90	1.10	98.0	54,321	36,359
May	M	17	24.0	0.0	408	-25	194	43.00	17.80	1.00	98.0	33,355	22,461
June	M	30	24.0	0.0	720	-24	187	36.20	16.50	1.00	98.0	47,765	32,198
July	M	31	24.0	0.0	744	-24	183	36.10	16.50	1.00	98.0	48,168	32,470
August	M	31	24.0	0.0	744	-24	179	38.00	16.70	1.00	98.0	49,595	33,432
September	M	23	24.0	0.0	552	-23	178	39.00	16.00	1.00	98.0	37,553	25,340
October	M	31	24.0	0.0	744	-24	178	40.20	16.70	1.00	98.0	52,173	35,170
November	M	30	24.0	10.0	710	-23	171	39.90	16.40	1.00	98.0	47,474	32,034
December	M	31	24.0	0.0	744	-23	167	39.00	15.90	1.00	98.0	47,488	32,044
Total					6,566							514,041	344,356

Please note: Only fill the "Yearly" table if data is not available or cannot be calculated nor estimated on a monthly basis

Yearly	Method M/C/E	Runtime days/year	Runtime hrs/day	Downtime hrs	Total runtime hrs/year	Average Inlet Pressure (mbg)	Average Flow Rate m ³ /hr	Average CH ₄ %v/v	Average CO ₂ %v/v	Average O ₂ %v/v	Combustion efficiency (%)	Total CH ₄ m ³	Total CH ₄ kgs
2012					0						98.0	0	0

Appendix II

Ecological Assessment 2012

Kilbarry Bog Ecological Monitoring 2012

**Annual Ecological Monitoring 2012
of Kilbarry Bog pNHA,
Waterford**

Report for

Waterford City Council



Prepared by

Ger Stanton and David Horgan

08 March 2013 (Issue 2 Final)

Acknowledgements

We would like to acknowledge and thank Mr. Patrick Smiddy (Wildlife Surveys) for his contributions to this report.

CONTENTS

	<i>Page no.</i>
1.....	ii
1. Introduction	1
1.1 Scope of Works	1
1.2 Site Description	1
1.3 Historic Extent of Kilbarry Bog	2
1.4 Recent Activity.....	2
1.5 Current & Previous Studies.....	3
1.6 Leachate Management.....	3
2. Methodology	5
2.1 Desktop Study	5
2.2 Consultation	5
2.3 Field Surveys.....	5
2.3.1 Habitat Assessment	5
2.3.2 Water Quality Assessment	6
2.3.3 Salmonid Assessment.....	8
2.3.4 Otter Survey	8
2.3.5 Avian Fauna Survey	9
2.3.6 Invasive Species Survey	9
2.3.7 Seasonal Limitations	10
3. Results.....	11
3.1 Habitat Assessment	11
3.1.1 Site Habitats	11
3.1.2 Plant list.....	11
3.1.3 Quadrat Survey Results	11
3.1.4 Willow Woodland Habitat Assessment.....	15
3.2 Water Quality and Salmonid Assessment	15
3.2.1 Biological Monitoring	15
3.2.2 Salmonid Assessment.....	17
3.3 Otter Assessment.....	18
3.4 Kingfisher and Additional Bird Survey.....	19
3.5 Invasive Species and Threats to the Conservation of Kilbarry Bog.....	20
4. Discussion and Conclusion	22
4.1 Water Quality and Fisheries Assessment	22
4.2 Otters	23
4.3 Bird Survey's.....	24
4.4 Invasive Species	25
5. Recommendations	26
6. References and Bibliography.....	27

FIGURES

Figure 1 - Site plan	30
Figure 2 - Boundaries of historical Kilbarry Bog ASI and current Kilbarry Bog pNHA.....	3
Figure 3 - Habitat map.....	31
Figure 4 - Quadrat location map.....	32
Figure 5 - Kick sample location map	33
Figure 6 - Otter survey map.....	34
Figure 7 - Invasive species/dumping activity map	35

TABLES

Table 1 - DOMIN scale of cover/abundance.....	6
Table 2 - Freshwater monitoring locations.....	7
Table 3 - Q-value taxa groups and pollution sensitivity.....	8
Table 4 - The EPA Q-value categories.....	8
Table 5 - Vegetation quadrat results 2012.....	12
Table 6 - Changes in vegetation between 2009 and 2012	14
Table 7 - Changes in water level between 2009 and 2012	15
Table 8 - Biological Monitoring results from 2003 to 2012	18
Table 9 - Kick sample species list 2012	37
Table 10 - Kick samle physio-chemical results and field observations	38
Table 11 - Otter monitoring results 2003 to 2012	18
Table 12 - Bird monitoring results 2012	20
Table 13 - Invasive species and other threats to Kilbarry Bog.....	21

GRAPHS

Graph 1 - Changes in vegetation composition (Q1 – Q9) vs. time.	13
Graph 2 - Changes in vegetation composition (Q1 – Q5) vs. time	13
Graph 3 - Changes in vegetation composition (Q6 – Q9) vs. time	14
Graph 4 - Temporal trend graph of Q-values recorded since 2003 (L6 not included)	18

APPENDIXES

Appendix A - NPWS site synopsis sheet for Kilbarry Bog pNHA	40
Appendix B - Quadrat recording sheets 2012	43
Appendix C - Kilbarry Bog plant list (Green 1997 to 2007).....	53

1. Introduction

1.1 Scope of Works

Ger Stanton and David Horgan were appointed by Waterford City Council to carry out an ecological assessment of the Kilbarry Bog proposed Natural Heritage Area (pNHA). Monitoring at the bog is required by the facility's EPA Waste Licence (W0018-1). Condition 9.20 of the license states the following:

“9.20. Ecological Monitoring

9.20.1. An ecological assessment of the habitats and associated plant and animal communities within and immediately adjoining (i) the Kilbarry Bog proposed Natural Heritage Area and (ii) the associated watercourses, shall be undertaken annually and shall be submitted to the Agency. This assessment shall include a description of remedial measures to be introduced to control discharges of leachate and contaminated water from the landfill into surface and groundwater regime within Kilbarry Bog. The assessment shall establish the status of salmonid species, kingfisher and otter in the watercourses and adjoining habitats within Kilbarry Bog and in the John's River and its tributaries in the immediate vicinity of, upstream and downstream of the landfill.”

In 2010, WYG Environmental & Planning (Ireland) Ltd. (WYG) was awarded a contract by Waterford City Council to conduct annual ecological monitoring of Kilbarry Bog for five years (2010-2014). However, this contract was terminated due to company liquidation in late August 2012. This report presents the findings of the 2012 survey, which is the third annual report on the ecological monitoring completed thus far.

This study presents an assessment of the habitats and plant communities in the form of quantitative habitat mapping. Water quality and salmonid species were assessed by means of biological monitoring and habitat assessment. Otter and kingfisher are assessed by means of field surveys.

In 2012, an additional bird survey was completed to assess the current population status of the reed warbler *Acrocephalus scirpaceus* at Kilbarry Bog. All bird species encountered during the survey were recorded. The findings of the surveys are presented below along with a discussion and recommendations.

1.2 Site Description

Kilbarry Bog is located on the southern outskirts of Waterford City (Grid Ref S602, 905). It is approximately 45 ha in size and is a proposed Natural Heritage Area (pNHA) under the Wildlife Amendment Act (2000). Although the site is called Kilbarry Bog it is not a bog but rather a reed and large sedge swamp. It has an irregular shape. The northern section is narrow and widens in the southern half of the site. The site is flat. Kilbarry Landfill is located to the north west of the pNHA, as presented in Figure 1. The NPWS site synopsis sheet is presented in Appendix A.

The site is predominantly drained by the St John River, which flows from in a south to north direction through the site. The Waterford to Tramore road (R675) runs parallel with the St John River and a footpath is located between the road and river. The footpath is situated on the dismantled old Southern Railway line.

The Couse River drains the south eastern section of the site and flows into the St John River within the site boundary. A number of land drains are located across the pNHA. The Lisduggan Stream flows along the northern boundary of the Kilbarry Landfill. A land drain is located around the landfill and forms part of the boundary between the pNHA and the landfill, and is connected to the Lisduggan stream. The Lisduggan Stream and St John's River converge approximately 300m north of the pNHA boundary.

In addition to the landfill, the surrounding area consists of residential and commercial properties to the north and north-east. The land use to the south, west and south-east is predominately agricultural both grazing and cereal crops. At the southern tip of the bog the road passes within the pNHA boundary.

1.3 Historic Extent of Kilbarry Bog

Much of the historic extent of Kilbarry Bog extends under where the Kilbarry Landfill was constructed in the 1970s. It was designated by An Foras Forbartha as Kilbarry Bog Area of Scientific Interest (ASI) and was described in the ASI Report as being “*an area of fen, swamp and open water*” (Young 1972). As a result of the loss of the much of the Kilbarry Bog ASI to the landfill, the adjacent Ballynakill Marsh was incorporated into the boundary of the Kilbarry Bog pNHA. The boundaries of historical Kilbarry Bog ASI and current Kilbarry Bog pNHA are presented in Figure 2.

1.4 Recent Activity

In recent years the Waterford Outer Ring-road dual-carriageway has been constructed along the southern and south western edge of the pNHA.

In 2010, road improvement works on the Tramore road, which passes through the pNHA, was carried out by Waterford City Council to prevent flooding of the road. Most of the works were kept to within the existing road.

The Kilbarry landfill has undergone re-developed since 2010 to make it into a public amenity park. It now includes several walkways, viewing points, seating/picnic areas, a car park and information boards around the former landfill site. The park's landscaping is now complete and is open to the public for recreational use.

In response to the European Court of Justice Case 494/01, Waterford City Council procured approximately 3.6 hectares of land adjacent to Kilbarry Bog for the creation of a compensatory wetlands habitat. It is proposed to create habitats similar to those found at Kilbarry Bog. Works on the proposed are scheduled to go ahead on receipt of planning approval in 2013.

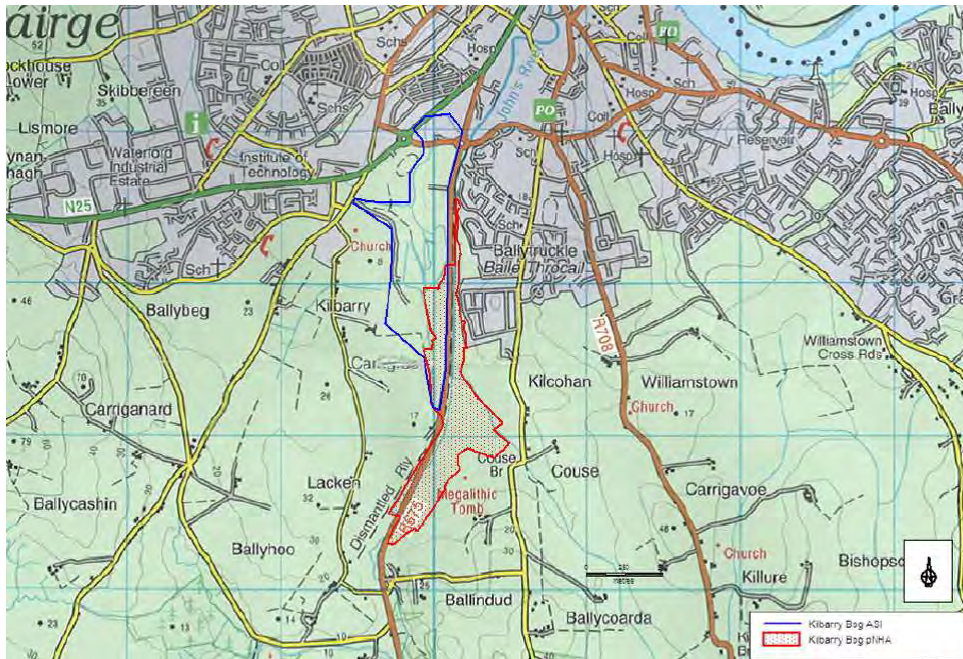


Figure 2: Boundaries of historical Kilbarry Bog ASI and current Kilbarry Bog pNHA (Atkins 2008)

1.5 Current & Previous Studies

As part of the landfill management and facility's waste license conditions, the site has been surveyed a number of times in recent years:

- 2008 -2010 by WYG
- 2004 by Limosa Environmental
- 2003 by Biosphere Environmental Services

Government organisations have also reported on the site:

- NPWS Site Synopsis Sheet (2005)
- 1972 - A Report on Areas of Scientific Interest in County Waterford (Young 1972)

In 2008 the draft Kilbarry Bog Management Plan was prepared by Atkins Consulting on behalf of Waterford City Council. In 2012 Atkins Consulting revised and updated the objectives of the Habitat Management Plan and is now referred to as *Waterford Nature Park Management Plan (including Kilbarry Bog pNHA)*. The management plan has set out several objectives with a considerable emphasis on the conservation of Kilbarry Bog pNHA. The plan has also put forward recommendations to designate Kilbarry Bog as statutory Nature Reserve.

1.6 Leachate Management

The waste license requires “a description of remedial measures to be introduced to control discharges of leachate and contaminated water from the landfill into surface and groundwater regime within Kilbarry Bog” be presented in the report.

Waterford City Council reported that “leachate management of the site comprises five pumped sumps around the perimeter of the landfill slope and 13 No leachate wells in the waste body itself. The sumps are fed by a slotted high density polyethylene (HDPE) pipe designed to collect any leachate seeping from the side of the waste body. The wells were drilled to various depths

into the waste body and have level sensor pumps which periodically pump out leachate collected in the well. All leachate is pumped to the lagoon at the north of the site and allowed to settle. This leachate is then released to the sewer through a monitoring sump which records dissolved methane and pH”.

2. Methodology

2.1 Desktop Study

In advance of conducting the field survey, a review of aerial photographs, maps, report and plans of the site was completed. This included reports listed in Section 1.5 above.

2.2 Consultation

Consultation with government agencies was carried out by WYG in 2008 with the Dept of Environment, Heritage & Local Government, National Parks and Wildlife Service, Waterford County Council Heritage Officer and Eastern Regional Fisheries Officer. No response was received from these organisations.

In 2009 consultation was conducted with:

- Paul Green, Waterford Vice-County Recorder, Botanical Society of the British Isles (BSBI) – response received.
- Evelyn Moorkens, Mollusc specialist – no response received.

No additional consultation was conducted with these or other organisations in 2012.

2.3 Field Surveys

The field surveys consisted of the following aspects:

- Habitat Assessment
- Water Quality and Fisheries Assessment
- Otter Survey
- Kingfisher Survey
- Invasive Species Survey
- Additional Bird Survey (reed warbler)

2.3.1 Habitat Assessment

In 2008, WYG submitted a monitoring report concluded that habitat monitoring, by means of habitat mapping on an annual basis, did not provide adequate detail or resolution to allow for long term monitoring of Kilbarry Bog. Therefore a semi-quantitative monitoring method, in the form of monitoring permanent quadrats, was recommended as the most appropriate approach to assess vegetative changes across the bog. It is to be noted that a similar approach was recommended by Limosa Environmental in 2004. Vegetative surveys have been complete at each quadrat location within the bog annually since 2009.

Quadrat Location

In 2009 nine quadrats (Q1 to Q9) were set up. Five quadrats (Q1 to Q5) were located on the north western section of the bog close to the landfill. They were concentrated in this area to monitor any future changes in the habitat structure due to possible interactions with the landfill. A further four quadrats (Q6 to Q9) were surveyed across the rest of the site to establish background trends and to determine if future changes are site wide or localised.

In 2010 a new quadrat was established at the location which corresponded with Q7 from 2009, as the original bamboo stake markers for Q7 could not be found. This new quadrat is called Q7-A and was surveyed during the 2011 habitat assessment. All quadrat locations were chosen to be representative of the typical vegetation composition found in that particular area of the bog. Refer to Figure 3 for the habitat map and Figure 4 for quadrat locations.

Quadrat Set up and Surveying Methodology

Permanent quadrat monitoring stations were established across the site and consisted of the following:

- Quadrats were sized 4m × 4m square. This is the recommended size for tall herb habitats as per the *National Vegetation Classification: Users’ handbook* (JNCC 2006) and *Guidelines for a National Fen Survey of Ireland: Survey Manual* (Foss and Crushell 2008)
- Bamboo canes were placed at each of the four corners of the quadrat. The corner which the bamboo cane represented was written in permanent marker e.g. the north east corner was indicated by “NE Corner”. This will allow surveyors to more easily establish the quadrat area, in the future. Red tape was also placed on the top of each bamboo cane
- For each quadrat a recording sheet was completed, which was based on the National Fen Survey Manual. Information recorded included vegetation composition, water level, GPS and a photograph
- A measure of the abundance of all vascular plants was recorded using the DOMIN scale (as described in JNCC 2006). The DOMIN scale is outlined in Table 1 below:

Table 1: DOMIN scale of cover/abundance

Cover	DOMIN score
91–100%	10
76–90%	9
51–75%	8
34–50%	7
26–33%	6
11–25%	5
4–10%	4
<4% (many individuals)	3
<4% (several individuals)	2
<4% (few individuals)	1

The completed quadrat recording sheets are presented Appendix B.

2.3.2 Water Quality Assessment

To monitor the water quality of the St John’s River and adjacent water courses, as required by the facility’s waste license and biological monitoring, through kick samples, was conducted.

Kick Sample Locations

Six kick sample locations were sampled in 2012 to obtain the EPA Q-value score as outlined in Table 2 below. The sampling stations are presented in Figure 5.

Table 2: Freshwater monitoring locations

Location Code	Water course name	Comment	GPS location	Habitat Type
S1	St. John's River	Control	S59914 08800	Riffle
S3/4	St. John's River	Downstream of pNHA and upstream of confluence with Lisduggan Stream	S60225 10894	Depositing
L1	Lisduggan Stream	Upstream of the landfill	S59455 10592	Riffle
L2	Lisduggan Stream	Along the northern boundary of the landfill	S59841 10502	Depositing
L6	Lisduggan Stream	Upstream of landfill site at IDA site close to WIT	S58611 10875	Eroding/Riffle
D1	Landfill Drainage Ditch	Located at north eastern boundary of landfill	S60047 10351	Depositing

Kick Sample Methodology

The kick sampling methodology follows that used by the EPA in its River Water Quality Q-value Monitoring programme (EPA 2006). It involves a two minute kick sample and one minute stone washing, of riffle habitats, at each sampling location. A 'D' shaped hand net (mesh size 0.5mm, 35cm diameter) is used to collect the samples. The net was placed in the water, with the open end of the net facing into the current. The sampler, standing upstream of the net, kicks the substrate (river bed). The dislodged macroinvertebrates float down current into the net. The stone washing involves placing large cobbles in the mouth of the net which are brushed/rubbed to dislodge any macroinvertebrates which may be clinging to the cobbles.

Once the sample has been collected it is carried in the net to the river bank and decanted into a tray for sorting. Specimens are collected and placed in a labelled plastic container with a 70% methylated spirits (IMS) preservative solution for off-site identification. Specimens were identified to as low a taxonomic level as possible using standard reference keys listed in Section 6.0.

EPA Q-Value

The EPA Q-value system is a biometric index. The water quality of a river or stream is determined primarily on the relative abundance of indicator groups of bottom dwelling (benthic) macroinvertebrates. The indicator groups have different sensitivities to organic pollutants (EPA 2006) and are presented in Table 3 below. Other parameters taken into account in determining the Q-value score include the channel substrate, macrophytes and the presence or absence of sewage fungus and filamentous algae. Physio-chemical parameters (pH, temperature, conductivity and dissolved oxygen) are also considered.

Table 3: Q-value taxa groups and pollution sensitivity

Group	Pollution Sensitivity	Example of taxa
Group A	Sensitive	Mayfly, stonefly
Group B	Less sensitive	Cased caddis fly
Group C	Tolerant	Beetles
Group D	Very tolerant	Snails
Group E	Most tolerant	Certain worm and fly species

The relative abundance of the indicator groups, in conjunction with the other recorded parameters, is used to determine the Q-value of a water course. The Q-value categories are presented in Table 4.

Table 4: The EPA Q-value categories

Biotic Index	Quality Status	Quality Class
Q5, Q4-5, Q4	Unpolluted	Class A
Q3-4	Slightly polluted	Class B
Q3, Q2-3	Moderately Polluted	Class C
Q2, Q1-2, Q1	Seriously Polluted	Class D

It's to be noted that an additional suffix of '0' or '*' can be assigned were excessive substrate siltation or contamination is present at the time of sampling.

Q-value Limitations

It should be noted that the EPA Q-value is designed to be sampled at riffle type habitats in the water course. This habitat is where the water levels are low and the water can be seen flowing/bubbling over the gravels and cobbles. The turbulent actions add oxygen into the water which is important for allowing the sensitive species to exist. Stretches of rivers that are deeper may be depositing stretches and may be less turbulent and as such have less dissolved oxygen for the sensitive species to exist. These depositing habitats are not considered suitable for applying the Q-value to obtain a Q-value score. The habitat type of each sampling location is presented in Table 2.

2.3.3 Salmonid Assessment

The 2004 and 2008 survey included a fish stock assessment of the St John River and Lisduggan Stream by means of electro-fishing of the watercourses. It was recommended in the 2008 report that electro fishing should not be conducted until there was a significant improvement in water quality and fisheries habitat. The overall water quality and fisheries habitat in the St. John River and Lisduggan Stream has not improved significantly between 2008 and 2012 and therefore there is unlikely to be a significant improvement in fish stock.

2.3.4 Otter Survey

The European Otter *Lutra lutra* is listed on Annex II and IV of the Habitats Directive and is thus afforded special conservational protection. Otters are secretive animals and survey methodology does not rely on seeing the animal to determine if they use an area. They can travel large distances (c.15-20km) and any sighting within several hundred metres downstream or upstream of the route would indicate their presence on a considerable length of that particular watercourse.

Otters leave their droppings (spraints) in prominent sites (e.g. bridges, boulders) within their range. These spraints are used to determine if otters are present within frequenting an area. Other evidence of otter activity includes holts, foot prints and slides.

The ‘standard otter survey’ (Lenton *et al.* 1980) method was used to assess the Kilbarry bog environs for the absence or presence of the mammal. The survey consisted of a search of bridges within the area at locations identified in Figure 6. Accessible banks of the water courses, within the study area, were surveyed. The pathway along the St John’s River was walked and banks of the river searched for otter signs. The River Couse was walked from the Outer Ring Road to where it meets the St. John’s River. Accessible sections of the Lisduggan Stream were walked along the northern section of the landfill. The survey was completed on 5th April 2012.

2.3.5 Avian Fauna Survey

The kingfisher *Alcedo atthis* is protected under the EC Bird Directive (79/409/EEC). It is listed on the Amber List of Birds of Conservation Concern in Ireland (2008 – 2013) (Lynas *et al.* 2007) indicating that it has ‘medium conservation concern’.

The survey consisted of walking along the banks of the water courses outlined above with observations for kingfishers being made. The survey was completed on foot by walking along the footpath beside the banks of the St John River between Outer Ring Road and the Superquinn Roundabout. The River Couse was walked from the Outer Ring Road to where the river meets the St. John’s River. The Lisduggan Stream banks were walked, where accessible, along the northern section of the landfill. The kingfisher survey was completed on 5th April and 2nd October 2012.

In addition, and as recommended in 2011, a survey to assess the breeding population status of the scarce reed warbler was conducted at Kilbarry Bog in 2012. Two early morning survey visits were made on 28th May 2012 and 2nd July 2012. The purpose of these visits was to establish whether reed warblers were using (breeding) the site, and if so to what extent. Both survey visits began about 7.30am and ended at about 2.30pm. In addition to recording reed warblers, a checklist of all species encountered was also kept, and numbers were recorded for scarcer species.

2.3.6 Invasive Species Survey

During the surveys all signs of invasive species encountered were recorded. Invasive species are non-native plants and animals which can “negatively impact on native species, can transform habitats and threaten whole ecosystems causing serious problems to the environment and the economy” (Invasive Species Ireland website (www.invasivespeciesireland.com)). Currently, Irish legislation contained in European Communities (Birds and Natural Habitats) Regulations (S.I. 477 of 2011) prohibits the introduction, dispersal, establishment or spread of an animal or plant that are considered non-native and/or invasive in Ireland. These invasive non/native species are listed under the 3rd Schedule of the Regulations.

Examples of invasive species recorded on the site are Japanese knotweed *Fallopia japonica* and Himalayan balsam *Impatiens glandulifera*. When these plants establish on a river or wetland habitat they can cause bank erosion, outcompete native species and, as such, could have a negative impact on the integrity of the pNHA. Other threats to the site are illegal dumping and infilling. Observations of any such activity were recorded during the site visits.

2.3.7 Seasonal Limitations

- The Quantitative habitat mapping was conducted in September. This is within the botanical growing season of April to September.
- The freshwater biological monitoring was carried out in September which is within the optimum period, which is generally considered to be between June to October, when flows are likely to be low and temperatures highest.
- Otters are active at all times of the year and there are no seasonal constraints on surveys, although winter months are preferred when vegetation has died back.
- Kingfisher is resident in Ireland and thus there is not a seasonal limitation to surveying for this species.
- The additional bird survey (with emphasis on reed warblers) was conducted in May and July. This is within the optimal period of April to July for migratory breeding birds.

3. Results

3.1 Habitat Assessment

3.1.1 Site Habitats

As part of the WYG 2008 survey a baseline habitat map of Kilbarry Bog was completed to Fossitt (2000) and in accordance with Draft Habitat Survey Guidelines (Heritage Council, 2005). The dominant habitat type within Kilbarry Bog is reed and large sedge swamps (FS1). Other habitats include depositing/lowland rivers (FW2) and drainage ditches (FW4) associated with the St John's and Couse Rivers. There is an area of Wet-willow-alder-ash woodland (WN6) located towards the southern end of the site as well as in the north west corner of the site adjacent to the landfill. Refer to Figure 3 for site habitat map.

3.1.2 Plant list

Consultation between WYG and Mr. Paul Green (Waterford vice-county BSBI recorder) regarding botanical records for Kilbarry Bog was conducted in 2009. Mr. Green kindly supplied a species list for the site which he has compiled between 1997 and 2007. A total of 237 plant species have been recorded on the site and are presented in Appendix C.

The NPWS Site Synopsis sheet (as presented in Appendix A) states that summer snowflake *Leucojum aestivum* was known to be on the site. The last reported sighting was 1979 by L. Farrell. Paul Green states that he has not been able to locate this plant and it is likely to have been located on the part of the bog on which the landfill was constructed.

Paul Green reported that he has not found any species rare in Ireland in Kilbarry Bog but three species which are rare on a county scale are present, namely Mare's-tail *Hippuris vulgaris*, greater bladderwort *Utricularia vulgaris* and pink water speedwell *Veronica catenata*. None of these species were recorded in the nine quadrats surveyed in 2012.

3.1.3 Quadrat Survey Results

All the quadrats were surveyed in the "Reed and Large Sedge swamp" habitat type, which was the dominant habitat on the site. The other significant habitat type is Wet-willow-alder-ash woodland which was not surveyed in the quadrat assessment but is addressed in Section 3.1.4.

Common reed *Phragmites australis* was the dominant species in seven of the nine quadrats and greater tussock-sedge *Carex paniculata* was the dominant species in two of the quadrats. A summary of the dominant vegetation type is presented in Table 5 and the completed quadrat field recording sheets are presented in Appendix B. Quadrat locations are presented in Figure 4.

Overall the species diversity was low in each quadrat, with the number of species identified ranging from two to eight. Low species diversity is not uncommon within this type of habitat (Fossitt 2000). Apart from common reed and greater tussock-sedge, other species present in at least one quadrat were water horsetail *Equisetum fluviatile*, meadowsweet *Filipendula ulmaria*, nettle *Urtica dioica*, bindweed *Convolvulus arvensis*, willowherb *Epilobium sp.*, common valerian *Valeriana officinalis*, reed canary-grass *Phalaris arundinacea*, erect bur-reed *Sparganium erectum*, and common duckweed *Lemna spp.*

New species such as water mint *Mentha aquatica* Marsh-bedstraw *Galium palustr.*, Fool's-water-

grass *Apium nodiflorum* and Gypsywort *Lycopus europaeus* were recorded in 2012.

Table 5: Vegetation Quadrat results 2012

Quadrat Code	Dominant Species	DOMIN value	Number of plant species in quadrat	Water Level above ground level
Q1	Common Reed	8	4	1 cm
Q2	Common Reed	7	5	0.5 cm
Q3	Common Reed	10	2	3 cm
Q4	Common Reed	10	5	0 cm (damp)
Q5	Common Reed	10	6	3.5 cm
Q6	Greater Tussock-sedge	8	4	0 cm (damp)
Q7-A	Common Reed	9	8	0.5 cm
Q8	Common Reed	10	4	0 cm (damp)
Q9	Greater Tussock-sedge	8	6	5 cm

Note: GPS locations presented in field recording sheets in Appendix B.

Vegetation

The dominant plant species has not changed in all nine quadrats between 2011 and 2012 as presented in Table 6. All dominant species especially the common reed have remained stable and unchanged since the summer of 2011. There was variation in DOMIN values of the main plant species (greater tussock-sedge) in quadrat Q7, with the total number of this species decreased from a value of 3 in 2011 to 1 in 2012. This quadrat is located in the reedbed east of the St. Johns River and adjacent to a residential estate as presented in Figure 4.

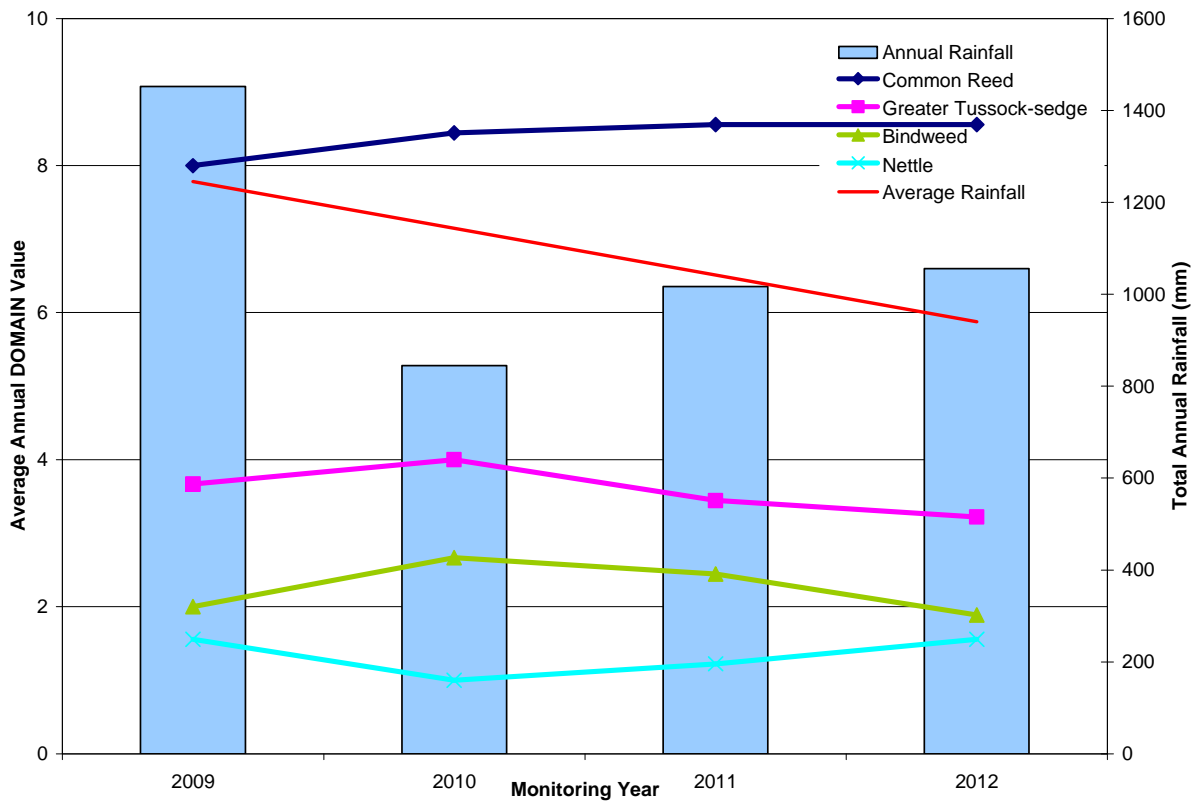
Understory species such as bindweed and nettle which occur frequently across the bog can often be indicators of drying out and/or eutrophication. The abundance of bindweed species has decreased across the site in 2012 when compared to previous years. Overall, there was an increase in the abundance of nettles identified in four of the baseline quadrats (Q6 – Q9) and in the remaining quadrats (Q1 – Q5), DOMIN values decreased slightly during 2012 (see Graphs 2 and 3).

A comparison of the annual average DOMIN values between four widespread species; common reed, greater tussock-sedge, bindweed and nettle are presented in Graph 1 (Q1 – Q9), 2 (Q1 – Q5) and 3 (Q6 – Q9) below. Annual rainfall for the monitoring period was obtained from Met Eireann (www.met.ie) for the nearest rainfall gauging station to the site at Johnstown Castle near Wexford (approximately 43 km east of Kilbarry Bog). It is to be noted that rainfall recorded at Johnstown Castle are only indicative of the hydrological changes occurring at the bog.

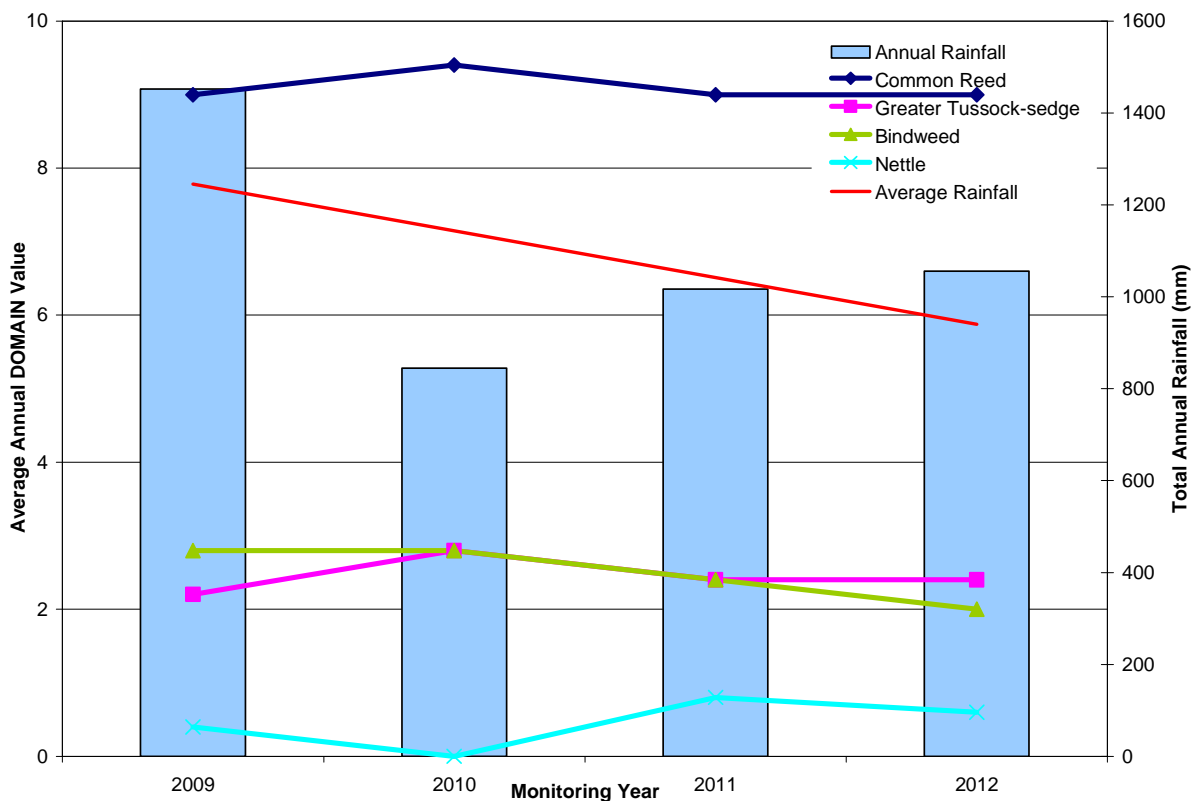
In general, the abundance of the common reed, greater tussock-sedge, bindweed and nettle have remained stable at Kilbarry Bog since 2009. The slight changes apparent in all species ($<1 \pm$ DOMIN value) are likely to be in response to natural fluctuation in seasonal rainfall, as presented in Graph 1. An increasing trend in common reed abundance (6.8 – 8.0) and proportionally decreasing trend in greater tussock-sedge abundance (5.5 – 4.3) averaging between four of the baseline quadrats Q6 – Q 9 as shown in Graph 3 are considered to be in response to the overall declining trend in annual rainfall from 2009 – 2012. However, trends in both common reed and

greater tussock-sedge in quadrats Q1 – Q5 (Graph 2) remain stable. This may suggest hydrological conditions have a greater impact the vegetative composition in the eastern part of the bog.

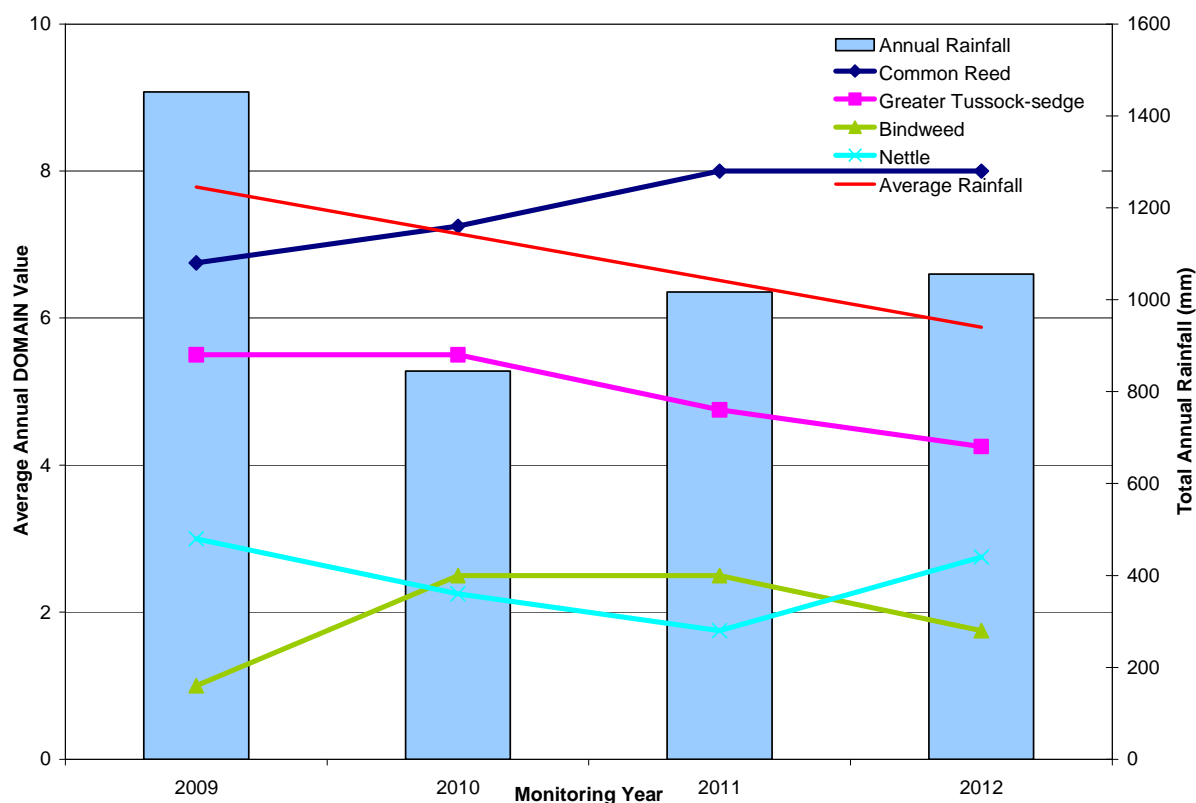
Graph 1: Changes in Vegetation Composition (Q1 – Q9) vs. Time.



Graph 2: Changes in Vegetation Composition (Q1 – Q5) vs. Time.



Graph 3: Changes in Vegetation Composition (Q6 – Q9) vs. Time.



There was an increase in the number of species in four (Q4, Q5, Q7-A, and Q9) of the quadrats and in one (Q6) quadrats, total species number decreased during 2012. There was no change in the number of plant species in the remaining three (Q1, Q2, Q3 and Q8) quadrats in 2012.

The plants which varied generally made up a small percentage of the quadrat (<5%). Overall there was no significant change in the general vegetation type or structure of any of the quadrats between 2009 and 2012.

Table 6: Changes in vegetation between 2009 and 2012

Quadrat Code	Dominant Species	DOMIN value				Number of plant species in quadrat			
		2009	2010	2011	2012	2009	2010	2011	2012
Q1	Common Reed	10	10	8	8	4	5	4	4
Q2	Common Reed	5	7	7	7	4	5	5	5
Q3	Common Reed	10	10	10	10	2	3	2	2
Q4	Common Reed	10	10	10	10	4	3	4	5
Q5	Common Reed	10	10	10	10	4	3	4	6
Q6	Greater Tussock-sedge	9	9	8	8	4	6	5	4

Q7-A	Common Reed	n/a	9	9	9	n/a	7	7	8
Q8	Common Reed	7	9	10	10	5	4	4	4
Q9	Greater Tussock-sedge	9	9	8	8	4	6	5	6

Note – There was no change in the dominant plant species in all nine quadrats surveyed in 2012.

Water level

The water levels in 2012 have decreased in six of the quadrats since 2009 as presented in Table 7. There has been a significant difference in the amount of precipitation between 2009 and 2012, with the annual rainfall following an overall decreasing trend, as shown in Graph 1.

Table 7: Changes in observed water level between 2009 and 2012

Quadrat Code	Water Level above ground level (cm)			
	2009	2010	2011	2012
Q1	11	0 (damp)	1	1
Q2	2	2	1	0.5
Q3	10	5	3	3
Q4	22	5	3	0 (damp)
Q5	20	10	8	3.5
Q6	2	0 (damp)	0 (damp)	0 (damp)
Q7-A	n/a	0 (damp)	1	0.5
Q8	0 (damp)	0 (damp)	0 (damp)	0 (damp)
Q9	2 to 3	2	1	5

3.1.4 Willow Woodland Habitat Assessment

The Ordinance Survey Ireland (OSI) website provides aerial photographs of Ireland from 1995, 2000 and 2005. A review of the aerial photographs of the site from these years indicates that the extent of the Wet-willow-alder-ash woodland habitat has not altered significantly between 1995 and 2005. There has not been a significant increase in the extent of the trees on site. This indicates that the balance between the willow woodland and the surrounding reed habitats has not altered significantly in recent years. Due to copy right it has not been possible to reproduce the aerial photographs in this report. They are available for review on www.osi.ie.

3.2 Water Quality and Salmonid Assessment

3.2.1 Biological Monitoring

The Q-value score for 2012, along with previous years is presented in Table 8 and Graph 4 below. The full taxa list for each kick sample is presented in Table 9 and the physio-chemical measurements and sampling location characteristics are presented in Table 10, which are presented at the end of the report.

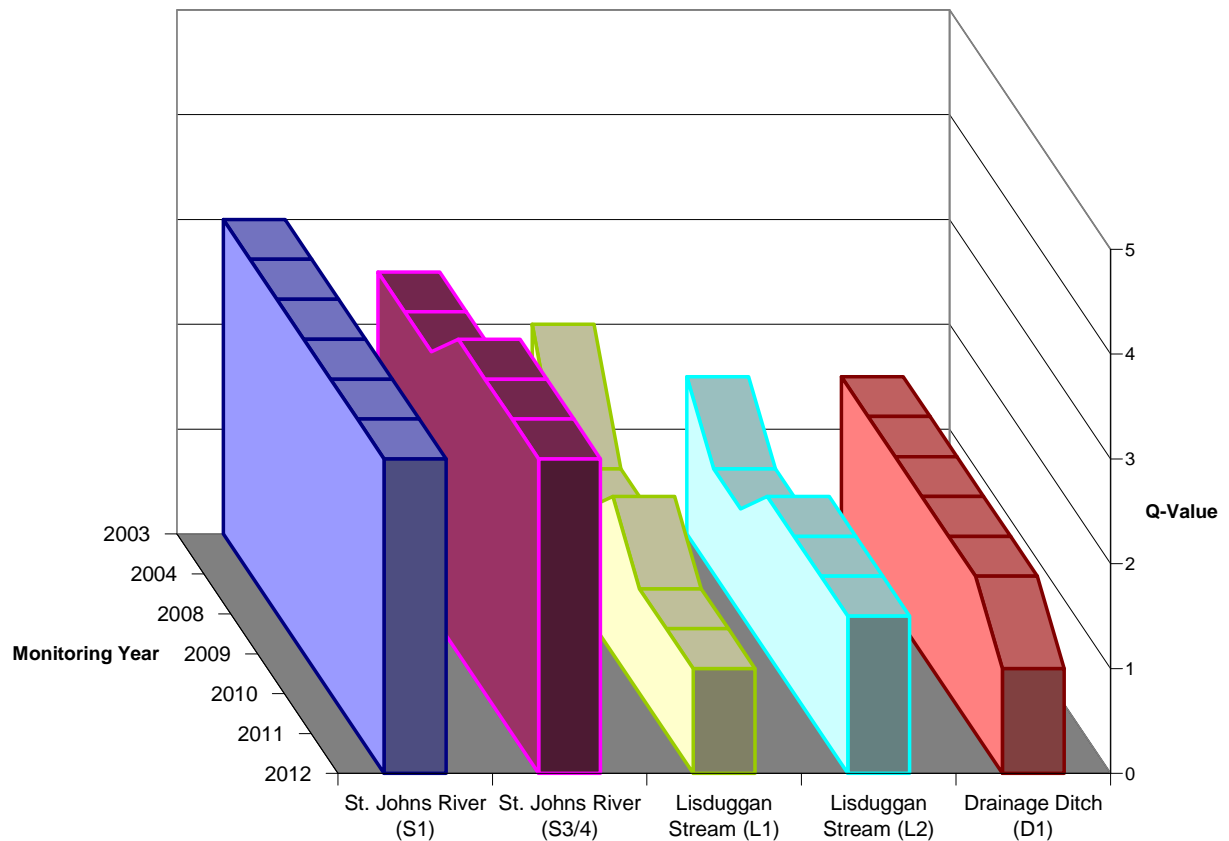
The results for St John’s River indicate that the river continues to suffer from moderate pollution with a Q3 rating recorded in the two monitoring locations (S1 and S3/4) during 2012. The sampling location S3/4 is located downstream of the landfill and showed a modest improvement from Q2-3 in 2008 to Q3 in 2009. Location S1, situated upstream of the landfill, continues to have a score of Q3.

Table 8: Biological monitoring results from 2003 to 2012

Location Code	Watercourse	2003	2004	2008	2009	2010	2011	2012
S1	St John’s River	Q3	Q3	Q3	Q3	Q3	Q3	Q3
S3/4	St John’s River	Q2-3	Q2-3	Q2-3	Q3	Q3	Q3	Q3
L1	Lisduggan Stream	Q2/0	Q1/0	Q1	Q1-2	Q1	Q1	Q1*
L2	Lisduggan Stream	Q1-2	Q1	Q1	Q1-2	Q1-2	Q1-2	Q1-2
L6	Lisduggan Stream	-	-	-	Q1	-	-	Q1-2
D1	Drainage Ditch	Q1-2	Q1-2	Q1-2	Q1-2	Q1-2	Q1-2	Q1*

*indicates evidence of contamination; - not sampled

Graph 4: Temporal trend graph of Q-values recorded since 2003 (L6 not included).



The Lisduggan Stream remains seriously polluted with a score of Q1 recorded immediately upstream of the landfill (L1). Water quality at L1 continues to deteriorate since 2009 when a Q-value of Q1-2 was recorded. Along the landfill's northern boundary (L2) the Q-value is Q1-2 which is similar to previous years. The drainage ditch along the northwest boundary of the landfill is also seriously polluted and has deteriorated from Q1-2 in 2011 to Q1 in 2012. In 2012 a kick sample was obtained from a location on the Lisduggan Stream approximately 500m upstream of the landfill at the IDA Business Park (L6). A score of Q1-2 in 2012 has marked a modest improvement in water quality at this location from Q1 recorded in 2009.

Field Observations

Physico-chemical parameters (pH, temperature, conductivity and dissolved oxygen) were measured in the field and are presented in Table 10.

Water in the St. Johns River appears to deteriorate in quality when moving from S1 (at Sheep's Bridge) to S3/4 (Superquinn roundabout bridge) downstream. Dissolved oxygen measurements ranged between 65.6% (S3/4) to 90.9% (S1). Conductivity measurements ranged from 370 $\mu\text{S}/\text{cm}$ (S1) to 401 $\mu\text{S}/\text{cm}$ (S3/4). The pH ranged from 7.2 to 7.4 while temperature ranged from 12.1 to 12.2 °C.

Dissolved oxygen measurements along the Lisduggan Stream decreased in values from 95.8% at L6 to 70.7% at L2. Conductivity values follow a similar trend of deterioration with values ranging from 350 $\mu\text{S}/\text{cm}$ (L6) to 420 $\mu\text{S}/\text{cm}$ (D1) as measurements are taken at locations progressing downstream. The pH ranges from 7.76 to 7.20 while temperature ranged from 12.7 to 13.1 °C.

During the otter survey in April 2012, gross hydrocarbon contamination of the water surface and banks of the Lisduggan Stream was observed. The contamination appeared to be emanating from an unknown source immediately upstream of Bleach Bridge and continued to where the stream disappears from the field of view when standing on the road bridge of the R709 (adjacent to Superquinn Shopping Centre). The drainage ditch which runs along the landfills north east boundary was also heavily contaminated.

Grey silty water was noted at sampling locations L2 and D1 in October 2012. Slight siltation of the water column was due of temporary construction works on Bleach Bridge upstream of these locations.

3.2.2 Salmonid Assessment

The 2008 fish stock assessment reported that the St John River upstream of the site had the highest numbers of brown trout *Salmo trutta* (16), eel *Anguilla anguilla* (9) and brook lamprey *Lampetra planeri* (3) in relation to the other sampling locations. Three-spined stickleback *Gasterosteus aculeatus* was also present. The section of the St John River surveyed downstream of Kilbarry Bog had the same species but in lower densities. The Lisduggan stream had no trout, only one eel and no lampreys. Salmon *Salmo salar* was not recorded in any sampling location on either the St John River or Lisduggan Stream.

In 2010, a brook lamprey was collected in the kick sampling net at S3/4 and stickleback collected at the S3/4, Lisduggan L2 and Drainage Ditch D1. No such species were recorded during kick sampling in 2012.

As there has been no improvement in water quality since 2008 it is unlikely that there has been a significant improvement in salmonid populations in these water courses.

3.3 Otter Assessment

The 2012 otter survey results are presented in Table 11 along with results of previous surveys conducted in 2003, 2004, 2008, 2009, 2010 and 2011. Refer to Figure 6 for otter survey map.

Table 11: Otter monitoring results 2003 to 2012

Location Watercourse (Grid Ref.)	Oct 2003	Sept 2004	July 2008	Sept 2009	Sept 2010	April 2011	April 2012
Tramore Road. <i>St. Johns River</i> (S59666 07988)	Otter spraint	*	*	*	*	*	*
Sheep's Bridge. <i>St. Johns River</i> (S59906 08789)	Otter spraint & mink scats	Otter spraint	*	Otter spraint	Otter spraint	Otter spraint	Otter spraint
Couse Bridge. <i>Couse River</i> (S60234 10902)	Otter smear	Otter spraint	*	*	*	Otter spraint ¹	Otter spraint ¹
Foot Bridge at leisure Centre. <i>St. Johns River</i> (S60062 10666)	-	-	*	Otter spraint	Otter spraint	*	*
Superquinn Bridge. <i>St. Johns River</i> (S60123 10967)	-	-	-	*	*	*	*
Drainage Ditch <i>Lisduggan Stream</i> (S59788 10547)	-	-	-	Mink scats	*	*	Otter spraint
Bleach Bridge <i>Lisduggan Stream</i> (S60125 10850)	Otter spraint	*	*	*	*	Mink Footpri nts	*

*indicates no otter signs encountered; - not surveyed

Note 1 –Spraint located at Waterford Outer Ring Road culvert upstream of Couse Bridge (see Figure 6).

The 2012 survey encountered otter spraint at one location along the St John River – Sheep's Bridge. Otter spraints were also recorded at this location in 2003, 2004, 2009, 2010 and 2011.

The Superquinn roundabout bridge is located at a busy junction with high banks and may not be a favourable location for otters to spraint. No spraints were recorded here in survey completed between 2009 and 2012.

There were otter spraints identified on the Lisduggan Stream in 2012; beneath a bridge and upstream of the confluence point between the stream and drainage ditch. Otter spraints were last detected at Bleach Bridge in 2003. The water quality of Lisduggan Stream is very poor and does not contain significant fish stocks. Therefore otters may only use the stream intermittently. Mink footprints were identified on the Lisduggan Stream approximately 250 meters upstream of the

R709 road bridge in during the survey in April 2012.

Otter spraints were recorded on the Couse River upstream of the Waterford Outer Ring Road culvert during the 2012 survey, at the similar location identified in 2011. The spraint remains were observed on a typical otter sprainting site known as a ‘seat’ comprising of a large flat stone at the rivers bank. Access routes have been constructed during the road works to allow the mammal’s safe passage under the road to other areas of their habitat. No evidence of spraint were recorded at the Couse Bridge in 2012. Table 11 shows evidence of previous otter activity on the Couse River in 2003 and 2004. No otter holts were located during the survey.

3.4 Kingfisher and Additional Bird Survey

No kingfishers were observed within the Kilbarry Bog, along the St John’s River or along the Lisduggan Stream or Couse River by the authors in April or September 2012. This is a similar finding to the 2004, 2008, 2009, 2010 and 2011 surveys. The 2003 survey identified a kingfisher at the drainage ditch to the east of the landfill. A buzzard *Buteo buteo* was seen soaring overhead in the southern section (adjacent to Q8) of the bog during the vegetation survey in September 2012.

In 2012, an additional bird survey was completed by Mr. Patrick Smiddy to assess the current population status of the reed warbler at Kilbarry Bog. The bird breeds on the site during the summer months. The Birds of Conservation Concern in Ireland (www.BirdWatchIreland.ie) has placed the reed warbler on its amber list (medium conservational concern) indicating that the breeding population of this species has declined nationally by 20 - 50 % in the past 25 years. Five pairs were recorded in 1999 (NPWS Site Synopsis Sheet). All other bird species encountered during the survey were also recorded.

Only one reed warbler was identified during the surveys completed in May and July 2012. This bird was recorded at the north western section of the Bog in exactly the same location in May and July. This particular bird was located by its distinctive song (guttural churring phrases), the normal way in which this species is initially located. It’s possible that this was an unmated male which remained on his territory throughout the summer or a male of a breeding pair, but where the female went undetected. Another observer (Mr. Paul Walsh) also heard a reed warbler singing at Kilbarry Bog in 2012, although at a different location within the bog. The observation was made in early May and its likely that on this date the bird had just arrived and may not have settled into its territory. An adult and juvenile were observed in the north western section (adjacent to Q3) of the bog during the vegetation survey in July 2011. The field characteristics of the reed warbler and distinctive call from the adult confirmed its identification.

A total of 34 other bird species were recorded over two visits in late May and early July and results are presented in Table 12. Of these, 15 species were proved to breed, while a further ten were considered likely to be breeding, but for which absolute proof was lacking. The reed warbler is considered a possible breeder on the evidence obtained. The remaining eight species are considered either non-breeders or unlikely to breed, although several (collared dove *Streptopelia decaocto*, jackdaw *Corvus monedula*, starling *Sturnus vulgaris*, house sparrow *Passer domesticus*) are very likely to be breeding nearby, but off the site.

Table 12: Bird monitoring results 2012

Species	28 May 2012	02 July 2012	Breeding Status	Birds of Conservation Concern In Ireland (2009)	Remarks
Mallard	1	-	Very likely		Flying over
Sparrowhawk	1	1	Very likely		A male
Water Rail	2	1	Very likely	Amber List	Calling at 2 sites
Woodpigeon	√	√	Yes		Occupied nest
Collared Dove	1	-	Unlikely		Calling off site
Common Swift	3	1	No	Amber List	Flying over
Barn Swallow	√	√	No	Amber List	Flying over
Wren	√	√	Yes		Fledged young
Dunnock	√	√	Yes		Fledged young
Blackcap	5	2	Very likely		Males in song
Whitethroat	3	1	Very likely		Males in song
Sedge Warbler	√	√	Yes		Food carrying
Reed Warbler	1	1	Possible	Amber List	Male in song
Chiffchaff	√	√	Yes		Fledged young
Willow Warbler	√	√	Yes		Fledged young
Goldcrest	√	-	Very likely		In song
Spotted Flycatcher	-	1	Yes	Amber List	Fledged young
Blackbird	√	√	Yes		Fledged young
Song Thrush	√	√	Yes		Food carrying
Robin	√	√	Yes		Fledged young
Great Tit	√	√	Yes		Fledged young
Blue Tit	√	√	Yes		Fledged young
Starling	√	-	No	Amber List	Flying over
Magpie	√	√	Yes		Fledged young
Rook	√	-	No		Flying over
Hooded Crow	√	√	Very likely		Several seen
Jackdaw	√	-	No		Flying over
House Sparrow	2	-	No	Amber List	In reeds
Chaffinch	√	√	Yes		Fledged young
Greenfinch	√	1	Very likely		One site
Goldfinch	√	√	Very likely		In song
Lesser Redpoll	-	2	Very likely		In song
Bullfinch	1	-	No		A male
Reed Bunting	√	√	Yes		Food carrying

√ indicates numerous individuals observed; - not detected.

3.5 Invasive Species and Threats to the Conservation of Kilbarry Bog

The main invasive species noted in the study area is Japanese knotweed which is well established at several locations across the site. Himalayan balsam was recorded at one location along the northern boundary of the landfill, outside of the Kilbarry Bog pNHA boundary. Refer to Table 12 for grid reference location of invasive species/treats to the site and Figure 7 for visual representation of their locations.

Infilling and illegal dumping are a threat to the site. A review of aerial photographs indicates that a significant area of the site (>1ha) was in-filled with hardcore material between 1995 and 2000. This has resulted in the loss of reed and tall sedge habitat. There is illegal dumping of builder's waste and other household material into the bog along the north east corner of the site close to the adjacent housing estate. Whilst at present this activity is minor, if it is allowed to continue it could become more substantial. In April 2012, illegal dumping of domestic refuse was recorded at the Lacken Road Bridge surveyed for otter activity.

Table 13: Invasive species and other threats to Kilbarry Bog

Threat	Grid Ref
Japanese knotweed	S 60125 09722
Japanese knotweed	S 60125 09832
Japanese knotweed	S 60126 09867
Japanese knotweed	S 60134 10087
Japanese knotweed	S 60121 10217
Himalayan Balsam	S 59782 10557
Builders Waste Material	S 60190 09676
In-filling	S 59973 09682
Domestic refuse	S 59666 07988

4. Discussion and Conclusion

There was no obvious change in habitat structure or composition between 2009 and 2012. As presented in the 2008 report, habitat monitoring by means of habitat mapping did not provide adequate detail or resolution to allow for long term monitoring of Kilbarry Bog. Therefore a semi-quantitative monitoring method, in the form of permanent quadrats, was recommended and commenced in 2009. Nine quadrats were installed and surveyed across the pNHA.

In 2010 eight of the nine quadrats were re-surveyed. One of the quadrats, Q7, could not be located and a replacement quadrat Q7-A was installed and surveyed. All nine quadrats were surveyed in 2012.

Overall there seems to be a slight increase in the abundance of common reed, where they had dominated in previous surveys and a decrease in the abundance of greater tussock-sedge (Q7) from 2009 to 2012 (as presented in Graph 1). The increase in abundance of common reed may be due to environmental changes such as the decreasing water levels observed in the bog between 2009 and 2012. This conclusion is also confirmed by a decreasing trend in annual rainfall as recorded at Johnstown Castle between these years. The common reed is likely to out-compete the greater tussock-sedge in dryer conditions as its deep roots can access groundwater from further beneath the soil surface. The abundance of bindweed has decreased slightly, while the abundance of nettle has increased.

A comparison between 2009 and 2012 quadrat survey results indicate that there has been no significant change in the vegetative composition in the quadrats. Minor fluctuations in species abundance are likely to be in response to varied rainfall over the past four years and exhibit a pulsing state of equilibrium expected in an established wetland ecosystem. The dominant plant species in each quadrat surveyed in 2012 did not change since 2011. Continued quadrat monitoring over the next few years together with an accurate hydrological assessment will allow for a more robust and definitive picture to emerge of the vegetative changes that are occurring in Kilbarry Bog.

4.1 Water Quality and Fisheries Assessment

The biological monitoring of the St John River, which was surveyed upstream and downstream of Kilbarry landfill, indicated that the river has moderate pollution (Q-value rating of Q3). This is similar to the water quality status of previous monitoring rounds in 2003, 2004 and 2008 – 2011. The land use upstream of the site is predominantly agricultural. Organic pollution from farming activity, e.g. land spreading of farm waste material, may be the main cause of the moderate pollution in the water course. Physico-chemical parameters recorded in September 2012 are considered typical for Irish surface waters.

The Lisduggan Stream is seriously polluted upstream of the landfill (Q1 at Bleach Bridge and Q1-2 at IDA Business Park) and remains polluted downstream of the landfill. The EPA conducts analysis of water samples from the Lisduggan Stream and ditches associated with the landfill which indicate that certain parameters in these waters exceed some of the relative comparative standards. Thus, the landfill may be attributing to a certain extent to the poor water quality of the Lisduggan Stream along the landfill boundary but based on the biological monitoring the main cause of the serious pollution in the stream is from a source(s) originating upstream of the site.

One of the overall objectives in of the EU Water Framework Directive (2000/60/EC) is to have all water bodies achieve a ‘good’ status by 2015. In 2010, the Suir Estuary Water Management Plan (WMP) classified the sub basin in which the Lisduggan Stream flows (Kilbarry, Tributary of Suir) as being of moderate ecological status. The Suir Estuary WMP’s target for this sub basin is to achieve a ‘good’ ecological status by 2021. It is understood that remediation of the stream is now underway by Waterford City Council and catchment pressures along the Lisduggan Stream have been identified. It was noted in April 2012 that a serious contamination incident had occurred immediately upstream of Bleach Bridge. This incident will cause even further deterioration to the Lisduggan Stream’s freshwater habitat.

Salmonid stocks in the St John River within and downstream of the Kilbarry Bog are poor according to the 2004 and 2008 electro fishing survey. No salmon were recorded upstream or downstream of the landfill, indicating that the moderate pollution of the river has negatively impacted on the salmonid fish population within the study area. Downstream of the pNHA there were low numbers of 3+ aged trout and no juveniles recorded. Upstream of the pNHA however there was relatively high number of trout, including juveniles, recorded.

The river originally meandered through the Kilbarry Bog. However it was channelised as part of the construction of a railway line in the nineteenth Century. Such changes to a river’s morphology tend to have a significant impact on the salmonid quality of a river. The bottom of the channel becomes covered with silt and mud and there are less riffle habitats. This reduces the spawning and nursery potential for salmonid as they need silt free gravels in riffle habitats. The silting of the substrate also reduces the levels of macroinvertebrates on which salmonids can feed. The 2008 electro fishing survey indicated that the slow moving, deep water, channelised sections of the St John, within the pNHA boundary, can support older trout but not juveniles. Overall, a combination of moderate pollution and the morphological constraints of the river channel are negatively impacting on salmonid stocks in the Kilbarry Bog within the pNHA boundary.

Salmonid species are absent from the sections of the Lisduggan Streams within or adjacent to the landfill. The Lisduggan Stream is seriously polluted which is considered the main cause of negative impact on the salmonid stocks. The stream has also been channelised along the northern section of the landfill which would reduce the value to spawning salmonids.

An improvement of water quality in the St John River and Lisduggan Streams, to unpolluted status, may increase trout numbers and lead to a return of salmonid species to the river. However, channelised sections of the water courses will not provide salmonid spawning grounds. Inclusion of gravels and boulders in the channel improve the channel as a spawning/nursery habitat.

4.2 Otters

The otter survey indicates that the mammals are frequenting the St John River and are returning to one of the same locations in 2012 as they did in previous years. A sprainting site which was located during the 2011 survey upstream of the Couse River Bridge has shown continuing evidence of otter activity in 2012. Otters have extensive ranges, with territory size varying from c. 3km of river to as much as 30km or more (mean of c. 15-20km). As otters can travel large distances, the evidence observed along the St John River and Couse River within several hundred metres downstream or upstream of the route, indicates their presence on the entire length of that watercourse.

Otter spraints were identified beneath a bridge and upstream of the confluence point between the Lisduggan Stream and Kilbarry Landfill drainage ditch. Evidence of otter activity was last identified on the Lisduggan Stream at Bleach Bridge in 2003 and indicates a positive sign of potential habitat improvement. However, the contamination incident identified in April 2012 is likely to deter otters from using the water course in the immediate future.

4.3 Bird Survey's

In 2012, two separate bird surveys were completed at Kilbarry Bog. The first survey which has been conducted each year since 2009 was to assess the population or presence of kingfishers. The second survey carried out by Mr. Patrick Smiddy was to assess the current population status of the reed warbler at the bog.

No kingfishers were observed along the St John's River, Lisduggan Stream or Couse River in April or September 2012. These findings are in line with previous years monitoring. Within the pNHA boundary the St. John's River is slow moving, lacking tall vertical banks with soft material suitable for nesting and contains few suitable perches for fishing. In addition the dense and overgrown river bank vegetation, combined with the poor water quality recorded, would further indicate the unsuitability of the habitat to support kingfishers. The river channel or water quality has not changed significantly since the 2009 survey so the status of the site for kingfishers has not improved.

During the vegetation survey in September, a buzzard was seen soaring overhead in the southern section (adjacent to Q8) of the bog. In recent years, this bird of prey has increased its range into the southern counties of Ireland from their stronghold populations in Northern Ireland. Buzzards can now be seen with regularity in counties Cork and Waterford.

In Ireland, the reed warbler was unknown, even as a migrant, until 3 November 1907 when one was obtained at the Codling Bank lightship (Wicklow). Between 1950 and 1978 all records of reed warblers, except two in County Down, came from Counties Cork and Wexford, 68% from Clear Island and 22% from Great Saltee Island with only 10% from other sites within these counties. Breeding took place in Antrim in 1980, and soon after in several other counties.

By 1996 breeding population had increased and spread further south occurred at 13 sites within six different counties, but was regular only in Cork, Wexford and Wicklow. The largest breeding population was then at Ballyvergan Marsh (near Youghal, Co. Cork), with 25 to 50 pairs. The total Irish population was estimated in 1995/96 at between 55 and 97 pairs. As in the earlier period, most migrants occurred in Cork and Wexford, with 50% at Clear Island and 16% at Great Saltee Island (Smiddy & O'Mahony 1997). The major river valleys now have breeding populations, especially those of the River Slaney, Suir and Blackwater. Many lake and marsh habitats where extensive reedbeds occur also have breeding populations.

Surveys at Kilbarry Bog during the summer of 2012 revealed only a single singing reed warbler. This bird was seen during both surveys and was recorded at the north western section of the Bog in exactly the same location in May and July. An adult and juvenile were observed in the same area of the bog during the vegetation survey in July 2011. Results from 2011 and 2012 would suggest that there is least one breeding pair present at Kilbarry Bog, however five pairs of reed warbler were recorded in 1999 (NPWS Site Synopsis Sheet). This would indicate a decline in the number of reed warblers at Kilbarry Bog. This scarce bird species relies on the reed and large sedge swamp habitat for breeding purposes. Continued monitoring of this bird's population in future monitoring rounds will allow for a more accurate assessment of its status at the bog.

A total of 34 other bird species were recorded in May and July 2012. Of these, 15 species were proved to breed, while a further ten were considered likely to be breeding, but for which absolute proof was lacking. Five of these species are amber-listed on the Bird of Conservation Concern in Ireland (BoCCI).

4.4 Invasive Species

Japanese knotweed was recorded on a number of locations along the footpath and adjacent to the road within the site boundary. If left unchecked the Japanese Knotweed could have a significant impact on the integrity of the pNHA. It could cause bank stability issues along the St John River and may encroach on habitats within the site.

Himalayan balsam was not noted within the pNHA boundary but was noted along the Lisduggan Stream. This plant can spread rapidly along water courses. However, at present the current location of the plant is unlikely to impact on the pNHA as the Lisduggan stream joins the St John River downstream of the site. However, its seeds could be transported by animals brushing the plants.

Aerial photographs indicated that there was infilling of a section of the pNHA with hardcore material about 10 or 15 years ago. There is no evidence that such activity has occurred since then. This type of activity has an impact on the integrity of the pNHA by reducing the extent of natural habitat and possibly impacting on hydrology of the site. It could also lead to the introduction and further spread of invasive species such as Japanese knotweed.

5. Recommendations

Based on the current status of the site and results obtained between 2009 and 2012, the following recommendations are:

- The habitat assessment, in the form of quadrat monitoring, should be conducted again in 2013. It was previously recommended that due to insignificant variations in the quadrat composition that the semi-quantitative monitoring should be carried out every two to three years; however the increasing field data will allow for a more accurate and comprehensive assessment of the vegetative changes occurring in the bog over the next two years. Receipt of any hydrological studies carried out at Kilbarry Bog would also help future habitat assessments.
- Water sampling of the Lisduggan Stream upstream of kick sampling location L1 is recommended in 2013. This would help to accurately assess the chemical pressures affecting the benthic macroinvertebrate fauna. Although short term deterioration of the streams water quality as a result of contamination incidents (such that recorded in April 2012) are likely to occur, it is considered more likely that the long term effects of pollution upstream of L1 has had a greater impact on the streams health to date. Provided that remediation of the Lisduggan Stream is successful, water quality should improve gradually over time.
- The additional bird survey that was conducted in 2012 should be conducted again in 2014 for comparative purpose. Monitoring of the reed warbler during this survey will help to assess whether the current declining trend observed between 1999 and 2012 continues.
- Any future ecological monitoring of the site should record invasive species and other threats to the integrity of the pNHA.
- A Japanese Knotweed Management Plan (JKMP) should be prepared for Kilbarry Bog to minimise the threat of the species impacting on the site and to prevent further spread.
- A programme should be put in place to ensure that infilling and fly tipping on the site is prevented.
- The habitat assessment of the site has assessed the habitat and plant communities within the pNHA. However, the animal communities, with the exception of otters and kingfisher, have not been addressed. Macroinvertebrates, in the form of flies, snails, beetles etc, are a key part of the food web and can act as an indicator of the overall quality of an ecological system. To determine which macroinvertebrate community is most suited to be surveyed on an annual basis it may be necessary to survey several different macroinvertebrate communities the first year. It is therefore recommended that a macroinvertebrate survey of the site is conducted in future monitoring rounds. Hoverflies (syrphids) and molluscs should be surveyed across the site and within the standing water areas water beetles should be monitored. All macroinvertebrate surveys should be conducted within the appropriate survey period as per the NRA (2004) guidelines.

6. References and Bibliography

- Atkins (2008) *Kilbarry Bog Management Plan*, Report for Waterford City Council.
- Croft, P.S. (1986). A key to the major groups of invertebrates. *Field Studies* **6**, pp 531-579.
- Olsen L H, Sunesen J, Pedersen B V. (2001). *Small Freshwater Creatures*. Oxford University Press.
- Edington, J.M., Hildrew, A.G. (1995) *Caseless caddis of the British Isles (with notes on their ecology)*. Freshwater Biological Association, No. 53.
- Elliott, J.M., Mann, K.H. (1979). *A Key To The British Freshwater Leaches*. Freshwater Biological Association. Scientific Publication No 40.
- Elliott, J. M., U. H. Humpesch, & T.T. Macan (1988). *Larvae of the British Ephemeroptera a key with ecological notes*. *Freshwater Biological Association, Scientific Publication No. 49*.
- EPA (2006) *River Water Quality Report 2005. Annual report on biological quality of Irish rivers*. Environmental Protection Agency, Dublin.
- Fitter, R., Manuel, R. (1986) *Collins Field Guide to Freshwater Life*. Collins Sons and Co Ltd.
- Foss, P and Crushell, P (2008) *Guidelines for a National Fen Survey of Ireland Survey Manual*, Report for the National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Ireland.
- Heritage Council (2002). *Draft Habitat Survey Guidelines: A Standard Methodology for Habitats Survey and Mapping in Ireland*. Heritage Council, Kilkenny.
- Hynes, H.B.N., Macan., T.T., Williams, W.D. (1960). *Crustacea : Malacostraca (A Key To The British Species)*. Freshwater Biological Association. Scientific Publication No 19.
- JNCC (2006) *National Vegetation Classification: Users' handbook*. Joint Nature Conservation Committee, Peterborough, UK
- Lenton, E.J., Chanin, P.R.F. and Jefferies, D.J. 1980. *Otter Survey of England 1977-79*. Nature Conservancy Council, London.
- Lynas P, Newton SF and Robinson JA (2007). *The status of birds in Ireland: an analysis of conservation concern 2008 – 2013*. *Irish Birds* 8:149-167.
- Macan T.T. (1960) *A key to the British Fresh – and Brackish water Gastropods*. Freshwater Biological Association, No. 13.
- Macan, T.T. (1970). *A Key to The Nymphs of British Species of Ephemeroptera With Notes On Their Ecology*. Freshwater Biological Association. Scientific Publication No 20.
- National Roads Authority, (2004). *Guidelines for Assessment of Ecological Impacts of National*

Road Schemes. National Roads Authority, Dublin.

Rose, F. (1989) *Colour Identification Guide to the Grasses, Sedges, Rushes and Ferns of the British Isles and northwestern Europe*. Penguin Books Ltd., London

Smiddy, P. & O'Mahony, B. 1997. The status of the Reed Warbler *Acrocephalus scirpaceus* in Ireland. *Irish Birds* 6: 23-28.

Wallace, I.D., Wallace, B., Philipson, G.N. (1990). A key to the case bearing Caddis larvae of Britain and Ireland. Freshwater Biological Association, No. 51.

Webb, D.A., Parnell, J. and Doogue, D. 1996. *An Irish Flora* (6th ed.). Dundalgan Press, Dundalk.

Young (1972) *Report on Areas of Scientific Interest in County Waterford*. An Foras Forbartha, Dublin

Websites consulted

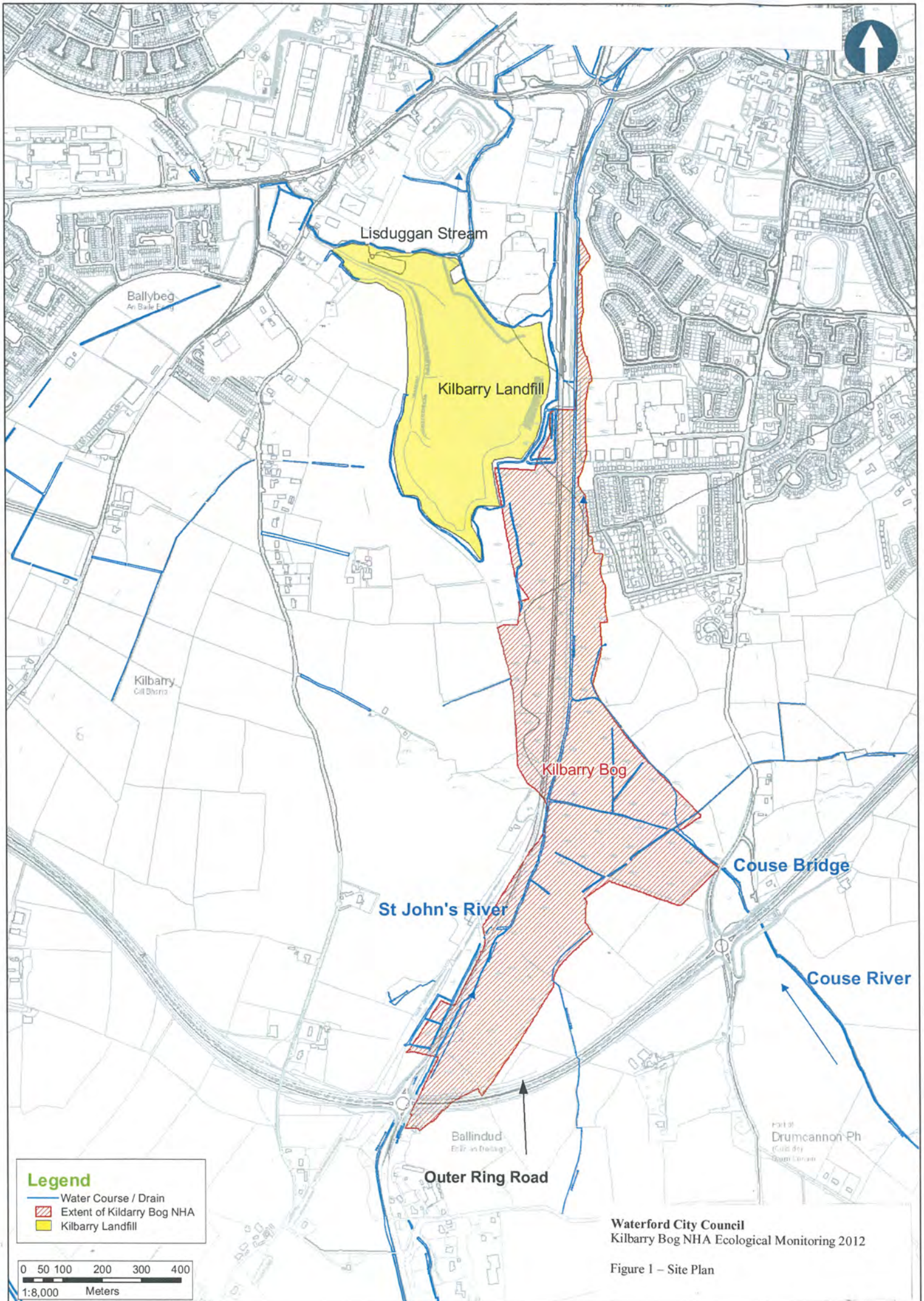
Environmental Protection Agency Ireland (EPA). EPA Data Website (www.epa.ie)

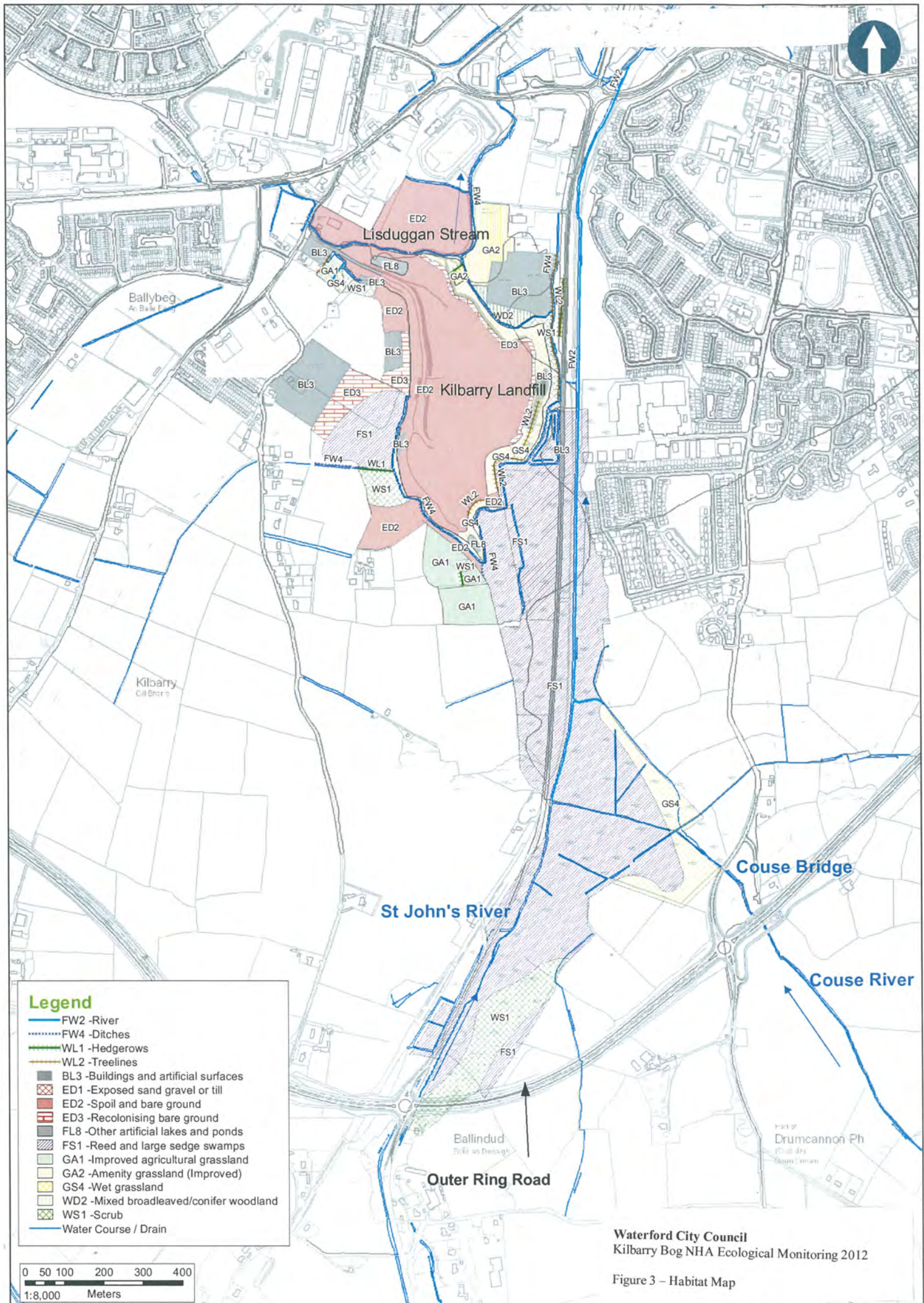
National Parks and Wildlife, the Heritage Service. Heritage Data Website (www.npws.ie)

National Biodiversity Data Centre. NBDC Website (www.biodiversityireland.ie)

Ordinance Survey of Ireland – (www.osi.ie)

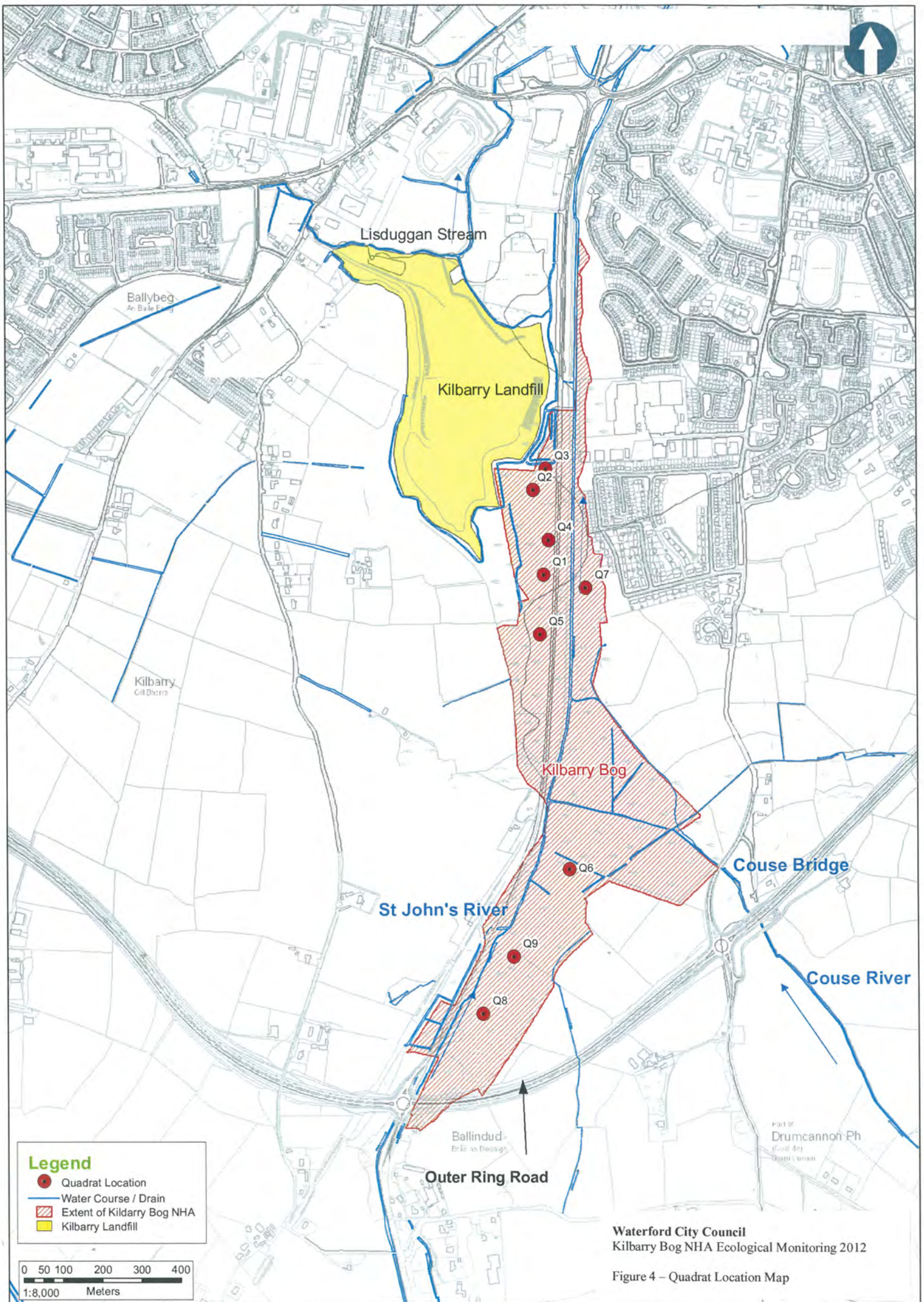
FIGURES





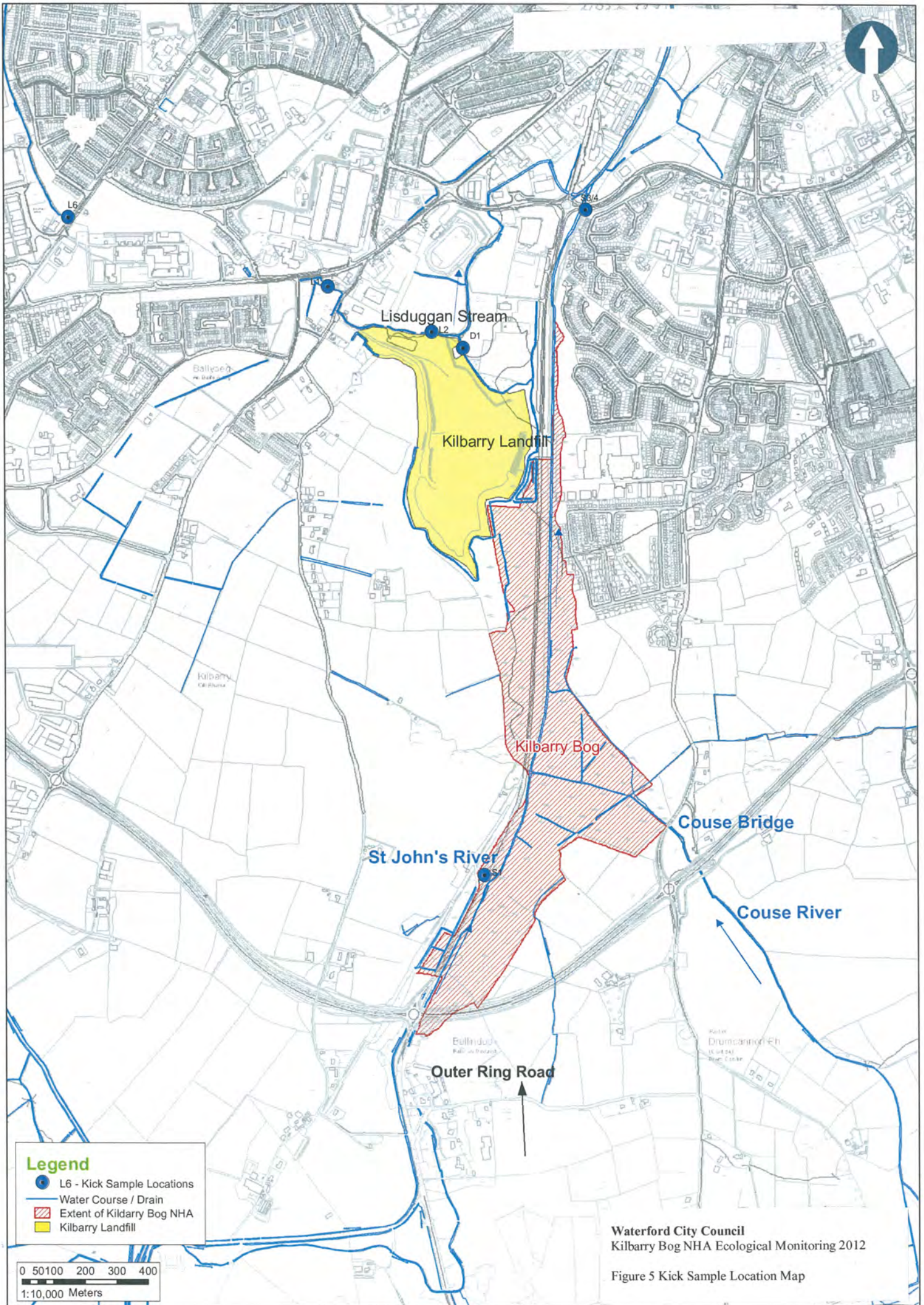
Waterford City Council
Kilbarry Bog NHA Ecological Monitoring 2012

Figure 3 – Habitat Map



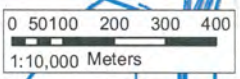
Waterford City Council
 Kilbarry Bog NHA Ecological Monitoring 2012

Figure 4 – Quadrat Location Map



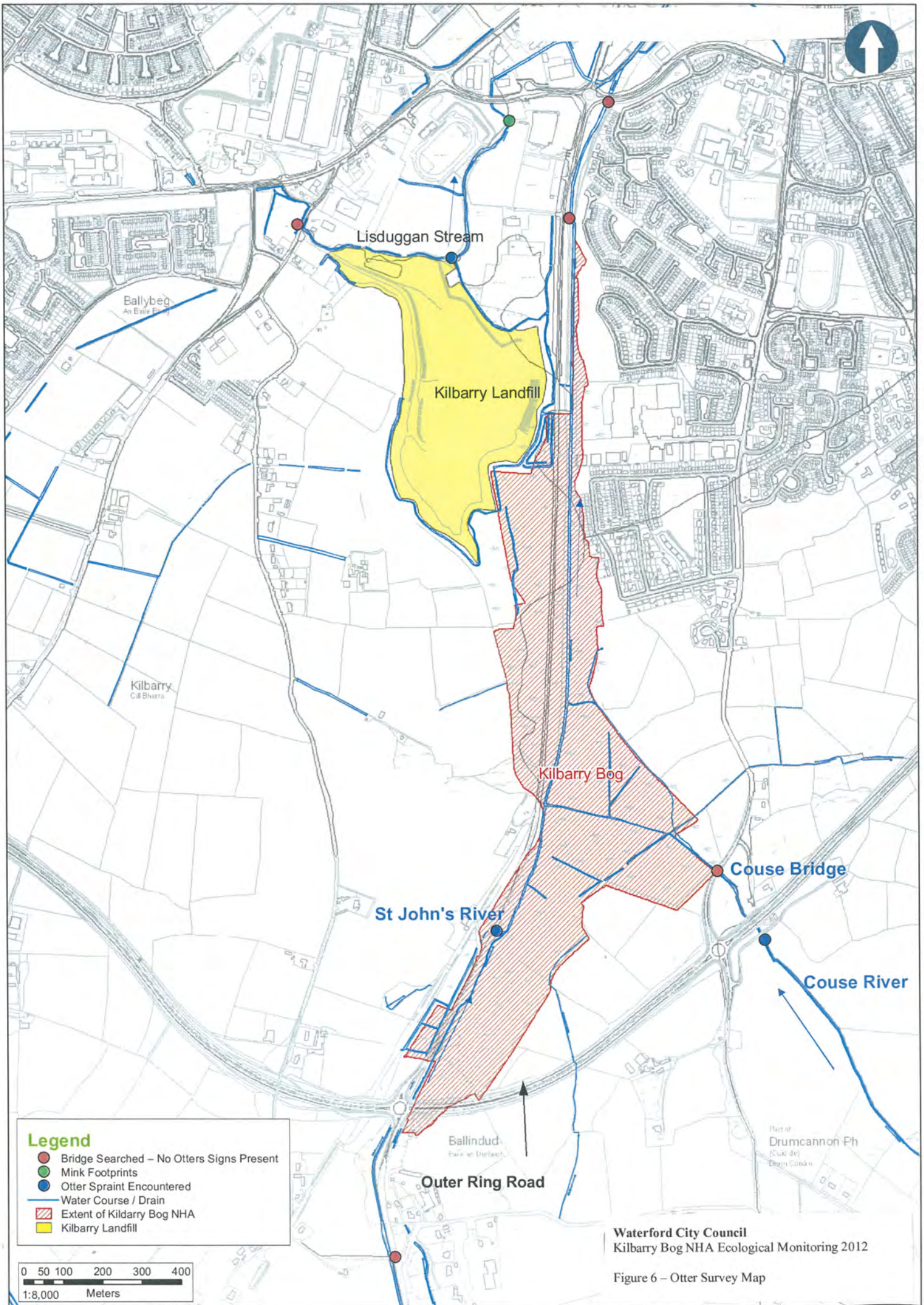
Legend

- L6 - Kick Sample Locations
- Water Course / Drain
- Extent of Kildarrey Bog NHA
- Kilbarry Landfill



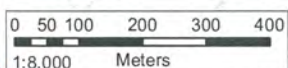
Waterford City Council
Kilbarry Bog NHA Ecological Monitoring 2012

Figure 5 Kick Sample Location Map



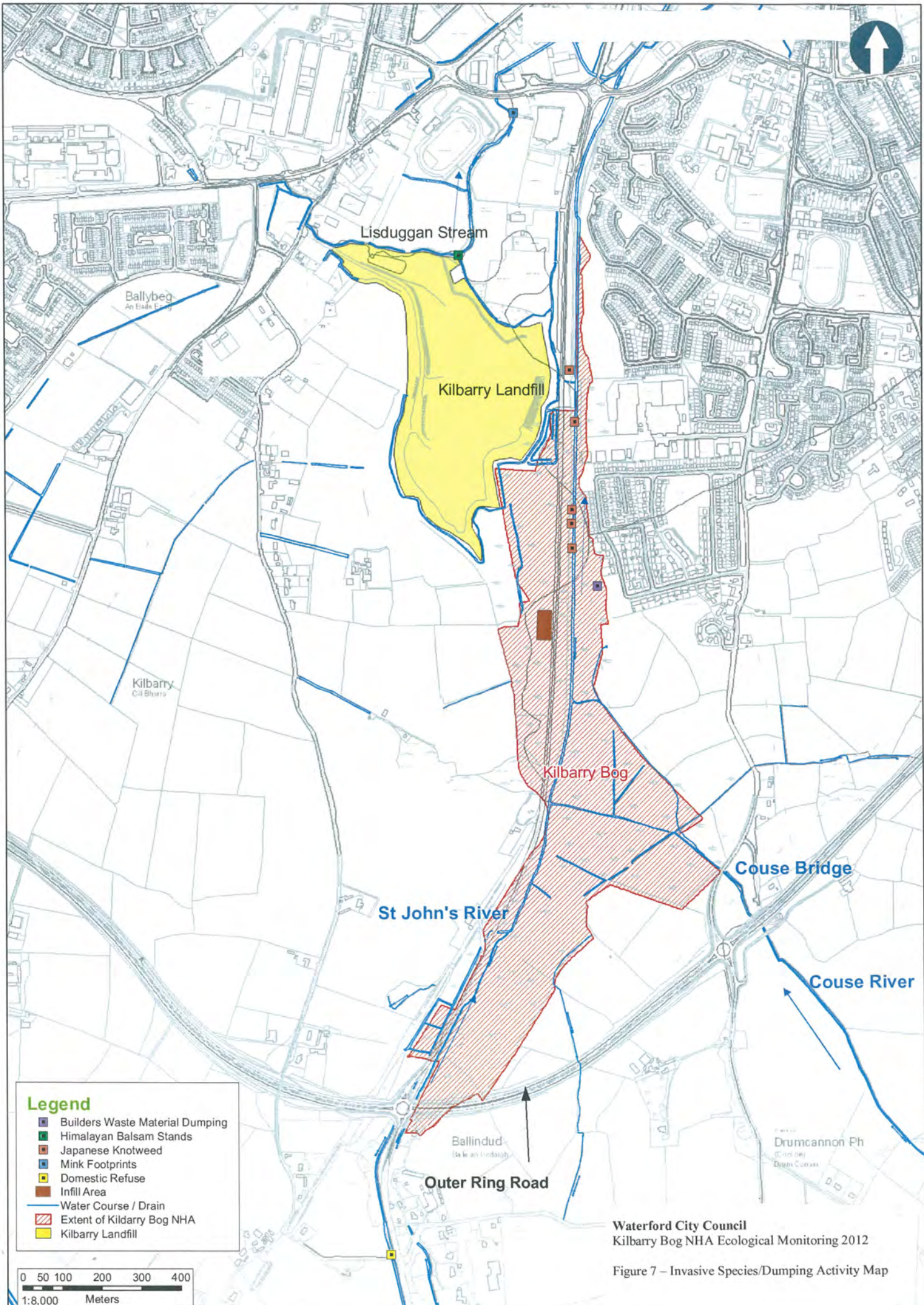
Legend

- Bridge Searched – No Otters Signs Present
- Mink Footprints
- Otter Spraint Encountered
- Water Course / Drain
- ▨ Extent of Kildarrey Bog NHA
- Kilbarrey Landfill



Waterford City Council
Kilbarrey Bog NHA Ecological Monitoring 2012

Figure 6 – Otter Survey Map



Legend

- Builders Waste Material Dumping
- Himalayan Balsam Stands
- Japanese Knotweed
- Mink Footprints
- Domestic Refuse
- Infill Area
- Water Course / Drain
- Extent of Kildarry Bog NHA
- Kilbarry Landfill

0 50 100 200 300 400
1:8,000 Meters

Waterford City Council
Kilbarry Bog NHA Ecological Monitoring 2012

Figure 7 – Invasive Species/Dumping Activity Map

TABLES

Table 9: Waterford City Council - Kilbarry Bog pNHA Ecological Monitoring 2012 - Kick Sample Species List 2012

Location Reference	EPA Indicator Group	Revised BMWP Score	St. John's River		Lisduggan Stream			Drainage Ditch
			S1	S3/4	L1	L2	L6	D1
Sampling Date			02/10/2012	02/10/2012	02/10/2012	02/10/2012	02/10/2012	02/10/2012
Mayflies (Ephemeroptera)								
<i>Heptageniidae</i>	A	9.8						
<i>Ephemeridae</i>	A	9.3						
<i>Siphonuridae</i>	A	11						
<i>Leptophlebiidae</i>	B	8.9						
<i>Ephemerellidae</i>	C	7.7						
<i>Caenidae</i>	C	7.1						
<i>Baetidae</i>	B	5.3						
<i>Baetis Rhodani</i> **	C	5.3						
Stoneflies (Plecoptera)								
<i>Perlidae</i>	A	12.5						
<i>Perlodidae</i>	A	10.7						
<i>Nemouridae</i>	A	9.1						
<i>Leuctridae</i>	B	9.9						
Caddis flies (Trichoptera)								
Cased								
<i>Sericostomatidae</i>	B	9.2	21					
<i>Goeridae</i>	B	9.9						
<i>Limmnophilidae</i>	B	6.9						
<i>Glossosomatidae</i>	B							
<i>Lepidostomatidae</i>	B	10.4						
Caseless								
<i>Hydropsychidae</i>	C	6.6						
<i>Philopotamidae</i>	C	10.6						
<i>Polycentropodidae</i>	C	8.6		1				
<i>Rhyacophilidae</i>	C	8.3						
Beetles (Coleoptera)								
<i>Elmidae</i>	C	6.4		3				
<i>Dytiscidae</i>	C	4.8						
Flatworms (Platyhelminthes)								
<i>Planariidae</i>	C	4.2		24	1	1		2
<i>Dendrocoelidae</i>	C	3.1						
Crustaceans (Crustacea)								
<i>Gammaridae</i>	C	4.5	160	129			4	
<i>Asellidae</i>	D	2.1	60	40	11	7	12	
True flies (Diptera)								
<i>Simuliidae</i>	C	5.8	4					
<i>Pediciidae</i>								
<i>Tipulidae</i>	C	5.5						
<i>Chironomidae</i>	C	3.7		2	17	1	10	14
<i>Chironomus spp.</i> **	E	3.7			11	3		5
<i>Syrphidae</i>	E							
Mites (Hydracarina)								
<i>Hydracarina</i>	C				1	12	1	
Snails & Limpets (Gastropoda)								
<i>Ancylidae</i>	C	5.6	8		1	4		
<i>Hydrobiidae</i>	C	3.9	176	208	11	4		15
<i>Planorbidae</i>	C	2.9	1	3	1	2	1	1
<i>Lymnaeidae</i>	C	3		31		2		3
<i>Lymnaea peregra</i> **	D	3						
<i>Physidae</i>	D	1.8					1	
Mussels (Bivalvia)								
<i>Sphaeriidae</i>	D	3.6	3					1
Leeches (Hirudinae)								
<i>Piscicolidae</i>	C	5		1				
<i>Glossiphoniidae</i>	D	3.1	6		1	1		
<i>Erpobdellidae</i>	D	2.8		1			4	
Worms (Oligochaeta)								
<i>Tubificidae</i>	E	3.5		5	135	40	31	540
<i>Lumbriculus</i>		3.5						
Stickleback (Gasterosteidae)								
<i>Gasterosteus aculeatus</i>						1		1
Number of individuals			439	448	190	78	64	582
Number of types of taxa			9	12	9	12	8	9
Q-value			Q3	Q3	Q1*	Q1-2	Q1-2	Q1*

Q-value with suffix '0' indicates toxic effect from hydrocarbon contamination

* indicates evidence of contamination

**Species level of identification

Table 10: Waterford City Council - Kilbarry Bog pNHA Ecological Monitoring 2012 - Biological Monitoring - Physical observations

Location Reference	Unit	St. John's River		Lisduggan Stream			Drainage Ditch
		S1	S3/4	L1	L2	L6	D1
Sampling date		02/10/2012	02/10/2012	02/10/2012	02/10/2012	02/10/2012	02/10/2012
GPS Grid Reference		S 59914 08800	S 60225 10894	S 59455 10592	S 59841 10502	S 58611 10875	S 60047 10351
Physio-chemical Observation							
Dissolved Oxygen	%	90.9	65.6	87.6	70.7	95.8	71.2
Dissolved Oxygen	mg/l	9.80	7.06	9.21	7.45	10.17	7.52
pH	pH Units	7.4	7.2	7.42	7.21	7.76	7.20
Conductivity @ 25°C	µS/cm	370	401	379	419	350	420
Temperature	°C	12.1	12.2	13.1	13	12.7	13
Physical Observation							
Habitat type		Riffle/Glide & Run	Run	Riffle/Glide	Stagnant	Riffle/Glide	Stagnant
Substrate composition		Gravel and cobbles	Mud, gravelly, concrete blocks	Gravel, sand	Gravel, mud	Gravel and cobbles	Sandy/silty
Filamentous Aglae present	Y/N	No	Yes	Yes	Yes	Yes	No
Sewage Fungus present	Y/N	No	No	No	No	Yes	No
Submerged vegetation	%	40	20	15	10	10	20
Water shading	%	50	50	70	20	50	40
Water depth	cm	60 - 70	50 - 60	10	20 - 30	10 to 20	40 - 50
Comment		Water levels high.	Water levels high.	Construction works at Bleach Bridge. Hydrocarbon contamination on banks and water surface of stream.	Water cloudy grey with silt from temporary works upstream.	Concrete outfall pipe immediately upstream of sample location.	Water cloudy grey with silt from temporary works upstream. Hydrocarbon sheen generated after walking in sediment.

APPENDIX A

SITE SYNOPSIS

SITE NAME: KILBARRY BOG

SITE CODE: 001700

Kilbarry Bog is located on the southern outskirts of Waterford City; it lies on either side of the former Great Southern Railway line, parts of which are today used as a foot path and cycle way. The site is drained by the St John's River in the north, whilst there is a flow of water into the site from the hills to the south-east. This wetland is not, in fact, a bog in the true sense, but rather comprises an area of reed swamp, freshwater marsh, wet grassland and scrub. Parts of the site are known as Ballynakill Marsh.

Over the years the wetland has been reduced in extent by municipal rubbish dumping and subsequent reclamation to the north. The present site includes areas of reed swamp that are dominated by Common Reed (*Phragmites australis*) and with an abundance of Greater Pond-sedge (*Carex riparia*) and Lesser Pond-sedge (*C. acutiformis*). Bushes of Eared Willow (*Salix aurita*) and Grey Willow (*Salix cinerea* subsp. *oleifolia*) are scattered about the site. Other plant species present include Meadowsweet (*Filipendula ulmaria*), Marsh Valerian (*Valeriana officinalis*) and Tufted Hair-grass (*Deschampsia cespitosa*).

Around the swamp margins the vegetation grades into marsh and then to wet grassland; here, such species as Bottle Sedge (*Carex rostrata*), Brown Sedge (*Carex disticha*), Creeping Bent (*Agrostis stolonifera*), Soft Rush (*Juncus effusus*), Yellow Iris (*Iris pseudacorus*), Tall Fescue (*Festuca arundinacea*) and Royal Fern (*Osmunda regalis*) are found.

Summer Snowflake (*Leucojum aestivum*), a scarce species in Ireland, was first recorded from the site in 1900, and was present here at least as recently as 1979.

The site is used by Otter, a protected species in Ireland and one that is listed on Annex II of the E.U. Habitats Directive.

The site supports a good diversity of bird species associated with swamp vegetation. Those found throughout the year include Mallard, Water Rail, Moorhen, Grey Heron, Snipe, Reed Bunting and Grey Wagtail. In summer the site also supports important populations of migrant species, including Sedge Warbler, Reed Warbler, Willow Warbler, Chiffchaff, Whitethroat and Blackcap. Most, if not

all, of these species breed at the site; the breeding population of Reed Warbler is of particular significance. This species was proved to be breeding at the site in 1999 (five pairs), the first breeding record for Co. Waterford. This is a scarce species in Ireland and Kilbarry Bog supports between 5% and 10% of the national breeding population. Other species using the site in late summer/autumn include Swallow, House Martin, Swift, Sand Martin and Starling, while in winter the site is visited by Lapwing, Black-headed Gull, Jack Snipe, Pied Wagtail and additional numbers of Mallard. Kingfisher, a species that is listed on Annex I of the E.U. Birds Directive, has also been recorded from the site.

A range of interesting and often scarce invertebrate species has been recorded from the site. These include dragonflies, butterflies, moths and spiders.

Kilbarry Bog is a site of conservation importance for a variety of reasons: it is the only remaining wetland of its type of significance in the vicinity of Waterford City; it supports a variety of wetland vegetation types and plant species; it is the site of records for the scarce Summer Snowflake; it supports a good diversity of birds, including an important breeding population of Reed Warbler; a range scarce invertebrate species has been recorded from the site.

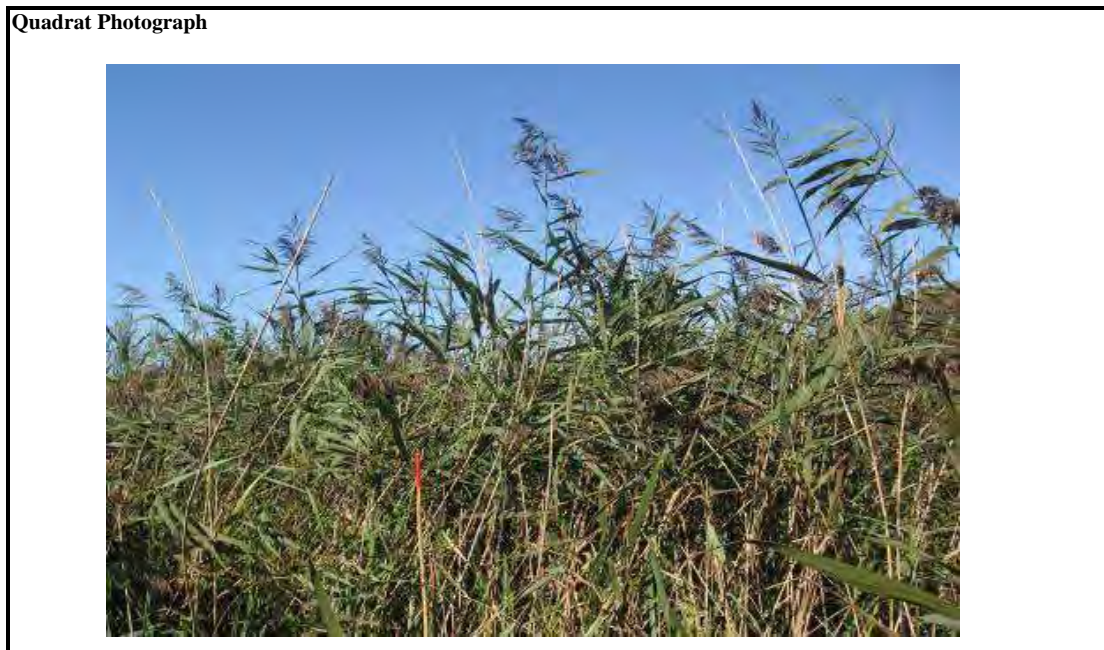
19.1.2005

APPENDIX B

Project Name	Kilbarry Bog Ecological Monitoring - Quantitative Habitat Mapping		
Quadrat Code	Q1	Surveyor	David Horgan and Ger Stanton
GPS Location	S60055 09700	Survey Date	28-Sep-12
Site Name	Kilbarry Bog pNHA	Quadrat Size	4m x 4m
Site Location	Waterford city	Slope	flat
Client	Waterford City Council	Aspect	N - S
		Water Level	1 cm
Substrate Type	Organic	Fossitt habitat Code	FS1 - Reed and large sedge swamps
Stability	Firm		
Adjacent Habitat Type	Urban (Road), agricultural, landfill		
Land Management	None		

Quadrat Vegetation Composition	
Taxa	Domin value
Common Reed <i>Phragmites australis</i>	8
Greater Tussock-sedge <i>Carex paniculata</i>	6
Water horsetail <i>Equisetum fluviatile</i>	2
Meadowsweet <i>Filipendula ulmaria</i>	1

Comments



Project Name	Kilbarry Bog Ecological Monitoring - Quantitative Habitat Mapping		
Quadrat Code	Q2	Surveyor	David Horgan and Ger Stanton
GPS Location	S60029 09914	Survey Date	28-Sep-12
Site Name	Kilbarry Bog pNHA	Quadrat Size	4m x 4m
Site Location	Waterford city	Slope	flat
Client	Waterford City Council	Aspect	N - S
		Water Level	0.5 cm
Substrate Type	Organic	Fossitt habitat Code	FS1 - Reed and large sedge swamps
Stability	Firm		
Adjacent Habitat Type	Urban (Road), agricultural, landfill		
Land Management	None		

Quadrat Vegetation Composition	
Taxa	Domin value
Common Reed <i>Phragmites australis</i>	7
Greater Tussock-sedge <i>Carex paniculata</i>	6
Bindweed <i>Convolvulus arvensis</i>	4 (change from 6 in 2011)
Nettle <i>Urtica dioica</i>	2
Meadowsweet <i>Filipendula ulmaria</i>	1

Comments
Willow trees to south and east of quadrat



Project Name	Kilbarry Bog Ecological Monitoring - Quantitative Habitat Mapping		
Quadrat Code	Q3	Surveyor	David Horgan and Ger Stanton
GPS Location	S60061 09968	Survey Date	28-Sep-12
Site Name	Kilbarry Bog pNHA	Quadrat Size	4m x 4m
Site Location	Waterford city	Slope	flat
Client	Waterford City Council	Aspect	N - S
		Water Level	3 cm
Substrate Type	Organic	Fossitt habitat Code	FS1 - Reed and large sedge swamps
Stability	Soft		
Adjacent Habitat Type	Urban (Road), agricultural, landfill		
Land Management	None		

Quadrat Vegetation Composition	
Taxa	Domin value
Common Reed <i>Phragmites australis</i>	10
Bindweed <i>Convolvulus arvensis</i>	2

Comments
Willow trees within 10m of quadrat



Project Name	Kilbarry Bog Ecological Monitoring - Quantitative Habitat Mapping		
Quadrat Code	Q4	Surveyor	David Horgan and Ger Stanton
GPS Location	S60068 09788	Survey Date	28-Sep-12
Site Name	Kilbarry Bog pNHA	Quadrat Size	4m x 4m
Site Location	Waterford city	Slope	flat
Client	Waterford City Council	Aspect	N - S
		Water Level	0 cm (damp)
Substrate Type	Organic	Fossitt habitat Code	FS1 - Reed and large sedge swamps
Stability	Firm		
Adjacent Habitat Type	Urban (Road), agricultural, landfill		
Land Management	None		

Quadrat Vegetation Composition	
Taxa	Domin value
Common Reed <i>Phragmites australis</i>	10
Bindweed <i>Convolvulus arvensis</i>	4
Meadowsweet <i>Filipendula ulmaria</i>	3 (change from 4 in 2011)
Nettle <i>Urtica dioica</i>	3
Marsh-bedstraw <i>Galium palustre</i>	1 (not recorded in 2011)

Comments
Willow and poplar trees located within 5m of quadrat



Project Name	Kilbarry Bog Ecological Monitoring - Quantitative Habitat Mapping		
Quadrat Code	Q5	Surveyor	David Horgan and Ger Stanton
GPS Location	S60045 09549	Survey Date	28-Sep-12
Site Name	Kilbarry Bog pNHA	Quadrat Size	4m x 4m
Site Location	Waterford city	Slope	flat
Client	Waterford City Council	Aspect	N - S
		Water Level	3.5 cm
Substrate Type	Organic	Fossitt habitat Code	FS1 - Reed and large sedge swamps
Stability	Firm		
Adjacent Habitat Type	Urban (Road), agricultural, landfill		
Land Management	None		

Quadrat Vegetation Composition	
Taxa	Domin value
Common Reed <i>Phragmites australis</i>	10
Water horsetail <i>Equisetum fluviatile</i>	4
Erect Bur-reed <i>Sparagnumium erectum</i>	3
Common Duckweed <i>Lemna spp.</i>	3
Fool's-water-cress <i>Apium nodiflorum</i>	1 (not recorded in 2011)
Gypsywort <i>Lycopus europaeus</i>	1 (not recorded in 2011)

Comments
Excavated pool located 5m east of quadrat



Project Name	Kilbarry Bog Ecological Monitoring - Quantitative Habitat Mapping		
Quadrat Code	Q6	Surveyor	David Horgan and Ger Stanton
GPS Location	S60118 08955	Survey Date	28-Sep-12
Site Name	Kilbarry Bog pNHA	Quadrat Size	4m x 4m
Site Location	Waterford city	Slope	flat
Client	Waterford City Council	Aspect	N - S
		Water Level	0 cm (damp)
Substrate Type	Organic	Fossitt habitat Code	FS1 - Reed and large sedge swamps
Stability	Firm		
Adjacent Habitat Type	Urban (Road), agricultural, landfill		
Land Management	None		

Quadrat Vegetation Composition	
Taxa	Domin value
Greater Tussock-sedge <i>Carex paniculata</i>	8
Common Reed <i>Phragmites australis</i>	7
Meadowsweet <i>Filipendula ulmaria</i>	3 (change from 2 in 2011)
Reed Canary-grass <i>Phalaris arundinacea</i>	1 (change from 3 in 2011)
Bindweed <i>Convolvulus arvensis</i>	0 (change from 3 in 2011)

Comments



Project Name	Kilbarry Bog Ecological Monitoring - Quantitative Habitat Mapping		
Quadrat Code	Q7-A	Surveyor	David Horgan and Ger Stanton
GPS Location	S60162 09667	Survey Date	28-Sep-12
Site Name	Kilbarry Bog pNHA	Quadrat Size	4m x 4m
Site Location	Waterford city	Slope	flat
Client	Waterford City Council	Aspect	N - S
		Water Level	0.5 cm
Substrate Type	Organic	Fossitt habitat Code	FS1 - Reed and large sedge swamps
Stability	Firm		
Adjacent Habitat Type	Urban (Road), agricultural, landfill		
Land Management	None		

Quadrat Vegetation Composition	
Taxa	Domin value
Common Reed <i>Phragmites australis</i>	9
Meadowsweet <i>Filipendula ulmaria</i>	4 (change from 5 in 2011)
Bindweed <i>Convolvulus arvensis</i>	4
Willowherb <i>Epilobium</i> sp	4 (not recorded in 2011)
Common Valerian <i>Valeriana officinalis</i>	2
Nettle <i>Urtica dioica</i>	2 (not recorded in 2011)
Greater Tussock-sedge <i>Carex paniculata</i>	1 (change from 3 in 2011)
Water Mint <i>Mentha aquatica</i>	1 (not recorded in 2011)
Creeping bent <i>Agrostis stolonifera</i>	0 (change from 4 in 2011)
Angelica <i>Angelica sylvestris</i>	0 (change from 2 in 2011)

Comments



Project Name	Kilbarry Bog Ecological Monitoring - Quantitative Habitat Mapping		
Quadrat Code	Q8	Surveyor	David Horgan and Ger Stanton
GPS Location	S59897 08591	Survey Date	28-Sep-12
Site Name	Kilbarry Bog pNHA	Quadrat Size	4m x 4m
Site Location	Waterford city	Slope	flat
Client	Waterford City Council	Aspect	N - S
		Water Level	0 cm (damp)
Substrate Type	Organic	Fossitt habitat Code	FS1 - Reed and large sedge swamps
Stability	Firm		
Adjacent Habitat Type	Urban (Road), agricultural, landfill		
Land Management	None		

Quadrat Vegetation Composition	
Taxa	Domin value
Common Reed <i>Phragmites australis</i>	10
Nettle <i>Urtica dioica</i>	4 (changed from 2 in 2011)
Meadowsweet <i>Filipendula ulmaria</i>	2
Willowherb <i>Epilobium sp</i>	2

Comments
Willow located within 5 meters of quadrat



Project Name	Kilbarry Bog Ecological Monitoring - Quantitative Habitat Mapping		
Quadrat Code	Q9	Surveyor	David Horgan and Ger Stanton
GPS Location	S59975 08735	Survey Date	28-Sep-12
Site Name	Kilbarry Bog pNHA	Quadrat Size	4m x 4m
Site Location	Waterford city	Slope	flat
Client	Waterford City Council	Aspect	N - S
		Water Level	5 cm
Substrate Type	Organic	Fossitt habitat Code	FS1 - Reed and large sedge swamps
Stability	Firm		
Adjacent Habitat Type	Urban (Road), agricultural, landfill		
Land Management	None		

Quadrat Vegetation Composition	
Taxa	Domin value
Greater Tussock-sedge <i>Carex paniculata</i>	8
Common Reed <i>Phragmites australis</i>	6
Nettle <i>Urtica dioica</i>	5
Bindweed <i>Convolvulus arvensis</i>	3
Meadowsweet <i>Filipendula ulmaria</i>	3 (not recorded in 2011)
Common Valerian <i>Valeriana officinalis</i>	1

Comments
Willow located within 10 meters of quadrat



APPENDIX C

Plant list - Kilbarry Bog

Surveys completed between 1997 and 2007 by Paul Green, Waterford vice-county BSBI Recorder

Common Name	Scientific Name
Alder	<i>Alnus glutinosa</i>
Almond Willow	<i>Salix triandra</i>
American Willowherb	<i>Epilobium ciliatum</i>
Amphibious Bistort	<i>Persicaria amphibia</i>
Annual Meadow-grass	<i>Poa annua</i>
Annual Mercury	<i>Mercurialis annua</i>
Apple	<i>Malus domestica</i>
Ash	<i>Fraxinus excelsior</i>
Atlantic Ivy	<i>Hedera helix subsp. hibernica</i>
Autumn Hawkbit	<i>Leontodon autumnalis</i>
Bittersweet	<i>Solanum dulcamara</i>
Bitter-vetch	<i>Lathyrus linifolius</i>
Black Medick	<i>Medicago lupulina</i>
Black Nightshade	<i>Solanum nigrum subsp. nigrum</i>
Blackthorn	<i>Prunus spinosa</i>
Bladder-sedge	<i>Carex vesicaria</i>
Bottle Sedge	<i>Carex rostrata</i>
Bramble	<i>Rubus fruticosus agg.</i>
Branched Bur-reed	<i>Sparganium erectum</i>
Broad Buckler-fern	<i>Dryopteris dilatata</i>
Broad-leaved Dock	<i>Rumex obtusifolius</i>
Broad-leaved Pondweed	<i>Potamogeton natans</i>
Broad-leaved Willowherb	<i>Epilobium montanum</i>
Brooklime	<i>Veronica beccabunga</i>
Bulrush	<i>Typha latifolia</i>
Bush Vetch	<i>Vicia sepium</i>
Butterfly-bush	<i>Buddleja davidii</i>
Canadian Waterweed	<i>Elodea canadensis</i>
Carnation Sedge	<i>Carex panicea</i>
Cat's-ear	<i>Hypochaeris radicata</i>
Celery-leaved Buttercup	<i>Ranunculus sceleratus</i>
Charlock	<i>Sinapis arvensis</i>
Cleavers	<i>Galium aparine</i>
Cock's-foot	<i>Dactylis glomerata</i>
Colt's-foot	<i>Tussilago farfara</i>
Common Bird's-foot-trefoil	<i>Lotus corniculatus</i>
Common Chickweed	<i>Stellaria media</i>
Common Comfrey	<i>Symphytum officinale</i>
Common Couch	<i>Elytrigia repens</i>
Common Dog-violet	<i>Viola riviniana</i>
Common Duckweed	<i>Lemna minor</i>
Common Field-speedwell	<i>Veronica persica</i>
Common Figwort	<i>Scrophularia nodosa</i>
Common Fleabane	<i>Pulicaria dysenterica</i>
Common Knapweed	<i>Centaurea nigra</i>

Waterford City Council – Kilbarry Bog Ecological Monitoring 2012.

Common Marsh-bedstraw	<i>Galium palustre subsp. palustre</i>
Common Mouse-ear	<i>Cerastium fontanum</i>
Common Nettle	<i>Urtica dioica</i>
Common Ragwort	<i>Senecio jacobaea</i>
Common Ramping-fumitory	<i>Fumaria muralis subsp. boraei</i>
Common Reed	<i>Phragmites australis</i>
Common Sorrel	<i>Rumex acetosa subsp. acetosa</i>
Common Valerian	<i>Valeriana officinalis</i>
Common Vetch	<i>Vicia sativa subsp. segetalis</i>
Compact Rush	<i>Juncus conglomeratus</i>
Cow Parsley	<i>Anthriscus sylvestris</i>
Crack-willow	<i>Salix fragilis</i>
Creeping Bent	<i>Agrostis stolonifera</i>
Creeping Buttercup	<i>Ranunculus repens</i>
Creeping Cinquefoil	<i>Potentilla reptans</i>
Creeping Thistle	<i>Cirsium arvense</i>
Crested Dog's-tail	<i>Cynosurus cristatus</i>
Cuckooflower	<i>Cardamine pratensis</i>
Curled Dock	<i>Rumex crispus subsp. crispus</i>
Cut-leaved Crane's-bill	<i>Geranium dissectum</i>
Daisy	<i>Bellis perennis</i>
Dandelion	<i>Taraxacum agg.</i>
Dog-rose	<i>Rosa canina</i>
Dove's-foot Crane's-bill	<i>Geranium molle</i>
Downy Birch	<i>Betula pubescens</i>
Eared Willow	<i>Salix aurita</i>
Elder	<i>Sambucus nigra</i>
Elm-leaved Bramble	<i>Rubus ulmifolius</i>
False Fox-sedge	<i>Carex otrubae</i>
False Oat-Grass	<i>Arrhenatherum elatius</i>
Fat-hen	<i>Chenopodium album</i>
Field Bindweed	<i>Convolvulus arvensis</i>
Field Horsetail	<i>Equisetum arvense</i>
Floating Sweet-grass	<i>Glyceria fluitans</i>
Foxglove	<i>Digitalis purpurea</i>
Garden Privet	<i>Ligustrum ovalifolium</i>
Garden Strawberry	<i>Fragaria ananassa</i>
Germander Speedwell	<i>Veronica chamaedrys</i>
Giant Knotweed	<i>Fallopia sachalinensis</i>
Glaucous Sedge	<i>Carex flacca</i>
Gorse	<i>Ulex europaeus</i>
Great Horsetail	<i>Equisetum telmateia</i>
Great Mullein	<i>Verbascum thapsus</i>
Great Willowherb	<i>Epilobium hirsutum</i>
Greater Bird's-foot-trefoil	<i>Lotus pedunculatus</i>
Greater Bladderwort	<i>Utricularia vulgaris sens. lat.</i>
Greater Plantain	<i>Plantago major subsp. major</i>
Greater Pond-sedge	<i>Carex riparia</i>
Greater Tussock-sedge	<i>Carex paniculata</i>
Ground-elder	<i>Aegopodium podagraria</i>

Ground-ivy	<i>Glechoma hederacea</i>
Groundsel	<i>Senecio vulgaris</i>
Gypsywort	<i>Lycopus europaeus</i>
Hairy Bitter-cress	<i>Cardamine hirsuta</i>
Hairy Sedge	<i>Carex hirta</i>
Hairy Tare	<i>Vicia hirsuta</i>
Hard Rush	<i>Juncus inflexus</i>
Hawthorn	<i>Crataegus monogyna</i>
Hedge Bindweed	<i>Calystegia sepium subsp. sepium</i>
Hedge Mustard	<i>Sisymbrium officinale</i>
Hedge Woundwort	<i>Stachys sylvatica</i>
Hemlock	<i>Conium maculatum</i>
Hemlock Water-dropwort	<i>Oenanthe crocata</i>
Hemp-agrimony	<i>Eupatorium cannabinum</i>
Herb-Robert	<i>Geranium robertianum</i>
Hoary Willowherb	<i>Epilobium parviflorum</i>
Hogweed	<i>Heracleum sphondylium</i>
Honeysuckle	<i>Lonicera periclymenum</i>
Horse-chestnut	<i>Aesculus hippocastanum</i>
Hybrid Knotweed	<i>Fallopia x bohemica</i>
Indian Balsam	<i>Impatiens glandulifera</i>
Ivy-leaved Duckweed	<i>Lemna trisulca</i>
Ivy-leaved Speedwell	<i>Veronica hederifolia</i>
Japanese Knotweed	<i>Fallopia japonica</i>
Jointed Rush	<i>Juncus articulatus</i>
Keeled-fruited Cornsalad	<i>Valerianella carinata</i>
Knotgrass	<i>Polygonum aviculare</i>
Large Bindweed	<i>Calystegia silvatica</i>
Large Bindweed	<i>Calystegia silvatica subsp. disjuncta</i>
Lesser Celandine	<i>Ranunculus ficaria subsp. ficaria</i>
Lesser Pond-sedge	<i>Carex acutiformis</i>
Lesser Spearwort	<i>Ranunculus flammula</i>
Lesser Stitchwort	<i>Stellaria graminea</i>
Lesser Swine-cress	<i>Coronopus didymus</i>
Lesser Trefoil	<i>Trifolium dubium</i>
Lesser Water-parsnip	<i>Berula erecta</i>
Lords-and-Ladies	<i>Arum maculatum</i>
Lousewort	<i>Pedicularis sylvatica</i>
Mare's-tail	<i>Hippuris vulgaris</i>
Marsh Foxtail	<i>Alopecurus geniculatus</i>
Marsh Horsetail	<i>Equisetum palustre</i>
Marsh Pennywort	<i>Hydrocotyle vulgaris</i>
Marsh Ragwort	<i>Senecio aquaticus</i>
Marsh Thistle	<i>Cirsium palustre</i>
Marsh Woundwort	<i>Stachys palustris</i>
Marsh-marigold	<i>Caltha palustris</i>
Meadow Buttercup	<i>Ranunculus acris</i>
Meadow Foxtail	<i>Alopecurus pratensis</i>
Meadow Vetchling	<i>Lathyrus pratensis</i>
Meadowsweet	<i>Filipendula ulmaria</i>

Waterford City Council – Kilbarry Bog Ecological Monitoring 2012.

Medium-flowered Winter-cress	<i>Barbarea intermedia</i>
Montbretia (C. aurea x pottsii)	<i>Crocsmia x crocosmiiflora</i>
New Zealand Willowherb	<i>Epilobium brunnescens</i>
Nipplewort	<i>Lapsana communis subsp. communis</i>
Osier	<i>Salix viminalis</i>
Oval Sedge	<i>Carex ovalis</i>
Oxeye Daisy	<i>Leucanthemum vulgare</i>
Parsley-piert	<i>Aphanes arvensis</i>
Pedunculate Oak	<i>Quercus robur</i>
Perennial Rye-grass	<i>Lolium perenne</i>
Petty Spurge	<i>Euphorbia peplus</i>
Pineappleweed	<i>Matricaria discoidea</i>
Plicate Sweet-grass	<i>Glyceria notata</i>
Prickly Sow-thistle	<i>Sonchus asper</i>
Procumbent Pearlwort	<i>Sagina procumbens</i>
Purple-loosestrife	<i>Lythrum salicaria</i>
R. crispus x obtusifolius	<i>Rumex x pratensis</i>
Red Bartsia	<i>Odontites vernus</i>
Red Clover	<i>Trifolium pratense</i>
Red Dead-nettle	<i>Lamium purpureum</i>
Red Fescue	<i>Festuca rubra agg.</i>
Red Valerian	<i>Centranthus ruber</i>
Redshank	<i>Persicaria maculosa</i>
Reed Canary-grass	<i>Phalaris arundinacea</i>
Remote Sedge	<i>Carex remota</i>
Ribwort Plantain	<i>Plantago lanceolata</i>
Rosebay Willowherb	<i>Chamerion angustifolium</i>
Rough Hawk's-beard	<i>Crepis biennis</i>
Rough Meadow-grass	<i>Poa trivialis</i>
Royal Fern	<i>Osmunda regalis</i>
Russian Comfrey (S. asperum x officinale)	<i>Symphytum x uplandicum</i>
Rusty Willow	<i>Salix cinerea subsp. oleifolia</i>
S. aurita x cinerea	<i>Salix x multinervis</i>
Scarlet Pimpernel	<i>Anagallis arvensis subsp. arvensis</i>
Scentless Mayweed	<i>Tripleurospermum inodorum</i>
Scots Pine	<i>Pinus sylvestris</i>
Selfheal	<i>Prunella vulgaris</i>
Sharp-flowered Rush	<i>Juncus acutiflorus</i>
Shepherd's-purse	<i>Capsella bursa-pastoris</i>
Shore Horsetail (E. arvense x fluviatile)	<i>Equisetum x litorale</i>
Short-fruited Willowherb	<i>Epilobium obscurum</i>
Silverweed	<i>Potentilla anserina</i>
Small Pondweed	<i>Potamogeton berchtoldii</i>
Small Sweet-grass	<i>Glyceria declinata</i>
Small-leaved Elm (sensu Stace)	<i>Ulmus minor</i>
Smooth Hawk's-beard	<i>Crepis capillaris</i>
Smooth Meadow-grass	<i>Poa pratensis</i>
Smooth Sow-thistle	<i>Sonchus oleraceus</i>
Soft Shield-fern	<i>Polystichum setiferum</i>
Soft-brome	<i>Bromus hordeaceus</i>

Waterford City Council – Kilbarry Bog Ecological Monitoring 2012.

Soft-rush	<i>Juncus effusus</i>
Spear Thistle	<i>Cirsium vulgare</i>
Square-stalked St John's-wort	<i>Hypericum tetrapterum</i>
Sticky Mouse-ear	<i>Cerastium glomeratum</i>
Sun Spurge	<i>Euphorbia helioscopia</i>
Sweet Vernal-grass	<i>Anthoxanthum odoratum</i>
Swine-cress	<i>Coronopus squamatus</i>
Sycamore	<i>Acer pseudoplatanus</i>
Tall Fescue	<i>Festuca arundinacea</i>
Thyme-leaved Speedwell	<i>Veronica serpyllifolia subsp. serpyllifolia</i>
Timothy	<i>Phleum pratense</i>
Toad Rush	<i>Juncus bufonius</i>
Tufted Hair-grass	<i>Deschampsia cespitosa subsp. cespitosa</i>
Tufted Vetch	<i>Vicia cracca</i>
Unbranched Bur-reed	<i>Sparganium emersum</i>
Velvet Bent	<i>Agrostis canina</i>
Water Figwort	<i>Scrophularia auriculata</i>
Water Horsetail	<i>Equisetum fluviatile</i>
Water Mint	<i>Mentha aquatica</i>
Water-cress	<i>Rorippa nasturtium-aquaticum</i>
Water-plantain	<i>Alisma plantago-aquatica</i>
Weld	<i>Reseda luteola</i>
White Clover	<i>Trifolium repens</i>
White Willow	<i>Salix alba</i>
Wild Angelica	<i>Angelica sylvestris</i>
Wild Carrot	<i>Daucus carota subsp. carota</i>
Wild Cherry	<i>Prunus avium</i>
Wild Plum	<i>Prunus domestica</i>
Wild Privet	<i>Ligustrum vulgare</i>
Wild Radish	<i>Raphanus raphanistrum subsp. raphanistrum</i>
Wild Teasel	<i>Dipsacus fullonum</i>
Wild Turnip	<i>Brassica rapa subsp. campestris</i>
Winter Heliotrope	<i>Petasites fragrans</i>
Winter-cress	<i>Barbarea vulgaris</i>
Wood Avens	<i>Geum urbanum</i>
Wood Burdock	<i>Arctium nemorosum</i>
Wood Dock	<i>Rumex sanguineus</i>
Wood Sage	<i>Teucrium scorodonia</i>
Yarrow	<i>Achillea millefolium</i>
Yellow Iris	<i>Iris pseudacorus</i>
Yellow-wort	<i>Blackstonia perfoliata</i>
Yorkshire-fog	<i>Holcus lanatus</i>

Appendix III

Environmental Management System and E.L.R.A.

Environmental Management System

Version 7, June 2012

Table of Contents

1.0 Environmental Management Plan

2.0 Schedule of Environmental Objectives and Targets

3.0 Corrective Action Procedure

4.0 Awareness and Training Procedures

5.0 Communications Programme

6.0 Waste Acceptance Procedures

7.0 Emergency Response Procedures

Kilbarry Landfill Site

1.0 Environmental Management Plan

1.0 Introduction

Kilbarry Landfill site is located (National Grid Reference 2598E 1103N) on the outskirts of Waterford City on the Dunhill Road, approximately 300m of the N25.

The site occupies an area of 20.1 hectares. Land use in the vicinity of the site is a mixture of open flat farmland with wetland to the southeast. The area to the north and west of the site is a mixture of residential and commercial properties.

The landfilling of waste at the site has resulted in the formation of a mound of waste above ground level. The waste body has a maximum height of 20mOD in the centre of the site. The remainder of the site has a maximum height of 17.5mOD on top of the waste body and a base level of 2m to 3mOD on the edge of the site.

The site has been in operation for approximately 40 years. The landfilling of waste has occurred on a former area of wetland known as Kilbarry Bog. A series of drains or channels are found on the entire western, southern and eastern perimeter of the landfill.

The waste license for the site was issued on the 19th of October 2001. The purpose of this Environmental Management Plan is to act as a site manual for Kilbarry Landfill and Civic Amenity Site. It outlines the requirements of the waste license (18-1) and sets out a programme for achieving the schedule of objectives and targets. A complete copy of the plan shall be kept at the site office and an additional copy at the offices of Waterford City Council.

1.1 Management and Staffing Structure of the Facility

The site is operated by Waterford City Council. The site is under the overall control of Colette Byrne, Director of Services, Waterford City Council. Mr. Richie Walsh, Senior Executive Officer, is responsible for the overall operation of the site. Mr. Vincent O'Shea, Civil Technician, is responsible for reporting to the E.P.A. and fulfilling responsibilities of the waste licence. Pauric McGarrigle, Executive Engineer, is responsible for the day to day supervision and management of the Civic Amenity Site and is assisted by the Facility Supervisor Mr. James Flavin. Details of the additional site staff are provided in Table 1.

Table 1: Operational Staff (Currently on Site)

Employee	<i>Duties and Responsibilities</i>
Mr. James Flavin	Collection of charges. Maintenance of on site records. Implementation of waste acceptance procedures. Site inspections. Monitoring of gas boreholes. Any other duties as required by site manager.
Mr. Ferdy Ozturk	Daily litter patrols. Maintenance of metals recovery compound. Any other duties as required by site manager/supervisor.

The facility manager maintains regular contact with the Senior Executive Engineer. Table 2 shows the current management structure of Kilbarry Landfill.

Table 2: Management Structure for Kilbarry Landfill

Position	Employee Contact Details
Director of Services Richard Walsh	Waterford City Council, Environmental Services, Menapia Building, The Mall, Waterford. Tel: 051 309900 Fax: 051 849701
Senior Executive Engineer John Nolan	Waterford City Council, Environmental Services, Menapia Building, The Mall, Waterford. Tel: 051 309900 Fax: 051 849701
Landfill Manager Vincent O'Shea C.A.S. Manager Pauric McGarrigle Facility Supervisor James Flavin	Kilbarry Landfill Site, Kilbarry, Waterford. Tel: 051 379615 Fax: 051 379615

Any changes to this structure will be submitted to the EPA by the Landfill Manager. It shall be the responsibility of the C.A.S. Manager to organise staff in the absence of the named persons from the facility.

1.2 SITE DESCRIPTION

1.2.1 Waste Management Activities at the Facility

The waste categories and quantities that may be accepted for disposal and recovery, as outlined in Table A.1 of the Waste License, are shown below in Table 3.

Table 3: Waste Categories & Quantities for Disposal and Recovery

Waste Type	Maximum Tonnes Per Annum
Household	17,000
Commercial	12,500
Industrial Non Hazardous	28,500
Treated Sewage Sludges	2,500
Treated Industrial Non Hazardous Sludges	7,500
Construction & Demolition Waste	2,000
Wastes for Recycling & Recovery at the Civic Waste Facility	3,000
Waste for Recycling & Recovery at the Metal Recovery Area	2,000
Total	75,000

As of the 19th January 2003 commercial waste hauliers were stopped from disposing of waste at Kilbarry Landfill. As of 26th August 2005 Kilbarry Landfill ceased accepting domestic waste for landfill disposal. The landfill is currently closed to the public and restoration including permanent capping, gas and leachate abstraction works has been completed. Surface water drainage and landscaping works are to be completed. Currently all domestic waste collected by Waterford City Council is deposited at Veolias waste facility in Six Cross Roads Business Park before being hauled to Homestown Landfill in Wexford.

All waste loads arriving at the site were dealt with as per the waste acceptance procedures.

A civic amenity centre is located adjacent to the site entrance. The following range of goods are accepted for recycling: W.E.E.E., scrap metal, timber, cardboard, batteries, engine oil, cooking oil, glass bottles, aluminium cans, clothes, fluorescent tubes, energy saving light bulbs, aerosols and paint tins.

1.2.2 Methods of Waste Deposition

Previously any vehicle entering the site was weighed and all relevant information recorded. The vehicle was directed to the tipping area where the driver discharged the waste. The machine operator compacted the waste and covered it with daily cover material at the end of the day. Inert waste (such as clay, stone and C&D materials) was used as cover.

Currently all waste for landfilling weighed at Kilbarry is sent to Veolia for haulage to Homestown Landfill in Wexford.

1.2.3 Site Capacity

The site has been in operation in the region of 40 years. The total volume of waste deposited to date is estimated to be 1,094,513m³.

The last area of landfilling was located in the new cell constructed in 2002/2003 located at the northern end of the landfill.

1.3 Engineering Details

1.3.1 Site Description

Kilbarry landfill is located on the outskirts of Waterford City. The landfilling of waste has primarily taken place in unlined cells. Only one lined cell was constructed on site and landfilling has been ongoing in this cell since June 2003. Once this cell was full landfilling operations ceased at the site in August 2005. The landfilling has resulted in the creation of a waste mound up to 20m in height.

A description of the existing situation for each component of the specified engineering works is provided below with details of the proposed works and timescale for completion of the future work.

1.3.2 Fencing, Gates and Other Security

Fencing is installed around the full perimeter of the site. The fencing is a palisade fence, 2.4m high. With the closure of the site the fencing is no longer of intrinsic security value except while works are ongoing onsite for the final capping and gas abstraction systems. The future use of the site is envisaged to be a park landscaped with respect to the NHA bog to the south and the fencing may not be required due to its visual impact.

As per Condition 4.3.2 of the waste license, the facility manager will ensure that any temporary repairs to gates/fencing will be carried out where necessary, before the end of each working day and final repairs will be carried out within three working days. It is the responsibility of the facility manager (or other nominated person) to ensure that all gates shall be locked shut when the facility is unsupervised.

Site lighting is provided at the civic amenity area, which also lights the area around the weighbridge and the site office.

1.3.3 Leachate Management System

A leachate collection trench was installed around the perimeter of the site in 2002/2003. This trench was designed so as to prevent any leachate migrating off site and pump it to the leachate lagoon. The trench is a minimum of 1.2m in depth and 1m wide. The outer wall and floor of the trench are lined with 2mm thick HDPE liner. Perforated pipes run along the floor of the trench to carry any leachate which is collected and the trench is backfilled with a non-calcareous, granular, rounded stone, 16-32mm in size. The collection trench drains to five sumps located at various intervals around the perimeter of the site. The leachate is then pumped from these sumps to the leachate lagoon.

10 leachate abstraction boreholes were installed in the main body of the waste. Leachate is pumped from these boreholes to the leachate lagoon. A further three abstraction boreholes were installed in 2008.

A leachate lagoon was constructed north of the new cell. The lagoon has an overall capacity of 3,670 m³ and allowing for a freeboard of 0.5m a capacity of 2,670m³. The lagoon is pumped directly to the sewer.

A monitoring system was installed on the outfall of the leachate lagoon in accordance with the waste license in 2005. This system monitors for flow, pH and methane. It also provides for a composite sampler that can be event controlled.

1.3.4 Construction of Lined Cell

Work began on the construction of a fully engineered lined cell in September 2002 and was completed in March 2003. The location of the cell is to the north of the site. The cell is made up of a number of different elements to ensure its integrity.

A subcell drainage layer 300mm thick was laid on the floor. Pipes were then laid in this layer to collect and carry any water that may arise. These pipes were then run underneath the western bank of the cell and into the adjoining stream. A 500mm layer of bentonite enhanced soil was then laid on the drainage layer and on the side slopes. The BES was batched on site and regularly tested in the site laboratory to ensure it could achieve the correct permeability. The BES was laid in two layers of 250mm each and compacted with a roller as it was laid. It was then tested using a nuclear densometer to ensure that it had achieved the correct moisture content and density.

A 2mm thick HDPE plastic liner and an 8mm thick geotextile were then laid over the bentonite layer. Over these a 500mm thick leachate collection blanket was laid. This consisted of a non-calcareous granular, rounded stone, 16-32mm grain size. A network of perforated pipes was placed through this collection blanket to collect and carry leachate arisings to the leachate sump. The leachate is then pumped from the sump to the leachate lagoon and on the sewer.

The cell was completed in March 2003 and waste was first placed in the cell on the 6th June. The cell was filled and the landfill closed in August 2005.

1.3.5 Surface Water Ponds

Three surface water ponds have been installed on the site. These ponds were operational while the site was. Since closure and the completion of final capping the surface water management system has become redundant and needs to be reinstated for the new levels onsite. A surface Water Management Plan was submitted to the Agency in April 2008. This was accepted by the Agency in a letter dated 26/11/08. Based on this contract documents were drafted in consultation with National Parks and Wildlife Services for the installation of a new surface water management system which compliments the use of the site as a public park. A further surface water pond was installed to the south of the landfill as part of this contract. These works were completed in early 2011.

1.3.6 Dry Wheel Shakeout Grid

The dry wheel shake out was located north of the metals recovery compound and was completed in late November 2002. All vehicles leaving the facility first passed over the grid.

The shakeout grid occupied an area of 10m by 4m. As a vehicle travels over the grid, dirt and grit were loosened from the wheels and fell into a chamber below. The spoil was later removed from the chamber below. A power wash could also be used in tandem with the

shakeout grid in particularly bad weather. This shakeout grid has been filled in since completion of all restoration works on site as it is no longer necessary for the operation of the CAS.

1.3.7 Groundwater Monitoring Boreholes

The following is the list of groundwater monitoring boreholes that are now in operation at the site: GW2, GW4, GW5, GW6, GW16 (artesian), GW25 and GW29.

Monitoring of groundwater levels is undertaken weekly and sampling occurs quarterly with a more comprehensive analysis on an annual basis.

1.3.8 Leachate

A total of six boreholes were originally installed at the landfill, LM1 – LM6. However over time landfilling operations damaged a number of the boreholes. The damaged boreholes were replaced and an extra two were also installed. However a further two, LM2 and LM3 were damaged at some point prior to the commencement of final capping. During the capping works LM7 and LM8 were buried due to their low levels. For most of the year there was only one operational leachate monitoring borehole, LM1, due to capping works preventing access to the others. There are now currently four operational boreholes on site, LM1, LM4, LM5 and LM6.

Leachate levels are monitored on a weekly basis.

Analysis of the composition of the leachate is undertaken at quarterly intervals for a limited range of parameters with a more comprehensive analysis on an annual basis.

1.3.9 Gas Monitoring Boreholes

82 no. gas abstraction wells have been installed for the active extraction and flaring of gas from the site. These wells can also be used to monitor the gas production in the waste body during field balancing.

Perimeter monitoring: LM1, GW2, GW4, GW5, GW6, GW7, GW9, GW12, GW15, GW17. Three temporary monitoring points GW19, GW20 and GW21 are now inoperable due to works adjacent to the landfill site. 8 new monitoring points have been established on the western perimeter between the landfill and the closest residential houses in Lacken Wood estate. These number GW22 to GW29.

1.3.10 Surface Water

The waste license requires the monitoring of surface water quality at the following locations,

- At monitoring points S1 to S9 inclusive,
- EPA monitoring locations 0300, 0330, 0350 and 0400.
- Water quality monitoring including biological monitoring of the John's River and the Lisduggan Stream and other unnamed watercourses and tributaries upstream and downstream of the facility.

1.3.11 Ecological Monitoring

Annual ecological monitoring is required to include an ecological survey of habitats and associated plant and animal communities within and adjoining Kilbarry Bog proposed NHA.

1.3.12 Noise

Noise monitoring is required at 14 locations in the vicinity of the landfill (B1, B2, B3, B4, B5, B6, B7, NSL2, NSL3, NSL4, NSL5, at the nearest noise sensitive location on the western boundary between NSL3 and NSL5 which has been taken as Templers Hall housing estate, at the nearest noise sensitive locations in residential areas to the south-east and north-east of the eastern facility boundary which have been taken as Avondale housing estate and the Regional Sports Facility respectively.

1.3.13 Dust

Dust monitoring is required at seven locations around the perimeter of the site. It is required three times annually, twice between the months of May and September.

1.3.14 Odours

Odour monitoring is required on a quarterly basis at seven locations in the vicinity of the site. Odour Ireland carry out all odour monitoring required.

1.3.15 Final Capping

Final capping commenced in the October of 2005. There is currently 100% of the landfill area capped to its final levels..

The proposed phasing of the restoration works is as follows:

Table 6: Phasing of the restoration works

Component	Commencement	Completion
Completion of liner and final capping	October 2005	June 2008
Completion of gas abstraction system	November 2006	April 2008
Installation of Permanent Flare	October 2009	October 2009
Installation 3 new leachate wells	January 2008	April 2008
Surface Water Management	September 2010	January 2011
Landscaping	March 2011	April 2012

1.4 Site Operation

1.4.1 Description of the operations

The landfilling of waste has ceased at Kilbarry but a Civic Amenity Site operates at the old landfill entrance to the North of the overall site. Materials accepted here are :

- Timber
- Cardboard
- Batteries

- Engine oil
- Cooking oil
- Textiles
- Aluminium cans
- Glass bottles
- Fluorescent tubes
- Energy saving lightbulbs
- Metal
- W.E.E.E.

1.4.2 Site Opening and Operation Hours

The hours of operation of the Civic Amenity Site are between 11.00am and 4.30pm, Monday to Friday and 11.00am to 2.00pm on Saturdays.

1.4.3 Access

All personnel and vehicles entering the site are required to stop at the weighbridge which is located adjacent to the site entrance gate and report the purpose of their visit to the weighbridge operator. The weighbridge operator then directs vehicles to the relevant area. Public access to the site is limited to the civic amenity area and the metals recovery compound only.

Only personnel who are involved in monitoring, or otherwise authorised by the facility manager shall be permitted access to the landfill area outside the civic amenity/metal compound areas. Access to the site outside of normal working hours is not permitted unless authorised by the facility manager.

1.4.4 Waste Acceptance

All waste entering the facility is subject to the acceptance procedures. All staff involved in waste acceptance at the site are trained in the waste acceptance procedures.

Cars and trailers including light vans carrying materials for recycling or disposal shall be directed to the civic amenity area. The site caretaker shall be responsible for ensuring that the area is kept tidy and that the goods for recycling are placed in the correct collection area.

1.4.5 Control of Nuisances

1.4.5.1 Litter Abatement Measures

It is the responsibility of the facility manager to ensure the prevention of the spread of litter. Regular monitoring and site inspections are carried out to this end.

Contractors transporting materials for recycling offsite are required to ensure that when transporting and discharging these loads that litter is kept to an absolute minimum. All vehicles are required to be totally sealed or covered with a net or tarpaulin to ensure that materials are not blown from the vehicles.

Routine litter patrols are carried out on a daily basis to ensure that any loose litter is collected, this shall include the area surrounding the landfill, all fences and the approach road to the site.

1.4.5.2 Birds

Birds are no longer a nuisance at the site since the landfill closed.

1.4.5.3 Vermin

A contract is in place with Rentokil Ireland. A programme of baiting can be employed as required to control rat infestations with preventative baiting at regular intervals to ensure that large populations do not become established.

1.4.5.4 Flying Insects

This does not pose a nuisance since the closure of the landfill.

1.4.5.5 Fires

The burning of waste or other material is not permitted at the facility. Hot or burning loads of waste arriving at the facility are rejected. In the event that a fire breaks out on the site it is treated as an emergency and dealt with immediately.

1.4.5.6 Odour Control

Odour monitoring is carried out at quarterly intervals and the results for 2008 are contained in Appendix V. There were no odour complaints in 2008 and to date there have been no complaints or results of significance from monitoring.

1.4.5.7 Dust Control

Dust control measures will be employed during the construction/installation of specified engineering works. A mobile sprayer is employed to control fugitive dust emissions from the movement of vehicles during dry and windy weather. This is achieved through the spraying with water of site roads and any other areas used by vehicles. Speed restrictions shall also apply to construction vehicles within the landfill. The results for the dust monitoring for 2008 are contained in Appendix V.

1.4.6 Wheel – Cleaning Procedures

A dry wheel shake out unit has been installed to the north of the metals recovery compound. All vehicles shall be required to pass through the unit on the instruction of the site caretaker prior to exiting the site. The site caretaker shall make an assessment as to the need for the vehicle to pass through the unit based on the site conditions at the time.

1.4.7 Emergency Response Procedures

The emergency response procedures for the facility are contained in Appendix X as part of the overall Environmental Management System

1.4.8 Awareness and Training

An ongoing training programme has been set up to ensure that staff involved with the facility are sufficiently trained in achieving compliance with the conditions of the waste license. The programme is maintained and updated as required.

1.4.9 Communications Programme

A communications programme has been set up in order to allow any local community groups or local resident's access to information concerning the environmental performance of the facility at all reasonable times.

1.4.10 Environmental Monitoring & Maintenance Procedures

Monitoring shall be undertaken at such locations and parameters as outlined in Schedule F: Monitoring of the waste license and as specified in Condition 9. All monitoring is to be carried out in accordance with the EPA Manual on Landfill Monitoring.

The facility manager shall be responsible for implementing the following:

- The monitoring and recording of landfill gas using an infrared gas analyser at the gas monitoring locations specified in the waste license. All monitoring equipment shall be calibrated, maintained and operated in accordance with the manufacturers instructions. Written records of the calibrations and maintenance shall be kept. All equipment used for monitoring landfill gas shall be certified as being intrinsically safe.
- If a gas concentration reading at the site office exceeds the emission limit specified in Schedule G, the Emergency Response Procedures will apply.
- The visual inspection on a weekly basis of surface water monitoring locations as outlined in Schedule F: Monitoring
- The monitoring and recording of leachate levels within the filled waste on a weekly basis.
- Recording of data from the agreed climatological station on a monthly basis.
- The provision of safe and permanent access to all on-site sampling and monitoring points and off-site points.
- The maintenance and clear labelling of all sampling points.
- The replacement of all monitoring infrastructure which proves to be unsuitable for its purpose.

Upon the written instruction of the Agency only the facility manager shall amend that frequency, locations, methods and scope of monitoring, sampling, analyses and investigations and shall provide information concerning such amendments as may be requested in writing by the Agency.

The facility manager shall be responsible for forwarding copies of all environmental monitoring data to the Agency at the frequencies set out in schedule D of the waste license.

In accordance with Condition 9.18 monthly inspections of the landfill for evidence of slippage shall be undertaken.

1.4.10.1 Emission Limits

Any exceedance of the trigger levels for emission limits as listed in Schedule G of the waste license shall be deemed an incident and documented in accordance with Condition 3.2 and 10.7 (a to e) of the waste license and reported to the Agency (and the Southern Regional Fisheries Board if necessary) by the facility manager in accordance with condition 3.3.

1.4.10.2 Annual Environmental Report

The facility manager shall prepare and submit to the Agency for its agreement the annual environmental report. In accordance with Condition 2.4 the facility manager shall submit the annual environmental report within one month of the end of each calendar year.

The facility manager shall ensure that the annual environmental report is prepared in accordance with any relevant written guidance issued by the Agency and includes at a minimum the information specified in Schedule C: Content of Annual Environmental Report.

1.4.11 Operational & Safety Rules Including Safety Statement

The general safety statement of Waterford City Council applies to operation in the Kilbarry Landfill. Regarding work to be constructed by outside contractors each contractor shall provide a specific safety statement and be appointed Project Supervisor Health & Safety as required by the Health, Safety & Welfare at Work Regulations 1995.

1.5 Closure & Aftercare

1.5.1 Final End Use of Site

The site has been turned into a public park.

A layout of the park is contained in Drawing 4 in the Appendices.

1.5.2 Aftercare Monitoring

The EU Directive on the Landfill of Waste (1999/31/EC) and the guidance published in the Agency's Landfill manual "Landfill Restoration & Aftercare" requires that the operators of landfill site continue to monitor the groundwater, surface water, leachate and landfill gas after the closure of the site.

The site management shall ensure that the aftercare programme for Kilbarry Landfill will include stability assessment of the side slopes including slope stabilisation measures if required, monitoring of groundwater quality, leachate composition, surface water quality and landfill gas composition. The monitoring is to be carried out in accordance with the requirements of the EPA Manual on Landfill Monitoring. The following programme is proposed for the initial monitoring subsequent to the closure of the site. The proposed monitoring frequencies are outlined in Table 8 (based on EPA Landfill Monitoring Manual recommendations). The programme shall be reviewed on an annual basis.

Medium	Parameter	Frequency
Surface Water	Composition	Six monthly
Groundwater	Levels Composition	Six monthly

Landfill Gas	Gas Emissions	Six monthly
Stability & Settlement		Annually
Leachate	Levels	Six monthly
	Composition	Six monthly

Sampling to be carried out at representative locations.

1.5.3 Maintenance Programme for Aftercare Phase

It is proposed that maintenance shall be carried out as required at the site. Maintenance of the following equipment is envisaged during the aftercare period.

- Leachate pumps in collection sumps and abstraction wells
- Gas flarestacks and abstraction system
- Fencing and gates

It is recommended that the above items are inspected on a regular basis (minimum six monthly) and that maintenance shall be carried out as required.

2013 Schedule of Objectives and Targets

Prepared by: Vincent O'Shea, Facility Manager

Date: March 2013

Approved by: Mr. Richard Walsh, Director of Services, Waterford City Council

	Target	Plan	Responsible Party	Timescale (for completion)
Objective 1 To establish site infrastructure as required by Licence Conditions	Repair all defects in the existing site gates and fences.	Regular inspections are carried out of gates and fencing.	Facility Manager	Within three working days of defect.
	Install active collection and flaring system for landfill gas.	Active gas collection system and permanent flare installed.	Facility Manager/ Consultant Contractor	Completed.
	Investigate utilisation of landfill gas	Utilisation not feasible.	Facility Manager/ Consultant	Completed.
	Surface Water Management	Install system as proposed	Facility Manager Consultant Contractor	Completed.
	Landscaping	Suitable tree and shrub planting required on the perimeter of the facility and for final capping/restoration.	Horticulturist	Completed.
	Permanent Enclosed Flarestack	Install flare and connect to gas abstraction system	Facility Manager Contractor	Completed

2013 Schedule of Objectives and Targets

Prepared by: Vincent O'Shea, Facility Manager

Date: March 2013

Approved by: Mr. Richard Walsh, Director of Services, Waterford City Council

	Target	Plan	Responsible Party	Timescale (for completion)
Objective 2 Management & Operation of the Facility	Develop written waste acceptance procedures and ensure all staff are familiar with same.	To minimise nuisance and ensure only permitted material accepted for recycling.	Facility Manager & Compactor Operator	Reviewed annually
	Objective 3 To Prevent Environmental Nuisance & Emissions	Implement Litter Control Measures	To maintain litter control measures	Facility Manager Site Staff
	Dust Control	To maintain dust control measures.	Facility Manager Site Staff	Ongoing
	Vermin Control:	Contract with Rentokil Ireland.	Facility Manager	In Place
	Continue existing gas monitoring program.	Continue with existing monitoring programme	Facility Manager	On Going
	Continue existing leachate monitoring program.	Monitor changes in the composition of the leachate with time.	Facility Manager	On Going
	Monitor dust control measures during construction works at the facility.	Dust control measures to be implemented on site during all construction works at the facility.	Facility Manager	On Going

2013 Schedule of Objectives and Targets

Prepared by: Vincent O'Shea, Facility Manager

Date: March 2013

Approved by: Mr. Richard Walsh, Director of Services, Waterford City Council

	Target	Plan	Responsible Party	Timescale (for completion)
Objective 4 Promotion of Waste Recycling	Make public aware of recycling initiatives, techniques and current methods as well as materials accepted at Kilbarry	Promotion through local newspapers, radio, school talks and information leaflets.	Environmental officer Facility Manager	Ongoing
Objective 5 To improve the Environmental Performance	Establish an Environmental Management System	To monitor the facility's environmental performance.	Facility Manager	Reviewed Annually
	Prepare the Annual Environmental Report	Summarise the results of environmental monitoring programme and assess facility's progress towards achieving its objectives and targets.	Facility Manager Consultant	March 2014
	Reduce non-compliance	Carry out site inspections.	Facility Manager Site Supervisor	Ongoing

2013 Schedule of Objectives and Targets

Prepared by: Vincent O'Shea, Facility Manager

Date: March 2013

Approved by: Mr. Richard Walsh, Director of Services, Waterford City Council

	Target	Plan	Responsible Party	Timescale (for completion)
	Improve environmental monitoring programme	Continue and expand groundwater, surface-water, leachate & landfill gas monitoring to ensure complete compliance with license.	Facility Supervisor Facility Manager	Ongoing.
	Reduce risk of gas migration	Install active gas abstraction system and flare. Also gas utilisation system to be assessed.	Facility Manager Consultant Contractor	Gas abstraction system completed. Utilisation unfeasible.

2013 Schedule of Objectives and Targets

Prepared by: Vincent O'Shea, Facility Manager

Date: March 2013

Approved by: Mr. Richard Walsh, Director of Services, Waterford City Council

	Target	Plan	Responsible Party	Timescale (for completion)
Objective 5 To improve the Environmental Performance (Continued)	Reduce visual impact	Landscaping of site into a public amenity park.	Horticulturist	Completed.
	Control dust emissions	Monitoring	Contractor	Quarterly
		Spray roads during dry weather	Facility Manager	Ongoing
		Operate and maintain wheelwash	Facility Manager	Ongoing
		Enforce speed limits	Facility Manager	Ongoing
	Litter control	Daily litter inspections	Facility Supervisor	Ongoing
	Reduce emissions to surface water	Install management system	Facility Manager	Completed.
	Reduce emissions of leachate from unlined waste body	Maintain leachate collection system.	Facility Manager Contractor	Ongoing

2013 Schedule of Objectives and Targets

Prepared by: Vincent O'Shea, Facility Manager

Date: March 2013

Approved by: Mr. Richard Walsh, Director of Services, Waterford City Council

	Target	Plan	Responsible Party	Timescale (for completion)
	Reduce long-term impact	Restoration & Aftercare Plan.	Senior Engineer	After landscaping.
Objective 6 To Monitor Management of Facility	Environmental Management System	Environmental Management System developed and included in this submission.	Facility Manager	Reviewed annually
	Environmental Management Programme	Environmental Management Plan established and included in this submission.	Facility Manager	Reviewed Annually
	Establish & Maintain Corrective Action Procedures	Procedures have been developed and are included in this submission.	Facility Manager	Reviewed Annually
	Establish Awareness & Training Procedures to identify training needs.	Procedures have been developed by Waterford City Council.	Facility Manager	Reviewed Annually
	Establish Communications Programme to ensure public access to information	Details included in this submission.	Facility Manager	Reviewed Annually
Objective 6 To Monitor Management of Facility (continued)				
	Record keeping to ensure proper site management	Written Records to be kept.	Facility Manager	Ongoing

3.0 Corrective Action Procedures

Throughout the operation of the landfill facility, there will be a need to resolve any non-compliance's of the waste license that may arise as a result of problems with operation, complaints from the local community, non-conforming subcontractors etc. This procedure defines the approach that will be taken in implementing and evaluating corrective action to prevent the recurrence of non-compliance's. The purpose of this procedure is to ensure that all corrective actions are documented and that the EPA are notified of any incident.

Responsibilities

The facility manager will be responsible for co-ordinating the corrective action procedures for Kilbarry Landfill and is responsible for retaining the corrective action file and forms. The Senior Engineer will be responsible for the review of corrective action forms and ensuring that controls are applied to ensure that corrective actions are implemented and effective. The landfill operational staff shall be responsible for following the procedure.

Corrective action is required in the event of the following:

- Any emission which results in the contravention of any relevant standard, including any standard for an environmental medium, or any relevant emission limit value, prescribed under the relevant enactment.
- Any emission which does not comply with the requirement of the license.
- Any trigger level specified in the license or in the EMS which is exceeded.
- Any indication that environmental pollution has, or may have taken place.
- Any occurrence with the potential for environmental pollution.
- Any emergency.
- Any incident which requires preventative action.
- Any failure to comply with procedures or systems.

Procedures

In the event of a non-compliance or incident occurring, the facility manager shall:

1. Take necessary short-term action to prevent the immediate reoccurrence of the problem or minimise any further impact.
2. Conduct a thorough investigation of the root cause of the problem to identify the nature, source and cause of the incident and any emission.
3. The person reporting the incident will identify the date, time and place of the incident. In the event that any monitoring, sampling or observations indicating that an incident has, or may have occurred the facility manager will be immediately notified.
4. Document the results of the investigation and propose a long-term corrective action to prevent recurrence of the problem on the corrective action form.
5. Enter the corrective action into the corrective action register.
6. Submit the completed corrective action form to the Senior Engineer who shall review the recommendation and accept or require additional investigation. If additional investigation is required the form and attachments will be returned to the facility manager, who will continue with the investigation as detailed by the Senior Engineer. If the recommendation is acceptable the facility manager will implement the corrective action.
7. Monitor the success of the corrective action.

8. Document the evidence that was reviewed to determine the effectiveness of the corrective action on the corrective action form.
9. File the original corrective action and any accompanying paperwork in the corrective action form and copy the completed form to the Senior Engineer.
10. Notify the EPA.
11. Implement changes in procedure resulting from the corrective action.
12. Arrange staff training if required.

Corrective Action Form

Non-compliance:

Briefly describe what the root cause of the problem was after your investigation

Name of investigator:

Signature:

Date:

Short-term Corrective Action:

Briefly describe the immediate action that was taken to prevent further impact

Action taken by:

Signature:

Date:

Long-term Corrective Action:

Briefly describe recommended action to prevent recurrence

Details of further investigation if necessary:

Approved By:

Responsibility assigned to:

Date:

Review of Monitoring:

Briefly describe the evidence that was reviewed to determine the effectiveness of the corrective action

Signature:

Date:

4.0 Awareness and Training Procedures

Purpose

The purpose of this procedure is to identify and provide appropriate training needs for all personnel whose work is related to the operation of Kilbarry Landfill. It shall ensure that personnel are aware of the potential hazards and environmental impacts associated with their work on the landfill.

The operation of a modern landfill requires staff to have the relevant knowledge, training and experience in order to minimise the potential impacts of the landfill on the surrounding environment and to meet the requirements of the waste license and all relevant legislation.

Responsibility

The facility manager will be responsible for the following:

1. To identify and assess the training needs of all staff involved in the operation of the landfill.
2. To ensure that each employee receives the necessary training relating to his or her work procedures.
3. To ensure that contractors have received the relevant training prior to work on the landfill.
4. To organise all training courses.
5. To increase employee awareness of potential hazards and necessary precautions.
6. To ensure that all staff are provided with the necessary instruction and training to carry out their work having due regard to their safety, the safety of others and the public at large and also to ensure that best practice is followed in every respect of the landfill operation.

Procedure

The facility manager shall:

1. Set up a register of all training programmes completed by personnel involved in the operation of Kilbarry landfill.
2. Identify the training needs of staff based on their work procedures.
3. Research suitable training programmes and forward details to Senior Engineer for approval.
4. Organise staff to attend training programmes.
5. Ensure additional training will be provided when new procedures are established, new equipment is obtained or at any time a change in the employees working environment may create a potential hazard.

Documentation

Completion of the training for each individual will be documented on a separate form and maintained by the facility manager to ensure that each member of staff is provided with the information they are required to have to perform their job safely.

5.0 Communications Programme

The communications programme shall ensure that members of the public can obtain information concerning the environmental performance of the facility at all reasonable times.

Introduction

Council Directive 90/313/EEC on the Freedom of Access to Information on the Environment recognised the significance of the public's access to information relating to the environment. To ensure that members of the public can obtain information concerning the environmental performance of Kilbarry landfill the communications programme described below shall be implemented at the facility.

The purpose of this programme is to allow any local community groups, key interest groups, local residents and members of the local community access to information on matters relating to the environmental performance of Kilbarry Landfill. This in turn will address any local community concerns and allow the public the opportunity to provide feedback on the facility.

Programme:

1. All requests concerning the environmental performance of the facility should be made in writing to:
Vincent O'Shea,
Facility Manager,
Kilbarry Landfill,
Kilbarry,
Waterford City.
2. The facility manager shall copy all requests to:
Colette Byrne,
Director of Services,
Waterford City Council,
Environment & Water Services Dept.,
Maritana Gate,
Canada Street,
Waterford.
3. Each request should indicate the name, address and contact telephone number of the concerned party, an outline of the information required and the manner in which they require the information.
4. If requested, a suitable member of staff will provide a clear, unbiased explanation of the information provided.
5. The Director of Services or other authorised, nominated representative in Waterford City Council or any other nominated person will deal with replies to requests made by the media for information relating to the environmental performance of the landfill.

Record Keeping

1. All records of request for information regarding the environmental performance of the landfill and all minutes of meetings with concerned parties and details of site visits/open days shall be maintained. All of the aforementioned files shall be stored at the site office at Kilbarry Landfill and at the offices of Waterford City Council, Planning & Environment Department.

6.0 Waste Acceptance Procedures

Kilbarry Landfill comprises of a closed landfill site and a civic amenity centre for recycling for a limited number of streams of waste.

The following procedures have been put in place for waste acceptance by Waterford City Council:

Household Waste:

Household waste in Waterford City is collected by the City Council and transferred to Veolia, Six Cross Roads Depot for transport to Powerstown Landfill in Carlow. There is a crush loader bin lorry kept onsite for any household waste that is brought direct to the civic amenity site by the public. When the waste arrives at the landfill the weighbridge operator instructs the member of the public that it must be bagged if it is not already and that there is a charge of 1 black bin tag per bag of waste.

Following a cursory visual inspection the householder is to be directed to the refuse lorry located in the civic amenity centre where he/she can dispose of the waste. If the weighbridge operator suspects that the load may contain unacceptable material (e.g. recyclables) a more thorough examination is to be carried out. If recyclable material is found that can be disposed of in the C.A. site the householder is to be directed to the appropriate location. If material is found that can neither be disposed of or recycled on site the householder should be instructed to remove said material off-site.

Fridges:

Fridges are a hazardous waste. Fridges are only stored on site before being transported off-site by KMK Recycling for correct disposal. When a householder arrives on-site he/she should be instructed to leave the fridge in or next to one of the two containers for the fridges. Every evening any fridge's that have been deposited that day should be moved into the container if not already done. If the container is nearing full KMK should be contacted and a collection organised.

Small W.E.E.E. :

Anyone bringing small electrical goods to Kilbarry should be directed to the cages for same inside the container in the Civic Amenity Site. These cages are emptied roughly once a week by KMK.

Large W.E.E.E.:

Large white electrical goods are to be stored in the metals compound in a neat and tidy manner for collection. The compound should be checked every evening and morning for signs of vandalism or dumping. Regular collections by KMK are essential to maintaining the compound in a clean and tidy state.

Commercial Waste:

There is no commercial waste of any type to be accepted at Kilbarry Civic Amenity Site.

Cardboard:

Householders bringing cardboard to the Civic Amenity Site should be directed to the compactor onsite and accompanied by a member of staff. The staff member should inspect the cardboard for contamination and remove any waste not suitable for compaction. This can be bagged and charged as per normal domestic waste. The cardboard should be placed into the compactor while it is not operating. Once the hopper is full the staff member should close the hopper and open the control mechanism locked in the compartment on the wall beside the compactor. The staff member can only operate the compactor whilst keeping the emergency stop button control in his hand at all times. The control must be locked away again once the

hopper is empty and ready for more cardboard. The control mechanism must never be left unlocked and accessible to the public.

Other Recyclables:

The following materials are accepted for disposal at the recycling centre:

Aluminium cans

Glass bottles

Untreated timber

Paint Tins

Batteries

Waste oil

Fluorescent tubes

When a person comes in wishing to recycle they should be directed to the appropriate location. If a person wishes to dispose of waste oil a City Council staff member should dispose of it for them.

7.0 Emergency Response Procedures

Condition No: 10.1 Emergency Response Procedures

Condition: The licensee shall, within six months of the date of grant of this licence, submit an updated written Emergency Response Procedure (ERP) to the Agency for its agreement. The ERP shall address any emergency situation which may originate on the facility and shall include provision for minimising the effects of any emergency on the environment.

7.1 Scope / Objective

Condition 10.1 of Waste Licence No. 18-1 granted to Waterford City Council for Kilbarry Landfill site by the Environmental Protection Agency (EPA) requires the City Council to prepare an Emergency Response Procedure (ERP). The ERP will apply to Kilbarry Landfill Site and describes the actions to be taken in the event of a site emergency.

The purpose of this procedure is to propose appropriate actions to ensure health and safety risks to employees and visitors, and damage to property and the environment is minimised.

7.2 Responsibility

This document describes the ERP for the Kilbarry Landfill Site. The ERP will be maintained at the landfill site by the Landfill Engineering Manager. He will be responsible for the implementation of this procedure.

The Landfill Deputy Managers, Weighbridge Clerk and all Waterford City Council employees at the site will be responsible for following this procedure. Changes to the ERP will not be made without written approval from the Agency.

In the event of an emergency the EPA must be notified. The contact details are shown below:

**Ms. Emer O'Reilly,
Environmental Protection Agency,
PO Box 3000,
Johnstown Castle Estate,
Co. Wexford.
Tel: 053 60600
Fax: 053 60699**

7.3 Definition

Emergency

An emergency is defined as an unforeseen or sudden occurrence demanding immediate action.

7.4 Circulation List

The ERP is distributed to those named below and is available for reference from the Landfill Engineering Manager whose copy will be maintained at the site office. In order to maintain control of the procedures within the revision process, the ERP should not be copied without permission from Ms. Colette Byrne, Director of Services. Persons using this document are responsible to ensure that they are using the most up to date version.

	Position
Richard Walsh	Director of Services
John Nolan	Senior Executive Engineer
Vincent O'Shea	Landfill Manager

7.5 Procedures

7.5.1 Emergency Response Procedures

1. Emergencies can be:-
 - activation of site office fire or gas alarm
 - discovery of a fire within the site boundary
 - landfill gas detected exceeding safe operating levels within the site boundary or outside the site
 - explosions
 - flooding
 - uncontained spillage / leakage
 - major injury or dangerous occurrence
2. In the event of an emergency all employees should react promptly and calmly, following the guidelines outlined in this document.

7.5.2 Activation of Office Fire or Gas Alarms

1. The site's offices is fitted with fire and gas detection systems. The landfill gas concentration limits are 1% v/v for methane and 1.5% v/v for carbon dioxide. The gas alarm will sound if gas is detected above these specified limits and the smoke alarm will sound if smoke is detected in the office.
2. On hearing an alarm all personnel must evacuate the offices, closing all windows and doors behind them, if practical.
3. All personnel should proceed to the assembly point outside the front gates where employees, site visitors and site contractors will be accounted for (the site visitors book and contractors sheets should be checked if accessible).
4. The emergency services should be notified immediately by dialling 999 if it is suspected a fire has broken out or if the fire alarm sounds. Personnel should only tackle a fire if safe to do so and if they have been trained in the use of a fire extinguisher.
5. If the alarm is legitimate, the Landfill Engineering Manager should be notified as soon as is practicable.
6. The EPA should be notified as per condition 3.3 of the waste license (contact details above) and the incident should be recorded in the site incident report form.

7.5.3 Procedure for Dealing with Hot or Burning Loads

1. If on inspection a load is found to be hot or burning it should be refused admission to the site.
2. Details of the load (name, registration number, type of load, site of origin) should be recorded in the appropriate register retained in the site office.
3. If the load has entered the site, prior to deposition, it should be directed to the Quarantine area, away from the Civic Amenity Site to a location where the material can be extinguished. These loads must never be located close to areas of the site which are lined in case of heat damage to the liner.
4. If the load has been deposited it should be spread in a controlled manner and covered with inert material. This should always be carried out by working from the edges of the load inwards toward the centre. Machines must never be driven through the burning material.
5. The EPA should be notified as per condition 3.3 of the waste license (contact details above) and the incident should be recorded in the site incident report form.

Refer to 7.5.4 for dealing with fires.

7.5.4 Procedure for Dealing with Fires and Explosions on Site

The EPA should be notified of all fires and explosions on site.

1. **Procedure for Dealing with Fires**

The Landfill Engineering Manager or deputy should be informed immediately. The previous procedure for fires assumed an operational landfill. Since the closure of the landfill and installation of the gas abstraction system the possibility of a fire in the waste is greatly reduced. The following is the procedure for any fires within the existing site.

- a) All personnel must evacuate the offices. The emergency services should be notified immediately by dialling 999. Personnel should only tackle a fire if safe to do so and if they have been trained in the use of a fire extinguisher
- b) All personnel should proceed to the assembly point outside the front gates where employees, site visitors and site contractors will be accounted for (the site visitors book and contractors sheets should be checked if accessible).
- c) The EPA should be informed as per Condition 3.3 of the Licence (contact details above) and the incident should be recorded in the Site Incident Report Form.

2. **Procedure for Dealing with Explosions**

- a) Ensure all personnel and site visitors are accounted for.
- b) Check site for signs of fires resulting from the explosion. If identified follow the procedure in Section 1 above.
- c) If the explosion results in personal injury the emergency services should be called by the Landfill Engineering Manager or his appointed deputy in his absence. In the event of a fire refer to Section 1 above. In addition, the EPA should be notified as soon as is practicable.
- d) Access to the immediate area should be restricted. Under no circumstances should further waste be deposited until authorised by the Landfill Engineering Manager.
- d) Every effort should be made after (d) above to identify the cause and source of the explosion.
- f) The EPA should be informed as per Condition 3.3 of the Licence (contact details above) and the incident should be recorded in the Site Incident Report Form

7.5.5 Procedure for Dealing with Uncontained Spillage/Leakage

1. Immediately report the occurrence to the Landfill Engineering Manager or in his absence, his appointed deputy.
2. The spill/leak should be contained using the spill kit and the material recovered (if possible) by the most appropriate means available (plant, inert material etc.).
3. Access to the immediate area should be restricted, if necessary.
4. The EPA should be notified as soon as is practicable (contact details in Section 2.0).
5. Having carried out all practicable actions the EPA should be consulted to agree any further action which may be required.
6. The incident will be reported to the Site's Incident Report Form.

7.5.6 Procedure for Dealing with a Serious Injury

1. Immediately report the incident to the Landfill Engineering Manager or in his absence, his appointed deputy. If required, the emergency services should also be notified as soon as is practicable.
2. The immediate area should be kept clear to provide access for the emergency services.
3. Record all injuries in the accident book and note as much information about the accident as possible.
4. Report the incident to the Health and Safety Manager as soon as is practicable. The Health & Safety Officer is Mr. Chris O'Sullivan, telephone number 051 309934.
5. If practicable the area in which the incident took place should remain undisturbed until any investigations into the circumstances are complete.
6. The incident will be reported on the Site's Incident Report Form.

7.5.7 Procedure for Dealing with a Landfill Gas Emergency

The following plan has been drawn up in accordance with the guidelines outlined in WMP 27. Areas around Kilbarry Landfill which may be affected by migrating gas include the landfill site offices and surrounding houses.

1. The landfill site office is currently monitored for the presence of methane and carbon dioxide.
2. If concentrations of methane and carbon dioxide in the office exceed 2,500ppm (0.25% v/v) and 5,00ppm (0.5% v/v) respectively, the building shall be ventilated and monitored until it can be demonstrated that concentrations remain below these levels.
3. If concentrations of methane and carbon dioxide in the landfill office exceed 10,000ppm (1% v/v) and 15,000ppm (1.5% v/v) respectively, the alarm will sound and the building shall be ventilated and then evacuated immediately.
4. The alarm will deactivate when the gas levels fall below the above levels. The building should be left to ventilate for another 15-20 minutes and then re-entered wearing the appropriate Personal Protective Equipment (PPE) and monitored until it can be demonstrated that concentrations remain below 0.25% and 0.5% for methane and carbon dioxide respectively.
5. The residence at the front of the landfill should be contacted and gas samples taken from the house to ascertain gas levels. The contact for this residence is Ms. Ann Kennedy, Kilbarry, Tel: 087 6717516.
6. If the gas levels exceed those in Step 2 the building should be monitored until it can be demonstrated that concentrations remain below those levels.
7. If gas levels persist both the Gardai (Telephone no. 051 305300) and Bord Gais (Telephone no. 1850 205 050) should be contacted.

7.6 Unable to Accept Waste

The inability to accept waste may be caused by one of the following:-

- Mechanical failure;
- Power failure;
- Industrial disputes;
- Fire;

In the event of a mechanical breakdown of plant at the site the Landfill Engineering Manager will make arrangements for the prompt repair of the machine. If the repair work will be prolonged then the Manager will make arrangements for replacement equipment.

7.7 Review

The Landfill Engineering Manager will review the cause of the emergency and will put appropriate measures in place to prevent the reoccurrence of such an emergency.

Golder Associates Ireland

Town Centre House,
Dublin Road, Naas,
Co. Kildare,
Ireland

Tel: [353] (0)45 874411
Fax: [353] (0)45 874549
E-mail: info@golder.ie
<http://www.golder.com>



REPORT ON

**ENVIRONMENTAL LIABILITY RISK ASSESSMENT
AND FINANCIAL PROVISION FOR KILBARRY
LANDFILL SITE, DUNHILL ROAD, KILBARRY,
WATERFORD CITY, CO. WATERFORD**

Submitted to:

Mr. Vincent O'Shea,
Civil Technician,
Environmental Department,
Waterford City Council,
Maritana Gate,
Canada Street,
Waterford City,
Co. Waterford.

DISTRIBUTION:

2 copies - Waterford County Council
2 copies - Golder Associates Ireland (minimum 2)

February 2009

08 5071 90340 R01/A.0

REPORT ISSUE FORM

<i>Version Code</i>	A.0	<i>Issue Date</i>	6 th February 2009
<i>Document Title</i>	Environmental Liability Risk Assessment and Financial Provision for Kilbarry Landfill Site, Dunhill Road, Kilbarry, Waterford City, Co. Waterford		
<i>Comments</i>	Formatted by: LC		
<i>List of Authors</i>	Garrett Byrne, MSc. Environmental Geoscientist & Acoustic Consultant AMIOA		
<i>Client</i>	Mr. Vincent O'Shea, Waterford City Council		
<i>Client Reference</i>			
<i>Project Manager Approval</i>	Garrett Byrne, MSc. Environmental Geoscientist & Acoustic Consultant MIOA		
<i>Reviewer</i>	Thomas Vainio-Matilla MSc, PGeo, Eur Geol		
<i>Approval Signatory</i>			
<i>Report Distribution</i>	<i>Name</i>	<i>No. Copies</i>	
	Waterford County Council	2	
	Golder Associates Ireland	2	

Definition of Version Code:

- D. Applied during initial drafting of the report before it has been reviewed.
- C. Applied after the report has been reviewed but before it has been approved by the Project Manager.
- B. Applied after the Project Manager has approved the report ready for issue to the client.
- A. Applied to reports after external/client review.

The version number starts at '0' and is raised by '1' at each re-type.

TABLE OF CONTENTS

SECTION	PAGE
1.0 INTRODUCTION	1
2.0 SCOPE OF ENVIRONMENTAL LIABILITY RISK ASSESSMENT	1
3.0 SITE DETAILS.....	2
3.1 Geology	2
3.2 Hydrogeology.....	3
3.3 Activities Undertaken at the Site.....	3
4.0 ENVIRONMENTAL LIABILITY RISK ASSESSMENT	4
4.1 Step 1 - Initial Screening and Operational Risk Assessment	4
4.2 Step 2 - Closure, Restoration, Aftercare Management Plan (CRAMP) – Known Liabilities.....	6
4.3 Step 3 - Environmental Liability Risk Assessment (ELRA) – Unknown Liabilities.....	6
4.3.1 Identification of Environmental Hazards.....	6
4.3.2 Hydrocarbons/ Chemicals Stored on Site	6
4.3.3 Leachate.....	7
4.3.4 Landfill Gas	7
4.3.5 Dust Deposition	8
4.3.6 Noise	8
4.4 Identification of Environmental Pathways	8
4.4.1 Air.....	8
4.4.2 Groundwater.....	8
4.4.3 Surface Water.....	9
4.5 Identification of Environmental Receptors	9
4.5.1 Local Air Quality	9
4.5.2 Flora and Fauna	9
4.5.3 Local Population and Land Use	10
4.6 Identification and Assessment of Mitigation Measures	10
4.6.1 Lining System.....	10
4.6.2 Capping System	10
4.6.3 Landfill Gas Management System	11
4.6.4 Surface Water Management System	11
4.6.5 Identification and Assessment of Operational Control Measures	12
4.7 Conclusion	13
4.8 Step 4 - Financial Provision – Known and Unknown Liabilities.....	15
4.9 Known Liabilities	15
4.10 Financial Provision for <u>Unknown</u> Environmental Liabilities	15
5.0 REVIEW OF THE ELRA AND FINANCIAL PROVISION.....	15

LIST OF TABLES

Table 1	Environmental Risks at Kilbarry Landfill
Table 2	Environmental Risk Register
Table A1	Completed Environmental Liabilities Risk Assessment Tables
Table A2	Most Likely Cost Financial Model
Table A3.1	Risk Assessment Table - Likelihood
Table A3.2	Risk Assessment Table - Severity
Table A3.3	Risk Assessment Table – Overall Risk

LIST OF APPENDICES

Appendix 1	Completed Risk Assessment Tables
Appendix 2	Financial Cost Model
Appendix 3	Risk Assessment Tables
Appendix 4	Copy of Environmental Liabilities Insurance Policy
Appendix 5	Figures and Site Photographs

LIST OF FIGURES

Figure 1	Rev A – Site Location Plan
Figure 2	Rev A – Existing Site Conditions

1.0 INTRODUCTION

This document represents the methodology and findings of an Environmental Liability Risk Assessment (ELRA), undertaken for the Kilbarry Landfill, Dunhill Road, Kilbarry, Waterford City, Co. Waterford. The document has been prepared by Golder Associates Ireland Ltd (Golder) on behalf of Waterford City Council. The document has been produced in compliance with Condition 8 (Restoration and Aftercare) and condition 11 (Charges & Financial Provision) of Waste Licence Register No. W0018-01. It is noted that no mention to ELRA is made in the waste licence as it predates the concept. This ELRA has been produced in response to a letter sent by the Agency to all licensed sites on the 13th of August 2008 seeking to assess the take-up of the ELRA concept by EPA licensed sites.

In addition, the Environmental Liability Directive 2004/35/EC which seeks to provide for the prevention and remediation of environmental damage and gives form and substance to the polluter pays principle was consulted in the preparation of this ELRA. It seeks to promote good environmental practice by inducing those concerned to adopt measures and develop practices that minimise the risks of environmental damage and reduce their exposure to financial liabilities.

A Closure Restoration Aftercare Management Plan (CRAMP) was sent to the Agency in September 2003. According to correspondence (Ref: cb/ol/letters08) sent to the Department of Environment, Heritage and Local Government from Director of Services and Environmental Services at Waterford City Council, it is envisaged that restoration of Kilbarry Landfill will be completed by summer of 2009.

The methodology outlined in the EPA *Guidance on Environmental Liability Risk Assessments, Residual Management Plans and Financial Provision* as well as the EU draft regulations transposing the Environmental Liability Directive have been followed in the preparation of this document.

2.0 SCOPE OF ENVIRONMENTAL LIABILITY RISK ASSESSMENT

The scope of this has been developed using the EPA Guidance and includes the following:

- A review of the activities that were and are carried out at the site is presented in section 3.3;
- The initial screening approach is set out in section 4.1;
- An examination of the potential hazards, pathways and associated receptors is set out in section 4.3, 4.4 & 4.5;

- The Known and Unknown liabilities associated with the closure and capping of the landfill are presented in section 4.2 and 4.3 with detailed figures presented in Appendix 2;
- Examination and assessment of mitigation measures at the site are presented in section 4.6;
- Conclusions are set out in section 4.7;
- The financial provision element of the ELRA is dealt with in section 4.; and
- Figure 1 Rev A and associated site photographs are presented in appendix 5.

3.0 SITE DETAILS

Kilbarry landfill is located (National Grid Reference 2598E 1103N) on the outskirts of Waterford City on the Dunhill Road.

The entire site occupies an area of 20.1 hectares. Land use surrounding the site is a mixture of open flat farmland with wetland to the south-east. The area to the north and west of the site is a mixture of residential and commercial properties. The landfill was in operation for 40 years until its closure in 2005 and has since been capped and a gas management system has been installed. The landfill opened in the mid 1960's but didn't become very active until the 1970's. A mixture of commercial, domestic and mixed municipal waste was accepted at the site until 2003 under Waste Licence W0018-01 when commercial waste deposition ceased. Waste license W0018-01 for the site was issued on the 19th of October 2001.

The landfilling of waste at the site has resulted in the formation of a mound of waste above ground level. The waste body has a maximum height of 20mOD in the centre of the site. The remainder of the site has a maximum height of 17.5mOD and a base level of 2 m to 3 mOD on the edge of the site. The final stage of the landfill consisted of a fully engineered cell in the north of the site. This cell comprised a total void size of 35,000 m³ and was constructed between 2002 and 2004. According to figures supplied by Kilbarry Landfill management, the total estimated wastes deposited at closure amounted to 1,112,410 m³. A topographical survey drawing indicating the current (June 2008) conditions is presented in Appendix 5.

3.1 Geology

The geology of the City is vital to the natural environment of Waterford City as the geology shapes the landscape and determines the overlying soil types and vegetation, all of which is integral to supporting a diverse flora and fauna. The city of Waterford stands on a bedrock of

rhyolitic volcanic rock; slaty mudstone formed about 450 million years ago (mya), during the Ordovician period, and reddish sandstone and conglomerate from the Devonian “Old Red Sandstone”, (ORS), period about 350 million years ago.

The bedrock beneath the site is classified as a Regionally Important Aquifer using the classification system prepared by the Geological Survey of Ireland (GSI). The direction of groundwater flow is from the south to the north/north west. A well search identified that there are no beneficial users of groundwater within 500 m of the site and all of the residents within 1 km of the site are connected to the Public Kilbarry water supply.

3.2 Hydrogeology

The major local discharge zone for the recharge area is Kilbarry Bog in which the landfill sits. The remaining areas of the bog to the south and east are now form a National Heritage Area.

The primary receptors of the identified environmental hazards include groundwater, surface water and the atmosphere. The secondary receptors of the environmental hazards would include humans, flora, fauna and livestock.

3.3 Activities Undertaken at the Site

The following processes and activities have been undertaken at the site in accordance with Schedule A: Waste Acceptance of Waste Licence W0018-01.

- i. The disposal of non-hazardous household, commercial and industrial waste;
- ii. The disposal of de-watered non-hazardous industrial treated sewage sludge/filtercake;
- iii. The disposal of treated industrial non-hazardous sludges;
- iv. The disposal of construction and demolition waste;
- v. Waste for recycling and recovery at the Civic waste site; and
- vi. Waste for recycling and recovery at the metal recovery area.

Moreover, a civic amenity site is located within the main site entrance accepting the following range of wastes for recycling:

- Metal;
- Timber;
- Cardboard;
- Batteries;
- Engine oil;
- Glass bottles;
- Fluorescent tubes; and
- Energy saving light bulbs.

4.0 ENVIRONMENTAL LIABILITY RISK ASSESSMENT

In the following, an approach as described in the ‘*Guidance Environmental Liability Risk Assessment, Residuals Management Plans incorporating Financial Provision*’ (EPA, 2006) has been adopted to describe and assess the ELRA for the facility. The Guidance proposes a system whereby higher risk facilities can reduce their risk profile through risk management in order to reduce the costs of implementing financial provision.

A systematic step-wise approach is outlined in the Guidance and has been adopted into this document:

- *Step 1 – Initial Screening & Operational Risk Assessment*
- *Step 2 – Preparation of a Closure, Restoration and Aftercare Management Plan (CRAMP) for KNOWN liabilities*
- *Step 3 – Environmental Liability Risk Assessment (ELRA) for UNKNOWN liabilities*
- *Step 4 – Identification of Financial Provision (FP) and Instruments*

4.1 Step 1 - Initial Screening and Operational Risk Assessment

Environmental risk may be assessed by considering the probability of occurrence of a defined hazard and the magnitude of the consequences of that occurrence.

To characterise and assess the risks identified in step 1 the risk assessment model set out in the EPA’s Guidance Document has been employed.

The risk assessment scores presented in Table 2 are based on the risk assessment methodology contained in Appendix 3.

The rationale for the likelihood and severity weightings is presented in Appendix 1.

These assessments have been undertaken with consideration to the findings outlined in Step 1 of this report and are based on the residual risk posed by the landfill after assessment of the engineering and operational controls deployed at the site.

A register of the risks, which is based on the site specific characteristics and the Classification Tables for Occurrence and Severity included in the Agency’s guidance document is presented in Table 2 below. The risk score is calculated by multiplying the likelihood score by the severity score. The assignment of the severity rating scores is based on the site specific assessment described in section 4.

Using the risk categorisation calculation tables presented in the Guidance document, the site can be given an accurate score and hence a risk category. The procedure is arranged using a combination of complexity, environmental sensitivity and the site’s compliance record.

Using the tables set out Appendix B (IPPC & Waste Activities Complexity look-up Tables) of the Guidance document, sites can be given a risk banding ranging from G1 – least complex to G5 – most complex.

Closed landfill facilities are set a complexity rating of G4. This complexity band equates to an automatic category **3** status according to the guidance.

Table 2: Environmental Risk Register for the Site

Risk ID	Description of Risk	Likelihood Score	Severity Score	Risk Score
R1	Discharge of landfill gas to sub-soils.	2	3	6
R2	Discharge of leachate to groundwater.	2	3	6
R3	Cracking of Landfill’s capping system resulting in uncontrolled release of landfill gas to the atmosphere.	2	3	6
R4	Failure of the Landfill’s gas management infrastructure, resulting in uncontrolled release of gas to the atmosphere.	2	3	6
R5	Failure of leachate pipe work or lagoon resulting in release of leachate to surface water.	2	2	4
R6	Operational accident resulting in release of oils/chemicals to the Landfill surface water.	1	2	2
R7	Uncontrolled landfill fire resulting in a release of noxious gas to the environment	1	4	4
R8	Uncontrolled landfill fire resulting in contamination of surface water from the water/foam and litter discharged during fire fighting.	1	4	4

4.2 Step 2 - Closure, Restoration, Aftercare Management Plan (CRAMP) – Known Liabilities

A Closure, Restoration Aftercare Management Plan (CRAMP) was submitted to the Agency in September 2003. Costs associated with the closure and restoration plan are presented in Appendix 2.

4.3 Step 3 - Environmental Liability Risk Assessment (ELRA) – Unknown Liabilities

The methodology used for the risk identification component of the ELRA is as follows;

1. Identification of possible **hazard sources**;
2. Identification of potential hazard **pathways**; and,
3. Identification and assessment of environmental **receptors** for those identified pathways.

The aim of the process is to provide an analysis of the environmental conditions at the landfill so to provide a baseline by which environmental liabilities may be established and assessed.

Identification of the environmental pathways and receptors has been undertaken with reference to Waste Licence W0018-01 of 2001, and in light of the environmental monitoring undertaken over the past seven years.

4.3.1 Identification of Environmental Hazards

The major environmental hazards associated with landfilling activities involve an emission of either hydrocarbons/chemical, leachate or landfill gas that has the potential to result in pollution of the receiving environment. In addition noise monitoring and dust deposition monitoring is carried out as per the licence. A total monitoring cost of €15,342.80 was spent in 2008.

4.3.2 Hydrocarbons/ Chemicals Stored on Site

The landfill has been closed since 2003 and capping will be completed in summer 2009. The civic amenity site is located at the main entrance to the site and no chemicals or hydrocarbons are used or stored on-site. Site vehicles are all fuelled off-site.

4.3.3 Leachate

A leachate collection drain, consisting of a 150mm slotted HDPE pipe around the perimeter of the waste body which directs leachate to 5 sumps at various points on the perimeter.

Leachate is pumped from the sumps via an 80mm rising main to a lined lagoon at the Northern tip of the landfill. In addition to this there are 13 additional pumped boreholes located throughout the waste body accessed by manholes on the upper level of the site. These boreholes provide coverage of the landfill area for leachate abstraction. The borehole pumps and perimeter sump pumps are controlled from panels located to the north and east of the site. It has been found that since the final capping little leachate has been pumped to lagoon. This would be assumed to be due to the inability of rain waters to permeate the waste body.

At the point of outlet from the lagoon to sewer there is a sump which contains monitoring equipment for the determination of pH, dissolved methane and flow. The leachate is released from the lagoon via a gravity feed and a valve allows a percentage of the outflow into the sump where readings can be taken for the prescribed parameters set out in table F.5.5 of Schedule F: Monitoring of the waste licence.

While leachate is being released, the quality is monitored daily. Any breach of limits requires the flow to be stopped and an alternative disposal method used, e.g. tanker and haul the liquid for disposal.

4.3.4 Landfill Gas

Commercial and industrial wastes have been deposited historically at Kilbarry Landfill. These wastes contain some biodegradable materials such as paper, wood, textiles etc. Gases have formed in the landfill due to the development of anaerobic conditions.

In total, 81 gas abstraction wellheads are currently installed at Kilbarry Landfill and are connected by a network of 110mm and 160mm pipes, which connect via 5 manifolds to a 225mm ring main. This terminates at a compound west of the leachate lagoon where the gas is flared. Currently 1 No.1000 m³/hr open flare is operational onsite with plans to install a 500 m³ enclosed flare. All collection pipes fall back towards the wellheads to allow condensate to exit the system.

A total of 5 no. condensate traps were placed onsite, four near the manifolds and one approximately 25m before the flare. The trap at the flare is not in the waste body and therefore the condensate is pumped to the adjacent leachate lagoon for disposal. In addition to the gas abstraction system there are a series of boreholes around the perimeter of the waste body for the monitoring of landfill gas to ensure migration is not occurring.

Most recently, residential dwellings were built within 250m of the site and 7 new boreholes were installed between the landfill and these houses specifically to ensure gas was not migrating in this direction. These boreholes are currently monitored daily but due to the active abstraction system in place and the lack of evidence of gas migration this monitoring is going to be scaled back to a weekly basis in agreement with the Agency.

4.3.5 Dust Deposition

Dust deposition surveys were undertaken at 7 no. locations three times per year in 2008 as specified in Tables F.3 and F.3.2 of the waste licence. Dust samples were set out at the landfill for a period of between 28 and 30 days. The samples were then sent to Bodycote Consultus Laboratories in Cork for gravimetric analysis in accordance with standard methodology. Over the course of the three dust monitoring surveys, elevated levels of dust were recorded at 2 locations in total over the year. This elevation was attributed to on-going rehabilitation works at the site.

4.3.6 Noise

Noise monitoring was undertaken at 7 no. on-site locations and 4 no. noise sensitive locations once during 2008 as specified in schedule F.4.2 of the waste licence. Although there were some elevations above the 55 dB(A) limit as specified in the licence, the sources of this noise were attributed to off-site activities.

4.4 Identification of Environmental Pathways

The primary pathways for hazards from the waste body to the environment is through the atmosphere (emissions to air), overland (emissions to surface water or land) or through the ground (emissions to the soil or groundwater).

4.4.1 Air

Metrological data is obtained from Waterford Regional Airport and indicates that the prevailing wind directions is to the south and west, while the average wind speed is 10.6 km/hr.

4.4.2 Groundwater

Groundwater quality is measured by samples taken by the Agency on a quarterly basis at the 7 no. active groundwater monitoring locations situated around the site. All parameters required under Table F.5.5 of Schedule F of Waste Licence Register Number W0018-01 are analysed for.

Currently, groundwater samples retrieved from the monitoring boreholes indicate that some pollution of the groundwater has taken place with several parameters being above guideline values. Currently, 7 no. groundwater monitoring boreholes are active at the site. These are labelled GW2, GW4, GW5, GW6, GW15, GW16, GW17.

4.4.3 Surface Water

The EPA carry out surface water monitoring at the site at designated monitoring locations on a frequency in line with the requirements of Waste Licence W0018-01. The analysis indicates that the surface water has been impacted upon by the presence of historic wastes that were deposited at the site in the past. It is noted that the site has been a landfill since the 1960's and at that time, the lining of landfills and protection of the environment was not enforced. However, a surface water management programme was recently submitted to the Agency and was approved. Funding has been made available which will enable the existing surface water ponds to be repaired and allow the construction of further collection ponds bringing the total on site to 4.

4.5 Identification of Environmental Receptors

4.5.1 Local Air Quality

Quarterly monitoring of ambient air is carried out by Odour Monitoring Ireland. The conclusions from the reports indicate that the air quality is good with hydrogen sulphide levels at levels below 3 ppm and general odour quality less than 45 odour units m³.

The results of the air quality assessment found that concentrations of VOC, mercaptans and sulphide compounds were below detection levels.

4.5.2 Flora and Fauna

Kilbarry landfill is located in Kilbarry bog. Kilbarry bog (Provisional National Heritage Area pNHA) comprises an area of reed swamp, freshwater marsh, wet grassland and scrub. It is a site of conservation importance for a variety of reasons:

- It is the only remaining wetland of its type of significance in the vicinity of Waterford City;
- It supports a variety of wetland vegetation types and plant species; it is the site of records for the scarce Summer Snowflake;

- It supports a good diversity of birds, including an important breeding population of Reed Warbler; and a range of scarce invertebrate species has been recorded from this site; and
- The site is also used by Otter, a protected species in Ireland and one that is listed on Annex II of the E.U. Habitats Directive. (NPWS, 2005).

Waterford City Development Plan 2007-2013 identifies Kilbarry Bog as being important for biodiversity. The bog is considered of national importance for Reed Warbler and of regional importance for aquatic biodiversity. In a recent report the National Parks & Wildlife Service (NPWS) recommended that consideration be given to designating the site as a Nature Reserve (Waterford City Council, 2008).

4.5.3 Local Population and Land Use

The surrounding area around the landfill is dominated by industrial, commercial and residential premises with Waterford Crystal located within 0.5 km of the site. Waterford Institute of Technology is located approximately 1 km from the site also. Kilbarry landfill is also situated close to the Six Cross Business Park. The land use is dominated by industrial premises. According to the 2006 census, the population of Waterford City grew to 45,800 over the course of that year.

4.6 Identification and Assessment of Mitigation Measures

4.6.1 Lining System

The site has been operational for over 40 years and is unlined.

4.6.2 Capping System

The capping system for the Landfill was developed considering the requirements of the EPA's Landfill Manuals – Site Design and the UK Environment Agency's Technical Guidance on Capping and Restoration of Landfills. The installation of the cap was supervised and project managed by MCOS RPS Plc. Consultant Engineers and a CQA program was completed for its construction.

The capping system comprises, starting at the waste surface and working upwards to the completed restored surface:

- 80mm layer of quarry fines with maximum aggregate size of 20mm free of sharp stones;
- Gas collection layer – Geosynthetic layer with Geotextile filter/separator on top and bottom and similar or equivalent to Finesse Pozidrain 6S240D/NW8;
- Barrier layer – Geotextile protection layer similar or equivalent to Bentomat Cap 75 geosynthetic clay liner, GCL, with a minimum hydraulic conductivity of 1×10^{-9} m/s;
- Surface water drainage layer – Geosynthetic layer with Geotextile filter/separator on top and bottom similar or equivalent to Pozidrain 6S240D/NW8;
- Subsoil – 850mm silty sandy gravel; and
- Topsoil – 150mm.

4.6.3 Landfill Gas Management System

The gas management system or components of it, will be employed and maintained as long it is required to ensure control and management of landfill gas in compliance with the waste licence.

4.6.4 Surface Water Management System

Three (3 no.) surface water monitoring ponds were provided in accordance with licence conditions 7.6, 9.3 and 9.6. Surface water was planned to be diverted to these ponds for monitoring and storage before being discharged into peripheral drains. This situation had to be re-evaluated following the completion of the final capping layer.

The landfill falls from a high central level outwards to the external edges of the cap. A continuous surface water drain and compacted clay bund have already been proposed as part of the final restoration. The surface water from this upper circumferential drain would then be collected at 4 points before being conveyed to the lower level area via heavy duty PVC pipes. The drain will be inclined to each collection point and each pond will serve an estimated 25% of the site area.

The following surface water management program proposal which was accepted by the Agency on the 26th of November 2008 (Ref: W0018-01/ap01cok.doc) is as follows:

All existing surface water ponds that have been idle since the closure of the landfill be reinstated and repaired.

1. A fourth surface water pond will be constructed in the south of the site. This will be lined with a HDPE layer and secured and ballasted to prevent flotation due to tidal conditions.
2. Discharge trigger levels for surface water will be proposed to the Agency within 8 weeks based on sampling results from surrounding water courses.
3. A schedule of grab sampling will be initiated rather than the continuous monitoring. The frequency will be altered to reflect a weekly monitoring program whereby the current required parameters of pH, Conductivity and Total Organic Carbon will be analysed for. Should the samples reveal that the collected waters are below trigger level values, they will be allowed to be discharged to the peripheral drains. However, if the samples exceed the trigger levels, the surface water will be collected in the ponds and tankered and discharged to the leachate lagoon for later disposal to the foul sewer.
4. The weekly grab sampling schedule will be maintained for a period of 6 months after which point if the analysed parameters prove to be consistently clean, the monitoring frequency period will be addressed once more.

Currently, grass growth on the east and south of the capped landfill is plentiful with further growth already visible on rest of the site. This will assist greatly in the capture and control of surface water on the landfill.

4.6.5 Identification and Assessment of Operational Control Measures

Environmental Management System

Kilbarry Landfill operates an Environmental Management System. The system ensures continual improvement through a process of internal audit, management review and the setting of target and objectives relating to environmental hazards.

Waste Acceptance Procedures

Waste acceptance at Kilbarry Landfill was carried out in compliance with the requirements of Council Decision 2003/33/EC on establishing criteria and procedures for the acceptance of waste at landfills, and pursuant to Article 16 and Annex II of Council Directive 1999/31/EC on landfill waste. Waste acceptance at the site comprised waste characterisation, compliance testing and on-site verification.

Emergency Response Procedures

Kilbarry Landfill has developed site specific emergency response procedures. These procedures outline the actions that are required to be undertaken in the event of an emergency and cover both general and specific emergency situations.

Emergency situations covered by these procedures include:

- Activation of alarm;
- Gas in building emergency;
- Accident;
- Fire;
- Overturned vehicle;
- Spillage; and
- Handling hazardous and chemical wastes.

4.7 Conclusion

Considering the hazard, pathway and receptor model for the site, and in light of an assessment of current mitigation measures employed at the Landfill, the following have been identified and outlined as environmental risks at the Site.

Table 1 is not meant to be a comprehensive list of all potential environmental liabilities associated with the Landfill. The table considers those environmental liabilities that have the potential to have significant financial implication on the Landfill, both in terms of the cost associated with the repair of infrastructure and the cost arising from the environmental remediation that may be required if the incident was to occur.

Table 1: Environmental Risks Identified at Kilbarry Landfill

Risk Register No.	Description of Risk
R1	Discharge of landfill gas to sub-soils.
R2	Discharge of leachate to groundwater.
R3	Cracking of Landfill's capping system resulting in uncontrolled release of landfill gas to the atmosphere.
R4	Failure of the Landfill's gas pipe work or flares resulting in uncontrolled release of gas to the atmosphere.
R5	Failure of leachate pipe work or sumps resulting in release of leachate to surface water.
R6	Operational accident resulting in release of oils/chemicals to the Landfill surface water management system
R7	Landfill fire resulting in a release of noxious gas to the environment
R8	Landfill fire resulting in contamination of surface water from the water/foam and litter discharged during fire fighting.

4.8 Step 4 - Financial Provision – Known and Unknown Liabilities

The financial provision requirements for the site have been assessed in relation to the known and unknown liabilities associated with the site. Details of the financial provision for these liabilities spent to date at the site and monies that are expected in 2009 are presented in Appendix 2.

4.9 Known Liabilities

A full break-down of costs associated with the KNOWN closure and remediation of the Kilbarry Landfill area from the Department of Environment, Heritage & Local Government (DEHLG) Landfill Remediation Grant Scheme is presented in Appendix 2. A full breakdown of associated closure costs from 2006 to present is also presented.

The table presented in Appendix 2 has been compiled by Waterford City Council and issued by the DEHLG and can be verified by contacting Waterford City Council directly.

4.10 Financial Provision for Unknown Environmental Liabilities

In terms of the UNKOWN environmental liabilities at the site, Waterford City Council as a public body is insured with the Irish Public Bodies Mutual Insurances Ltd. Public liability insurance of €12.7 million is already in place.

However, following detailed advice from the Agency, it is apparent that separate and specific environmental liability insurance cover be prepared in order to cover the costs associated with future unknown liabilities. This insurance procedure is currently on-going.

It has been made clear by the Agency that when the appropriate insurance is in place, provision must be made that allows the Agency access to the insurance funds in respect to the unknown liabilities at the site.

Details of the environmental liability cover at the site are presented in appendix 4.

5.0 REVIEW OF THE ELRA AND FINANCIAL PROVISION

The Restoration and Aftercare Plan will be reviewed as necessary to reflect any changes on site or at a minimum every three years following agreement with the Agency. Any Changes to the plan will be documented and submitted to the Agency for approval.

APPENDICES

APPENDIX 1

COMPLETED ENVIRONMENTAL LIABILITIES RISK ASSESSMENT TABLES

Table A1: Environmental Liabilities Risk Assessment Tables

Risk ID	Description of Risk	Environmental Effect	Likelihood Score ^{Note 1}	Basis of Likelihood	Severity Score ^{Note 2}	Basis Of Severity	Risk Score ^{Note 3}
R1	Discharge of landfill gas to sub-soils.	<p>Build up of gases in confined spaces resulting in the potential for asphyxiation.</p> <p>Release of greenhouse gases</p> <p>Risk of explosion</p>	2	<p>While it is considered that landfill liner will deteriorate over time, the amount of deterioration in the first 30 years of its operation is expected to be minimal and the risk that deterioration of liner with cause environmental harm is considered low.</p>	3	<p>If liner deterioration were to become acute, the cost of detection of the deterioration and repair of the lining system would be significant.</p> <p>The discharge of gas into sub soil surrounding the site would be significant over the short term, but would have a minor long term effect on the environment.</p>	6

Table A1: Environmental Liabilities Risk Assessment Tables, continued

Risk ID	Description of Risk	Environmental Effect	Likelihood Score ^{Note 1}	Basis of Likelihood	Severity Score ^{Note 2}	Basis Of Severity	Risk Score ^{Note 3}
R2	Discharge of leachate to groundwater.	Groundwater contamination	2	While it is considered that landfill liner will deteriorate over time, the amount of deterioration in the first 30 years of its operation is expected to be minimal and the risk that deterioration of liner will cause environmental harm is considered low .	3	<p>The cost of repair of the lining system as outlined above would, be significant.</p> <p>The discharge of leachate to groundwater has the potential to cause significant long term harm to the underlying aquifer. It should be noted however, that quality of the receiving groundwater has been previously affected by pollution from the existing unlined landfill that has been in place for several decades.</p>	6

Table A1: Environmental Liabilities Risk Assessment Tables, continued

Risk ID	Description of Risk	Environmental Effect	Likelihood Score ^{Note 1}	Basis of Likelihood	Severity Score ^{Note 2}	Basis Of Severity	Risk Score ^{Note 3}
R3	Cracking of Landfill's capping system resulting in uncontrolled release of landfill gas to the atmosphere.	Release of greenhouse gases Risk of explosion	2	The landfill cap was designed, constructed and installed in accordance with EPA Guidelines, therefore the risk of the cap cracking is considered low .	3	In the event of cracking of the Landfill cap the cost of locating and repairing the crack would be significant . The discharge of gas into atmosphere surrounding the site would be significant over the short term, but would have an insignificant long term effect on the environment.	6

Table A1: Environmental Liabilities Risk Assessment Tables, continued

Risk ID	Description of Risk	Environmental Effect	Likelihood Score ^{Note 1}	Basis of Likelihood	Severity Score ^{Note 2}	Basis Of Severity	Risk Score ^{Note 3}
R4	Failure of the Landfill's gas management infrastructure, resulting in uncontrolled release of gas to the atmosphere.	Release of greenhouse gases Risk of explosion	2	Due to the advanced monitoring system, the preventative maintenance program in place the risk of failure of the infrastructure is considered to be low .	3	In the event failure of the gas management system the cost of repair is expected to be significant . Due to its short term nature, the excepted environmental impact is considered to be minor .	6

Table A1: Environmental Liabilities Risk Assessment Tables, continued

Risk ID	Description of Risk	Environmental Effect	Likelihood Score ^{Note 1}	Basis of Likelihood	Severity Score ^{Note 2}	Basis Of Severity	Risk Score ^{Note 3}
R5	Failure of leachate pipe work or lagoon resulting in release of leachate to surface water.	Contamination of soil, ground water and surface water.	2	Due to the advanced monitoring system, and preventative maintenance program, the risk of failure of the infrastructure is considered to be low .	2	In the event of failure of leachate management infrastructure the cost of repair to the system is considered to be minor . In the event that leachate contaminated soil or groundwater, the environmental impact would be considered minor due to the minimal volume of discharge expected.	4

Table A1: Environmental Liabilities Risk Assessment Tables, continued

Risk ID	Description of Risk	Environmental Effect	Likelihood Score <small>Note 1</small>	Basis of Likelihood	Severity Score <small>Note 2</small>	Basis Of Severity	Risk Score <small>Note 3</small>
R6	Operational accident resulting in release of oils/chemicals to the Landfill surface water.	Contamination of soil, ground water and surface water.	1	The risk of an operational accident resulting in the spillage of either hydrocarbons or chemicals is considered very low due to the fact that that there are no continuing landfilling operations on site and operations ceased in 2005.	2	In the event on a hydrocarbon or chemical spill contaminating soil or groundwater, the environmental impact would be considered minor due to the minimal volume of discharge possible.	2

Table A1: Environmental Liabilities Risk Assessment Tables, continued

Risk ID	Description of Risk	Environmental Effect	Likelihood Score <small>Note 1</small>	Basis of Likelihood	Severity Score <small>Note 2</small>	Basis Of Severity	Risk Score <small>Note 3</small>
R7	Uncontrolled landfill fire resulting in a release of noxious gas to the environment	Release of greenhouse gases. Potential harm to the local population.	1	Due to the emergency response procedures in place, the capping design and the operational practices which were used to deposit waste, the risk of a landfill fire is considered to be very low .	4	The cost associated with a release of noxious gas/ smoke that would arise from a landfill fire has the potential to result in severe impact on the local population.	4

Table A1: Environmental Liabilities Risk Assessment Tables, continued

Risk ID	Description of Risk	Environmental Effect	Likelihood Score <small>Note 1</small>	Basis of Likelihood	Severity Score <small>Note 2</small>	Basis Of Severity	Risk Score <small>Note 3</small>
R8	Uncontrolled landfill fire resulting in contamination of surface water from the water/foam and litter discharged during fire fighting.	Pollution of surface water from contaminated fire fighting water and litter.	1	Due to the emergency response procedures in place, the capping design and the operational practices which were used to deposit waste, the risk of a landfill fire is considered to be very low .	4	The cost of remediation of local water course from the contamination caused by a landfill has the potential to be severe .	4

Note 1 **Rating for likelihood score is based on Risk Assessment Table A3.1 in Appendix 3**

Note 2 **Rating for Severity is based on Risk Assessment Table A3.2 in Appendix 3**

Note 3 **Risk score is based on likelihood of the hazard occurring and the severity of that hazard. The relationship between likelihood, severity and overall risk is shown in Table A3.3 in Appendix 3**

APPENDIX 2
FINANCIAL COST MODEL

Table A2 Most Likely Cost Financial Model

Risk Register No.	Likelihood Score	Likelihood of Occurrence Range <small>Note 1</small>	Median Likelihood of Occurrence	Severity Score	Likely Cost Range <small>Note 2</small>	Median Likely Cost	Most Likely Cost Scenario <small>Note 3</small>
R1	2	5-10%	7.5%	3	€100,001- €200,000	€ 150,000	€ 11,250
R2	2	5-10%	7.5%	3	€100,001- €200,000	€ 150,000	€ 11,250
R3	2	5-10%	7.5%	3	€100,001- €200,000	€ 150,000	€ 11,250
R4	2	5-10%	7.5%	3	€100,001- €200,000	€ 150,000	€ 11,250
R5	2	5-10%	7.5%	2	€10,0001 - €100,000	€ 55,000	€ 4,125
R6	1	0-5%	2.5%	2	€10,0001 - €100,000	€ 55,000	€ 1,375
R7	1	0-5%	2.5%	4	€200,001 - €500,000	€ 350,000	€ 8,750
R8	1	0-5%	2.5%	4	€200,001 - €500,000	€ 350,000	€ 8,750
R9	1	0-5%	2.5%	4	€200,001 - €500,000	€ 350,000	€ 8,750
R10	1	0-5%	2.5%	2	€10,0001 - €100,000	€ 55,000	€ 1,375
R11	2	5-10%	7.5%	2	€10,0001 - €100,000	€ 55,000	€ 4,125
R12	2	5-10%	7.5%	2	€10,0001 - €100,000	€ 55,000	€ 4,125
Total							€ 86,375

Note 1 See Table A3.1 for likelihood of occurrence ranges.

Note 2 See Table A3.2 for cost ranges.

Note 3 The most likely cost scenario is based on the median likelihood of occurrence, multiplied by the median likely cost.

**Department of Environment, Heritage & Local Government
Landfill Remediation Grant Scheme**

Local Authority	Waterford City Council				
Landfill Site	Kilbarry	Claim No.	5		
Grant Ref No	LR/09/08	Period of Claim	08/07/2008 – 02/12/2008		
Summary of Expenditure Details					
Approved Category	Approved Expenditure	Expenditure previous claims	Expenditure this claim	Total Expenditure claimed to date	Approved Expenditure - to be claimed
Preparatory Works	€ 130,298.14	€120,298.14	Nil	€120,298.14	€10,000.00
Leachate Collection	€ 182,541.29	€80,496.79	€72,488.89	€152,985.68	€29,555.61
Gas Collection	€2,341,605.90	€1,706,387.70	€223,730.44	€1,930,118.14	€411,487.76
Capping	€2,682,126.18	€2,442,802.36	€226,028.04	€2,668,830.40	€13,295.78
Landscaping	€1,209,910.00	Nil	Nil	Nil	€1,209,910.00
Project Management	€ 122,713.69	€52,713.69	€45,517.98	€98,231.67	€24,482.02
Other (Surface Water Management)	€ 350,000.00	Nil	Nil	Nil	€350,000.00
Expenditure Total	€7,019,195	€4,402,698.68	€567,765.35	€4,970,464.03	€2,048,731.17

Summary of Grant Claim Details

	Total Grant Approved	Grant previous claims	Grant this claim (75% of expenditure this claim)	Total Grant claimed to date	Approved Grant – to be claimed
Grant Total	€5,264,396	€3,302,024.01	€425,824.01	€3,727,848.02	€1,536,547.98

Return Form to: Waste Infrastructure & Regulation Section, Department of Environment, Heritage & Local Government, Custom House, Dublin 1.

**Department of Environment, Heritage and Local Government Landfill Remediation
Grant Application/Renewal of Grant Scheme**

Local Authority	Waterford City Council
Name of Landfill	Kilbarry Landfill LRG/05/06
EPA Licence Reference No.	18-1
Confirm that Restoration & Aftercare Plan is agreed with the Agency	Yes
Estimated Net-Total Cost of Plan	€7,019,194 (Est. Cost in '06 €6,943,416
Indicate if grant assistance was approved in 2006 or 2007	'06 -

Categories	Total costs incurred to 31/12/06	Total costs incurred to 31/12/07	Total costs estimated for 2008	Total estimated costs from 2009 onwards
1. Preparatory works (incl. design & consultation fees.	€73,650.58	€120,298.14	€10,000.00	
2. Leahate Collection	€71,493.76	€80,496.79	€102,044.00	
3. Gas Collection	€186,719.45	€1,523,878.80	€596,460.00 €182,508.90 *	
4. Capping	€2,518,536.75	€2,320,394.80	€238,192.00 €123,539.38 *	
5. Landscaping			€500,000.00	€709,910.00
6. Project Management	€50,078.09	€52,713.69	€50,000.00	€20,000.00
7. Other (Specify) Surface water mgmt Extracts			€350,000.00 €38,758.89	
Total Costs	€2,900,478.63	€4,097,782.22	€2,191,503.17	€729,910.00

*Included in claim 4

Additional Comments:

All grant aid approved has been claimed. Approval for additional expenditure of €2,615,285.00 now sought. The current estimated cost of €7,019,195.00 is €75,779.00 above the '06 estimate.

Signed Director of Service	Colette Byrne
County/City Council	Waterford City Council
Date	28/07/08

APPENDIX 3
RISK ASSESSMENT TABLES

Table A3: 1 – Risk Assessment - Likelihood

Rating	Likelihood		
	Description	Likelihood of Occurrence (%)	Category
1	Less than 5% of hazard occurring in 30 year period	0-5	Very Low
2	Low chance (5-10%) of hazard occurring in 30 year period	5-10	Low
3	Medium chance (10-20%) of hazard occurring in 30 year period	10-20	Medium
4	High chance (20-50%) chance of hazard occurring in 30 year period	20-50	High
5	Greater than 50% chance of the hazard occurring in 30 year period	>51	Very High

Table A3: 2 – Risk Assessment - Severity

Rating	Severity		
	Description	Cost of Remediation (€)	Category
1	No damage or negligible change to the environment	0-10,000	Insignificant
2	Minor impact/localised nuisance	10,001-100,000	Minor
3	Moderate damage to environment	100,001- 200,000	Significant
4	Severe damage to the environment	200,001-500,000	Severe
5	Catastrophic damage to a large area, irreversible in medium term	>500,001	Catastrophic

Table A3.3 – Risk Assessment - Overall Risk

The following risk assessment matrix is based the methodology proposed in the EPA’s Guidance Documents and Assessment Tools on Environmental Liabilities Risk Assessment and Residual Management Plan incorporation Environmental Liabilities Risk Assessment.

The matrix is designed to represent risk in terms of likelihood multiplied by severity and should be read in conjunction with Risk Assessment Tables A3.1 and A3.2.

			Risk Identification Number				
LIKELIHOOD	Very High	5					
	High	4					
	Medium	3					
	Low	2					
	Very Low	1					
Very Low Risk 1-5			1	2	3	4	5
Low Risk 6- 10			Insignificant	Minor	Significant	Severe	Catastrophic
Medium Risk 11-15							
High Risks 16- 20			SEVERITY				
Very High Risks 21-25							

The above risk assessment matrix is based the methodology proposed in the EPA’s Guidance Documents and Assessment Tools on Environmental Liabilities Risk Assessment and Residual Management Plan incorporation Environmental Liabilities Risk Assessment.

APPENDIX 4

**COPY OF ENVIRONMENTAL LIABILITY INSURANCE POLICY AND PROPERTY
INSURANCE POLICY**

APPENDIX 5

FIGURES & SITE PHOTOGRAPHS

Appendix IV

PRTR 2012



[Guidance to completing the PRTR workbook](#)

AER Returns Workbook

Version 1.1.16

REFERENCE YEAR	2012
-----------------------	------

1. FACILITY IDENTIFICATION

Parent Company Name	Waterford City Council
Facility Name	Kilbarry Landfill Site
PRTR Identification Number	W0018
Licence Number	W0018-01

Waste or IPPC Classes of Activity

No.	class_name
3.1	Deposit on, in or under land (including landfill).
3.11	Blending or mixture prior to submission to any activity referred to in a preceding paragraph of this Schedule.
3.13	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.
3.2	Land treatment, including biodegradation of liquid or sludge discards in soils.
3.4	Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons.
3.5	Specially engineered landfill, including placement into lined discrete cells which are capped and isolated from one another and the environment.
3.7	#####
4.11	Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule.
4.12	Exchange of waste for submission to any activity referred to in a preceding paragraph of this Schedule.
4.13	Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced.
4.3	Recycling or reclamation of metals and metal compounds.
4.4	Recycling or reclamation of other inorganic materials.
4.9	Use of any waste principally as a fuel or other means to generate energy.

Address 1	Kilbarry
Address 2	Waterford City
Address 3	Co. Waterford
Address 4	
Country	Waterford
Country	Ireland
Coordinates of Location	-7.12405 52.2422
River Basin District	IESE
NACE Code	3821
Main Economic Activity	Treatment and disposal of non-hazardous waste
AER Returns Contact Name	Vincent O'Shea
AER Returns Contact Email Address	vnoshea@waterfordcity.ie
AER Returns Contact Position	Technician
AER Returns Contact Telephone Number	051849534
AER Returns Contact Mobile Phone Number	
AER Returns Contact Fax Number	
Production Volume	0.0
Production Volume Units	
Number of Installations	0
Number of Operating Hours in Year	0
Number of Employees	2
User Feedback/Comments	
Web Address	

2. PRTR CLASS ACTIVITIES

Activity Number	Activity Name
5(d)	Landfills
5(c)	Installations for the disposal of non-hazardous waste
5(d)	Landfills
50.1	General

3. SOLVENTS REGULATIONS (S.I. No. 543 of 2002)

Is it applicable?	No
Have you been granted an exemption ?	
If applicable which activity class applies (as per Schedule 2 of the regulations) ?	
Is the reduction scheme compliance route being used ?	

4. WASTE IMPORTED/ACCEPTED ONTO SITE

[Guidance on waste imported/accepted onto site](#)

Do you import/accept waste onto your site for on-site treatment (either recovery or disposal activities) ?	
--	--

This question is only applicable if you are an IPPC or Quarry site

4.1 RELEASES TO AIR

[Link to previous years emissions data](#)

| PRTR# : W0018 | Facility Name : Kilbarry Landfill Site | Filename : 11_PRTR W0018_2012.xls | Return Year : 2012 |

10/05/2013 15:14

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

RELEASES TO AIR									
Please enter all quantities in this section in KGs									
No. Annex II	POLLUTANT	Name	M/C/E	METHOD		Emission Point 1	QUANTITY		
				Method Code	Designation or Description		T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
01	Methane (CH4)		C	MAB	as per calculation below Flue gas analyser, Testo 350/454 MXL	409354.0	818708.0	0.0	409354.0
02	Carbon monoxide (CO)		C	MAB	Flue gas analyser, Testo 350/454 MXL	8.76	8.76	0.0	0.0
08	Nitrogen oxides (NOx/NO2)		C	MAB	Flue gas analyser, Testo 350/454 MXL	87.6	87.6	0.0	0.0
11	Sulphur oxides (SOx/SO2)		C	MAB		175.2	175.2	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION B : REMAINING PRTR POLLUTANTS

RELEASES TO AIR									
Please enter all quantities in this section in KGs									
No. Annex II	POLLUTANT	Name	M/C/E	METHOD		Emission Point 1	QUANTITY		
				Method Code	Designation or Description		T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
						0.0	0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION C : REMAINING POLLUTANT EMISSIONS (As required in your Licence)

RELEASES TO AIR									
Please enter all quantities in this section in KGs									
Pollutant No.	POLLUTANT	Name	M/C/E	METHOD		Emission Point 1	QUANTITY		
				Method Code	Designation or Description		T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
						0.0	0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

Additional Data Requested from Landfill operators

For the purposes of the National Inventory on Greenhouse Gases, landfill operators are requested to provide summary data on landfill gas (Methane) flared or utilised on their facilities to accompany the figures for total methane generated. Operators should only report their Net methane (CH4) emission to the environment under T(total) KG/yr for Section A: Sector specific PRTR pollutants above. Please complete the table below:

Landfill:	Kilbarry Landfill Site					
Please enter summary data on the quantities of methane flared and / or utilised	T (Total) kg/Year	M/C/E	Method Used		Facility Total Capacity m3 per hour	
	Total estimated methane generation (as per site model)	753710.0	E	ESTIMATE	landfill gas prediction model	N/A
	Methane flared	344536.0	C	MAB	total run time, average meth	500.0 (Total Flaring Capacity)
	Methane utilised in engine/s	0.0				0.0 (Total Utilising Capacity)
	Net methane emission (as reported in Section A above)	409174.0	E	ESTIMATE	Calculation on above totals	N/A

4.3 RELEASES TO WASTEWATER OR SEWER

[Link to previous years emissions data](#)

SECTION A : PRTR POLLUTANTS

OFFSITE TRANSFER OF POLLUTANTS DESTINED FOR WASTE-WATER TREATMENT OR SEWER					Please enter all quantities in this section in KG:			
POLLUTANT		METHOD			QUANTITY			
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
06	Ammonia (NH3)	C	MAB		0.000112	0.000112	0.0	0.0
79	Chlorides (as Cl)	E	ESTIMATE		0.0182	0.0182	0.0	0.0
					0.0	0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION B : REMAINING POLLUTANT EMISSIONS (as required in your Licence)

OFFSITE TRANSFER OF POLLUTANTS DESTINED FOR WASTE-WATER TREATMENT OR SEWER					Please enter all quantities in this section in KG:			
POLLUTANT		METHOD			QUANTITY			
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
303	BOD	C	MAB		0.00098	0.00098	0.0	0.0
306	COD	C	MAB		0.0693	0.0693	0.0	0.0
357	Iron	C	MAB		0.00504	0.00504	0.0	0.0
338	Potassium	C	MAB		0.00525	0.00525	0.0	0.0
341	Sodium	C	MAB		0.0105	0.0105	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE

| PRTR#: W0018 | Facility Name : Kilbarry Landfill Site | Filename : 11. PRTR W0018_2012.xls | Return Year : 2012 |

10/05/2013 15:14

Please enter all quantities on this sheet in Tonnes

3

Transfer Destination	European Waste Code	Hazardous	Quantity (Tonnes per Year)	Description of Waste	Waste Treatment Operation	Method Used		Location of Treatment	Haz Waste : Name and Licence/Permit No of Next Destination Facility	Haz Waste : Address of Next Destination Facility	Name and License / Permit No. and Address of Final Recoverer / Disposer (HAZARDOUS WASTE ONLY)	Actual Address of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)
						Haz Waste: Name and Licence/Permit No of Recover/Disposer	Non-Haz Waste: Address of Recover/Disposer		Haz Waste: Name and Licence/Permit No of Recover/Disposer	Non-Haz Waste: Address of Recover/Disposer		
						M/C/E	Method Used					
Within the Country	19 07 03	No	700.0 in 19 07 02	landfill leachate other than those mentioned	D9	M	Weighed	Offsite in Ireland	Waterford City Waste Water Treatment Plant,-	Waterford City Waste Water Treatment Plant,Christendom,Ferrybank ,Waterford City,Ireland		

* Select a row by double-clicking the Description of Waste then click the delete button

[Link to previous years waste data](#)

[Link to previous years waste summary data & percentage change](#)

Appendix V

AER Templates 2012

Facility Information Summary	
AER Reporting Year	2012
Licence Register Number	W0018-01
Name of site	Kilbarry Landfill
Site Location	Kilbarry Lane, Waterford City
NACE Code	3821
Class/Classes of Activity	Treatment and Disposal of Non Hazardous Waste
National Grid Reference (6E, 6 N)	2598E, 1103N
<p>A description of the activities/processes at the site for the reporting year. This should include information such as production increases or decreases on site, any infrastructural changes, environmental performance which was measured during the reporting year and an overview of compliance with your licence listing all exceedances of licence limits (where applicable) and what they relate to e.g. air, water, noise.</p>	<p>ty Council Civic Amenity Site is located at the northern area of the landfill site and accepts small amounts of mixe</p>

Declaration:

All the data and information presented in this report has been checked and certified as being accurate. The quality of the information is assured to meet licence requirements.

_____	_____
Signature	Date
Group/Facility manager	
(or nominated, suitably qualified and experienced deputy)	

AIR-summary template									
					Lic No:	W0018-01	Year	2012	

Note 1: Volumetric flow shall be included as a reportable parameter

AIR-summary template	Lic No:	W0018-01	Year	2012
Continuous Monitoring				

4	Does your site carry out continuous air emissions monitoring? If yes please review your continuous monitoring data and report the required fields below in Table 3 and compare it to its relevant Emission Limit Value (ELV)	Yes	
5	Did continuous monitoring equipment experience downtime? If yes please record downtime in table 3 below	Yes	
6	Do you have a proactive service agreement for each piece of continuous monitoring equipment?	Yes	
7	Did your site experience any abatement system bypasses? If yes please detail them in table 4 below	No	

Table A2: Summary of average emissions -continuous monitoring

Emission reference no:	Parameter/ Substance	ELV in licence or any revision thereof	Averaging Period	Compliance Criteria	Units of measurement	Annual Emission	Annual maximum	Monitoring Equipment downtime (hours)	Number of ELV exceedences in current reporting year	Comments
	volumetric flow	3000m3/hr	2012	100 % of values < ELV	m3	2838433	515	1450	0	Due to a mechanical fault the Flare was passive venting only for the months of January and February
					SELECT					
					SELECT					
					SELECT					
	SELECT				SELECT					

note 1: Volumetric flow shall be included as a reportable parameter.

Table A3: Abatement system bypass reporting table [Bypass protocol](#)

Date*	Duration** (hours)	Location	Reason for bypass	Impact magnitude	Corrective action

* this should include all dates that an abatement system bypass occurred

** an accurate record of time bypass beginning and end should be logged on site and maintained for future Agency inspections please refer to bypass protocol link

AIR-summary template		Lic No:	W0018-01	Year	2012			
Solvent use and management on site								
8 Do you have a total Emission Limit Value of direct and fugitive emissions on site? if yes please fill out tables A4 and A5					No			
Table A4: Solvent Management Plan Summary Total VOC Emission limit value		Solvent regulations Please refer to linked solvent regulations to complete table 5 and 6						
Reporting year	Total solvent input on site (kg)	Total VOC emissions to Air from entire site	Total VOC emissions as %of solvent	Total Emission Limit Value (ELV) in licence or any revision thereof	Compliance			
					SELECT			
					SELECT			
Table A5: Solvent Mass Balance summary								
	(I) Inputs (kg)	(O) Outputs (kg)						
Solvent	(I) Inputs (kg)	Organic solvent emission in	Solvents lost in water (kg)	Collected waste solvent (kg)	Fugitive Organic Solvent (kg)	Solvent released in other ways e.g. by-	Solvents destroyed onsite through	Total emission of Solvent to air (kg)
Total								

AER Monitoring returns summary template-WATER/WASTEWATER(SEWER) Lic No: W0018-01 Year 2012

<p>1 Does your site have licensed emissions direct to surface water or direct to sewer? If yes please complete table W2 and W3 below for the current reporting year and answer further questions. If you do not have licensed emissions you <u>only</u> need to complete table W1 and or W2 for surface water analysis and visual inspections</p> <p>2 Was it a requirement of your licence to carry out visual inspections on any surface water discharges or watercourses on or near your site? If yes please complete table W2 below summarising <u>only any evidence of contamination noted during visual inspections</u></p>	<p>Additional information</p> <p>No</p> <p>No</p>
--	---

Table W1 Surface water monitoring

Location reference	Location relative to site activities	PRTR Parameter	Licensed Parameter	Monitoring date	ELV or trigger level in licence or any revision thereof*	Licence Compliance criteria	Measured value	Unit of measurement	Compliant with licence	Comments
	SELECT	SELECT	SELECT			SELECT		SELECT	SELECT	
	SELECT	SELECT	SELECT			SELECT		SELECT	SELECT	

*trigger values may be agreed by the Agency outside of licence conditions

Table W2 Visual inspections-Please only enter details where contamination was observed.

Location Reference	Date of inspection	Description of contamination	Source of contamination	Corrective action	Comments
			SELECT		
			SELECT		

Licensed Emissions to water and /or wastewater(sewer)-periodic monitoring (non-continuous)

<p>3 Was there any result in breach of licence requirements? If yes please provide brief details in the comment section of Table W3 below</p> <p>4 Was all monitoring carried out in accordance with EPA guidance and checklists for Quality of Aqueous Monitoring Data Reported to the EPA? If no please detail what areas require improvement in additional information box</p>	<p>Additional information</p> <p>SELECT</p> <p>SELECT</p>
---	---

Table W3: Licensed Emissions to water and /or wastewater (sewer)-periodic monitoring (non-continuous)

Emission reference no:	Emission released to	Parameter/ SubstanceNote 1	Type of sample	Frequency of monitoring	Averaging period	ELV or trigger values in licence or any revision thereof ^{Note 2}	Licence Compliance criteria	Measured value	Unit of measurement	Compliant with licence	Method of analysis	Procedural reference source	Procedural reference standard number	Annual mass load (kg)	Comments
	SELECT	SELECT	SELECT		SELECT		SELECT		SELECT	SELECT	SELECT	SELECT			

Note 1: Volumetric flow shall be included as a reportable parameter

Note 2: Where Emission Limit Values (ELV) do not apply to your licence please compare results against EQS for Surface water or relevant receptor quality standards

Continuous monitoring

5 Does your site carry out continuous emissions to water/sewer monitoring?

If yes please summarise your continuous monitoring data below in Table W4 and compare it to its relevant Emission Limit Value (ELV)

6 Did continuous monitoring equipment experience downtime? If yes please record downtime in table W4 below

7 Do you have a proactive service contract for each piece of continuous monitoring equipment on site?

8 Did abatement system bypass occur during the reporting year? If yes please complete table W5 below

Table W4: Summary of average emissions -continuous monitoring

Emission reference no:	Emission released to	Parameter/ Substance	ELV or trigger values in licence or any revision thereof	Averaging Period	Compliance Criteria	Units of measurement	Annual Emission for current reporting year (kg)	% change +/- from previous reporting year	Monitoring Equipment downtime (hours)	Number of ELV exceedences in reporting year	Comments
	<input type="text" value="SELECT"/>	<input type="text" value="SELECT"/>		<input type="text" value="SELECT"/>	<input type="text" value="SELECT"/>	<input type="text" value="SELECT"/>					
	<input type="text" value="SELECT"/>	<input type="text" value="SELECT"/>		<input type="text" value="SELECT"/>	<input type="text" value="SELECT"/>	<input type="text" value="SELECT"/>					

note 1: Volumetric flow shall be included as a reportable parameter.

Table W5: Abatement system bypass reporting table

Date	Duration (hours)	Location	Resultant emissions	Reason for bypass	Corrective action*	Was a report submitted to the EPA?	When was this report submitted?
						<input type="text" value="SELECT"/>	

*Measures taken or proposed to reduce or limit bypass frequency

Bund testing

dropdown menu click to see options

Additional information

- Are you required by your licence to undertake integrity testing on bunds and containment structures ? if yes please fill out table B1 below listing all **new bunds and containment structures** on site, in addition to all bunds which failed the integrity test- all bunding structures which failed including mobile bunds must be listed in the table below
- 1 Please provide integrity testing frequency period
Does the site maintain a register of bunds, underground pipelines (including stormwater and foul), Tanks, sumps and containers? (containers refers to "Chemstore" type units and mobile bunds)
 - 2 How many bunds are on site?
 - 3 How many of these bunds have been tested within the required test schedule?
 - 4 How many mobile bunds are on site?
 - 5 Are the mobile bunds included in the bund test schedule?
 - 6 How many of these mobile bunds have been tested within the required test schedule?
 - 7 How many sumps on site are included in the integrity test schedule?
 - 8 How many of these sumps are integrity tested within the test schedule?
- Please list any sump integrity failures in table B1**
- 9 Do all sumps and chambers have high level liquid alarms?
 - 10 If yes to Q11 are these failsafe systems included in a maintenance and testing programme?

Yes	
3 years	
No	
1	
0	
0	
No	
0	
0	
0	
Yes	
No	

Table B1: Summary details of bund /containment structure integrity test

Bund/Containment structure ID	Type	Specify Other type	Product containment	Actual capacity	Capacity required*	Type of integrity test	Other test type	Test date	Integrity reports maintained on site?	Results of test	Integrity test failure explanation <50 words	Corrective action taken	Scheduled date for retest	Results of retest (if in current reporting year)
	other (please specify)	Double skinned tank	Waste engine oil	2500	2500	Structural assessment		10/12/2008	Yes	Fail	Spilled oil discovered in the vo	Removed obstruction	2012	
	SELECT					SELECT			SELECT	SELECT		SELECT		

* Capacity required should comply with 20% or 100% containment rule as detailed in your licence

Has integrity testing been carried out in accordance with licence requirements and are all structures tested

[bunding and storage guidelines](#)

Commentary	
SELECT	
SELECT	
SELECT	

- 14 In line with BS8007/EPA Guidance?
- 15 Are channels/transfer systems to remote containment systems tested?
- 16 Are channels/transfer systems compliant in both integrity and available volume?

Pipeline/underground structure testing

- Are you required by your licence to undertake integrity testing on underground structures e.g. pipelines or sumps etc ? if yes please fill out table 2 below listing all underground structures and pipelines on site **which failed the integrity test**
- 1 Please provide integrity testing frequency period

SELECT	
SELECT	

Table B2: Summary details of pipeline/underground structures integrity test

Structure ID	Type system	Material of construction:	Does this structure have Secondary containment?	Type of secondary containment	Type integrity testing	Integrity reports maintained on site?	Results of test	Integrity test failure explanation <50 words	Corrective action taken	Scheduled date for retest	Results of retest (if in current reporting year)
	SELECT	SELECT	SELECT	SELECT	SELECT	SELECT	SELECT				SELECT

Please use commentary for additional details not answered by tables/ questions above

Groundwater/Soil monitoring template

Lic No:

W0018-01

Year

2012

- 1 Are you required to carry out groundwater monitoring as part of your licence requirements?
- 2 Are you required to carry out soil monitoring as part of your licence requirements?
- 3 Do you extract groundwater for use on site? If yes please specify use in comment section
- 4 Is there contaminated land and /or groundwater on site? If yes please answer q's 5-12
- 5 Is the contamination related to operations at the facility (either current and/or historic)
- 6 Have actions been taken to address contamination issues? If yes please summarise remediation strategies proposed/undertaken for the site
- 7 Please specify the proposed time frame for the remediation strategy
- 8 Is there a licence condition to carry out/update ELRA for the site?
- 9 Has any type of risk assessment been carried out for the site?
- 10 Has a Conceptual Site Model been developed for the site?
- 11 Have potential receptors been identified on and off site?
- 12 Is there evidence that contamination is migrating offsite?

Comments	
yes	
no	
no	
yes	
yes	
yes	Leachate Management System installed
SELECT	Completed
yes	
yes	
no	
yes	
no	

Table 1: Upgradient Groundwater monitoring results

Date of sampling	Sample location reference	Parameter/ Substance	Methodology	Monitoring frequency	Maximum Concentration++	Average Concentration+	unit	GTV's*	IGV	% change in average concentration
2012	GW6 (Outside Waste Body)	Ammonia		Quarterly	22	6.26	mg/l		0.15	705
2012	GW6 (Outside Waste Body)	Chloride		Quarterly	23	16.75	mg/l		30	-27
2012	GW6 (Outside Waste Body)	Total Oxidised Nitrogen		Quarterly	5.47	5.14	mg/l			3
2012	GW6 (Outside Waste Body)	Potassium		Quarterly	2.9	1.5	mg/l		5	-11
2012	GW6 (Outside Waste Body)	Sodium		Quarterly	19	16.75	mg/l		150	-23
2012	GW6 (Outside Waste Body)	Flouride		Annually	<0.5		mg/l			1
2012	GW6 (Outside Waste Body)	Sulphate		Annually	<50		mg/l		200	
2012	GW6 (Outside Waste Body)	Boron		Annually	120		ug/l		1000	
2012	GW6 (Outside Waste Body)	Cadmium		Annually	<0.5		ug/l		1	
2012	GW6 (Outside Waste Body)	Calcium		Annually	81		mg/l		200	
2012	GW6 (Outside Waste Body)	Chromium		Annually	9.5		ug/l		50	
2012	GW6 (Outside Waste Body)	Iron		Annually	6100		ug/l		200	
2012	GW6 (Outside Waste Body)	Lead		Annually	9.6		ug/l		10	
2012	GW6 (Outside Waste Body)	Magnesium		Annually	20		mg/l		50	
2012	GW6 (Outside Waste Body)	Manganese		Annually	510		ug/l		50	
2012	GW6 (Outside Waste Body)	Mercury		Annually	<0.5		ug/l		1	
2012	GW6 (Outside Waste Body)	Zinc		Annually	250		ug/l		100	
							SELECT			

.+ where average indicates arithmetic mean

.++ maximum concentration indicates the maximum measured concentration from all monitoring results produced during the reporting year

Table 2: Downgradient Groundwater monitoring results

Groundwater/Soil monitoring template

Lic No:

W0018-01

Year

2012

* please note exceedance of a relevant Groundwater threshold value (GTV) at a representative monitoring point does not indicate non compliance, an exceedance triggers further investigation to confirm whether the criteria for poor groundwater chemical status are being met.

**Depending on location of the site and proximity to other sensitive receptors alternative Receptor based Water Quality standards should be used in addition to the GTV e.g. if the site is close to surface water compare to Surface Water Environmental Quality Standards (SWEQS), If the site is close to a drinking water supply compare results to the Drinking Water Standards (DWS)

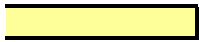
[Groundwater](#) [Drinking water](#)
[Surface](#) [regulations](#) [\(private supply\)](#)
[water EQS](#) [GTV's](#) [standards](#)

Groundwater/Soil monitoring template Lic No: W0018-01 Year 2012

Table 3: Soil results

Date of sampling	Sample location reference	Parameter/ Substance	Methodology	Monitoring frequency	Maximum Concentration	Average Concentration	unit
							SELECT
							SELECT

Where additional detail is required please enter it here in 200 words or less



[Drinking water \(public supply\) standards](#) [Interim Guideline Values \(IGV\)](#)



[Click here to access EPA guidance on Environmental Liabilities and Financial provision](#)

		Commentary	
1	ELRA initial agreement status	Submitted and agreed by EPA	
2	ELRA review status	Review required and not completed;	
3	Amount of Financial Provision cover required as determined by the latest ELRA	€86,375	
4	Financial Provision for ELRA status	Submitted and not agreed by EPA;	
5	Financial Provision for ELRA - amount of cover	€86,375	
6	Financial Provision for ELRA - type	Insurance with Environmental Impairment Liability cover,	
7	Financial provision for ELRA expiry date	na	
8	Closure plan initial agreement status	Closure plan submitted and agreed by EPA	
9	Closure plan review status	Review required and completed	
10	Financial Provision for Closure status	Submitted and agreed by EPA	
11	Financial Provision for Closure - amount of cover	na	
12	Financial Provision for Closure - type	Insurance with Environmental Impairment Liability cover,	
13	Financial provision for Closure expiry date	Site is closed since 2005	

Environmental Management Programme/Continuous Improvement Programme template	Lic No:	W0018-01	Year	2012
---	---------	----------	------	------

	Highlighted cells contain dropdown menu click to view	Additional Information
1	Do you maintain an Environmental Mangement System (EMS) for the site. If yes, please detail in additional information	Yes
2	Does the EMS reference the most significant environmental aspects and associated impacts on-site	Yes
3	Does the EMS maintain an Environmental Management Programme (EMP) as required in accordance with the licence requirements	Yes
4	Do you maintain an environmental documentation/communication system to inform the public on environmental performance of the facility, as required by the licence	Yes

Environmental Management Programme (EMP) report

Objective Category	Target	Status (% completed)	How target was progressed	Responsibility	Intermediate outcomes
Reduction of emissions to Air	Install Gas Abstraction System	100	Contract	Individual	Reduced emissions
Groundwater protection	Leachate Management	100	Contract	Section Head	Reduced emissions
Reduction of emissions to Air	Dust Control	100	Monitoring and operational p	Individual	Increased compliance with licence conditions
Reduction of emissions to Water	Surface Water Management	100	Contract	Individual	Reduced emissions
Reduction of emissions to Water	Leachate Management	100	Contract	Individual	Reduced emissions
SELECT				SELECT	SELECT

*Please ensure that a tonal analysis has been carried out as per guidance note NG4. These records must be maintained onsite for future inspection

If noise limits exceeded as a result of noise attributed to site activities, please choose the corrective action from the following options?

SELECT

** please explain the reason for not taking action/resolution of noise issues?

Any additional comments? (less than 200 words)

Resource Usage/Energy efficiency summary

Lic No:

W0018-01

Year

2012

Additional information

- 1 When did the site carry out the most recent energy efficiency audit? Please list the recommendations in table 3 below
- 2 Is the site a member of any accredited programmes for reducing energy usage/water conservation such as the SEAI programme linked to the right? If yes please list them in additional information
- 3 Where Fuel Oil is used in boilers on site is the sulphur content compliant with licence conditions? Please state percentage in additional information

no	
SELECT	

Table R1 Energy usage on site				
Energy Use	Previous year	Current year	Production +/- % compared to previous reporting year**	Energy Consumption +/- % vs overall site production*
Total Energy Used (MWHrs)				
Total Energy Generated (MWHrs)				
Total Renewable Energy Generated (MWHrs)				
Electricity Consumption (MWHrs)				
Fossil Fuels Consumption:				
Heavy Fuel Oil (m3)				
Light Fuel Oil (m3)				
Natural gas (CMN)				
Coal/Solid fuel (metric tonnes)				
Peat (metric tonnes)				
Renewable Biomass				
Renewable energy generated on site				

* where consumption of energy can be compared to overall site production please enter this information as percentage increase or decrease compared to the previous reporting year.

** where site production information is available please enter percentage increase or decrease compared to previous year

Table R2 Water usage on site					Water Emissions	Water Consumption	
Water use	Water extracted Previous year m3/yr.	Water extracted Current year m3/yr.	Production +/- % compared to previous reporting year**	Energy Consumption +/- % vs overall site production*	Volume Discharged back to environment(m ³ /yr):	Volume used i.e not discharged to environment e.g. released as steam m3/yr	Unaccounted for Water:
Groundwater							
Surface water							
Public supply	5	5					
Recycled water							
Total	5	5					

* where consumption of water can be compared to overall site production please enter this information as percentage increase or decrease compared to the previous reporting year.

** where site production information is available please enter percentage increase or decrease compared to previous year

Table R3 Waste Stream Summary					
	Total	Landfill	Incineration	Recycled	Other
Hazardous (Tonnes)					
Non-Hazardous (Tonnes)					

Resource Usage/Energy efficiency summary Lic No: W0018-01 Year 2012

Table R4: Energy Audit finding recommendations

Date of audit	Recommendations	Description of Measures proposed	Origin of measures	Predicted energy savings %	Implementation date	Responsibility	Completion date	Status and comments
			SELECT					
			SELECT					
			SELECT					

Table R5: Power Generation: Where power is generated onsite (e.g. power generation facilities/food and drink industry)please complete the following information

	Unit ID	Unit ID	Unit ID	Unit ID	Station Total
Technology					
Primary Fuel					
Thermal Efficiency					
Unit Date of Commission					
Total Starts for year					
Total Running Time					
Total Electricity Generated (GWH)					
House Load (GWH)					
KWH per Litre of Process Water					
KWH per Litre of Total Water used on Site					

WASTE SUMMARY	Lic No:	W0018-01	Year	2012
SECTION A-PRTR ON SITE WASTE TREATMENT AND WASTE TRANSFERS TAB- TO BE COMPLETED BY ALL IPPC AND WASTE FACILITIES	PRTR facility logon	dropdown list click to see options		

SECTION B- WASTE ACCEPTED ONTO SITE-TO BE COMPLETED BY ALL IPPC AND WASTE FACILITIES

Additional Information

Were any wastes accepted onto your site for recovery or disposal or treatment prior to recovery or disposal within the boundaries of your facility?; (waste generated within your boundaries is to be captured through PRTR reporting)

No	
----	--

If yes please enter details in table 1 below

2 Did your site have any rejected consignments of waste in the current reporting year? If yes please give a brief explanation in the additional information

No	
----	--

3 Was waste accepted onto your site that was generated outside the Republic of Ireland? If yes please state the quantity in tonnes in additional information

No	
----	--

Table 1 Details of waste accepted onto your site for recovery, disposal or treatment (do not include wastes generated at your site, as these will have been reported in your PRTR workbook)

Licensed annual tonnage limit for your site (total tonnes/annum)	EWC code European Waste Catalogue EWC codes	Source of waste accepted	Description of waste accepted Please enter an accurate and detailed description - which European Waste Catalogue EWC codes	Quantity of waste accepted in current reporting year (tonnes)	Quantity of waste accepted in previous reporting year (tonnes)	Reduction/Increase over previous year +/- %	Reason for reduction/increase from previous reporting year	Packaging Content (%) - only applies if the waste has a packaging component	Disposal/Recovery or treatment operation carried out at your site and the description of this operation	Quantity of waste remaining on site at the end of reporting year (tonnes)	Comments -
75000	13 02 --	13- OIL WASTES AND WASTES OF LIQUID FUELS (except edible oils, and those in chapters 05, 12 and 19)	waste engine oil	2.5	2.46	2%		0%			
75000	14 06 --	14- WASTE ORGANIC SOLVENTS, REFRIGERANTS AND PROPELLANTS (except 07 and 08)	aerosols	0	1.64	-100%		0%			
75000	16 06 01	16- WASTES NOT OTHERWISE SPECIFIED IN THE LIST	lead batteries	0.07	0.66	-89%		0%			
75000	16 06 04	16- WASTES NOT OTHERWISE SPECIFIED IN THE LIST	alkaline batteries	0.2	0.97	-79%		0%			
75000	20 01 01	20- MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS	cardboard	21.56	23.62	-9%		100%			
75000	20 01 02	20- MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS	glass	1042.48	1089.65	-4%		0%			
75000	20 01 11	20- MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS	textiles	1.76	50	-96%		0%			
75000	20 01 21	20- MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS	flourescent tubes	0.329	0.48	-31%		0%			

WASTE SUMMARY		Lic No: W0018-01		Year 2012			
75000	20 01 25	20- MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS	edible oil and fat	1.6	0.45	256%	0%
75000	20 01 27	20- MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS	paint tins	0.5	6.99	-93%	0%
75000	20 01 36	20- MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS	W.E.F.E.	181.38	288.98	-37%	0%
75000	20 01 38	20- MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS	wood	5	6	-17%	0%
75000	20 01 40	20- MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS	metals	13.18	41.39	-68%	0%
75000	20 02 01	20- MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS	biodegradable garden waste	428.66	825.86	-48%	0%
75000	20 03 01	20- MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS	mixed municipal waste	249.82	309.98	-19%	10%

SECTION C-TO BE COMPLETED BY ALL WASTE FACILITIES (waste transfer stations, Composters, Material recovery facilities etc) EXCEPT LANDFILL SITES

4 Is all waste processing infrastructure as required by your licence and approved by the Agency in place? If no please list waste processing infrastructure required onsite

Yes	
SELECT	
Yes	

5 Is all waste storage infrastructure as required by your licence and approved by the Agency in place? If no please list waste storage infrastructure required on site

6 Does your facility have relevant nuisance controls in place?
 7 Do you have an odour management system in place for your facility? If no why?
 8 Do you maintain a sludge register on site?

Yes	
No	Not Necessary
No	

WASTE SUMMARY	Lic No:	W0018-01	Year	2012
----------------------	---------	----------	------	------

Table 4 Environmental monitoring-landfill on [Landfill Manual-Monitoring Standards](#)

Was meteorological monitoring in compliance with Landfill Directive (LD) standard in reporting year +	Was leachate monitored in compliance with LD standard in reporting year	Was Landfill Gas monitored in compliance with LD standard in reporting year	Was SW monitored in compliance with LD standard in reporting year	Have GW trigger levels been established	Were emission limit values agreed with the Agency (ELVs)	Was topography of the site surveyed in reporting year	Has the statement under S53(A)(5) of WMA been submitted in reporting year	Comments
Yes	Yes	Yes	Yes	No	Yes	No	No	

-> please refer to Landfill Manual linked above for relevant Landfill Directive monitoring standards

Table 5 Capping-Landfill only

Area uncapped*	Area with temporary cap	Area with final cap to LD Standard m2 ha, a	Area capped other	Area with waste that should be permanently capped to date under licence	What materials are used in the cap	Comments
SELECT UNIT	SELECT UNIT					
0	0	200,000	0	200,000	Geosynthetic liner and composites with sub and topsoil	

*please note this includes daily cover area

Table 6 Leachate-Landfill only

9 Is leachate from your site treated in a Waste Water Treatment Plant?

Yes
No

10 Is leachate released to surface water? If yes please complete leachate mass load information below

Volume of leachate in reporting year(m3)	Leachate (BOD) mass load (kg/annum)	Leachate (COD) mass load (kg/annum)	Leachate (NH4) mass load (kg/annum)	Leachate (Chloride) mass load kg/annum	Leachate treatment on-site	Specify type of leachate treatment	Comments
700	0.00098	0.0693	0.000112	0.0182	none		

Please ensure that all information reported in the landfill gas section is consistent with the Landfill Gas Survey submitted in conjunction with PRTR returns

Table 7 Landfill Gas-Landfill only

Gas Captured&Treated by LFG System m3	Power generated (MW / KWh)	Used on-site or to national grid	Was surface emissions monitoring performed during the reporting year?	Comments
1295946			Yes	

DRAWINGS


Drawing No. 1	Site Location Plan
Drawing No. 2	Gas Abstraction Network
Drawing No. 3	Surface Water Management
Drawing No. 4	Landscaping Concept Design
Drawing No. 5	Map of Monitoring Points
Drawing No. 6	Leachate Collection System



RPS
 Innishmore,
 Ballincollig,
 Co Cork,
 Ireland

T +353 21 4665900
 F +353 21 4873742
 E ireland@rpsgroup.com
 W rpsgroup.com/ireland

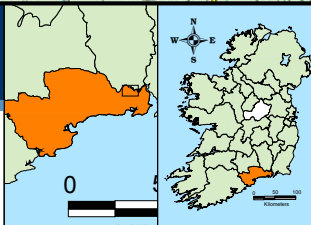
Client
Waterford City Council



Project
Kilbarry Landfill Permanent Gas Flare Contract

Title
1:50,000 Site Location Map

Figure **DG0001**



Issue Details			
Drawn by:	C. Doyle	Project No.	MCW0568
Checked by:	B. O'Leary	File Ref.	MCW0568M0001B01
Approved by:	K. O'Sullivan	Drawing No.	Dg0001
Scale:	NTS	Rev.	B01
Date:	03.02.09		

Notes

1. This drawing is the property of RPS Group Ltd. It is a confidential document and must not be copied, used, or its contents divulged without prior written consent.
2. All levels are referred to Ordnance Datum, Mean Head.
3. Ordnance Survey Ireland Licence EN 0005008 ©Copyright Government of Ireland.



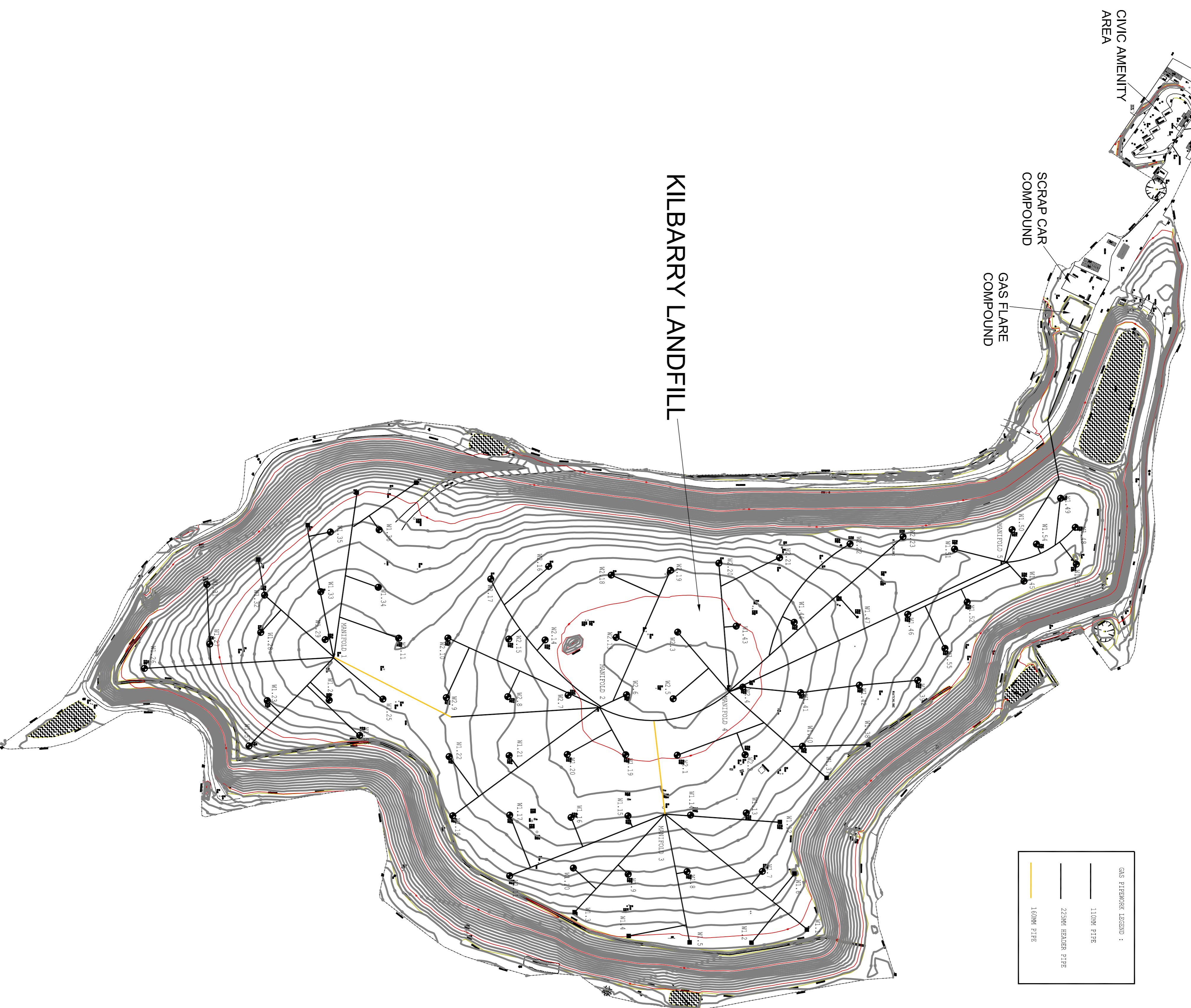
ENTRANCE

CIVIC AMENITY AREA

SCRAP CAR COMPOUND

GAS FLARE COMPOUND

KILBARRY LANDFILL



GAS PIPEWORK LEGEND :	
	1100W PIPE
	2250W HEADER PIPE
	1600W PIPE

NOTES

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

No.	Date	Amendment / Issue	App
B01	Feb.09	ISSUE FOR TENDER	
A01	Nov.08	ISSUE FOR APPROVAL	

RPS
 Freshmore
 Ballinacraig
 Co Cork
 Ireland
 T +353 21 466500
 F +353 21 467742
 W www.rpsgroup.com/ireland
 E ireland@rpsgroup.com

Client
WATERFORD CITY COUNCIL

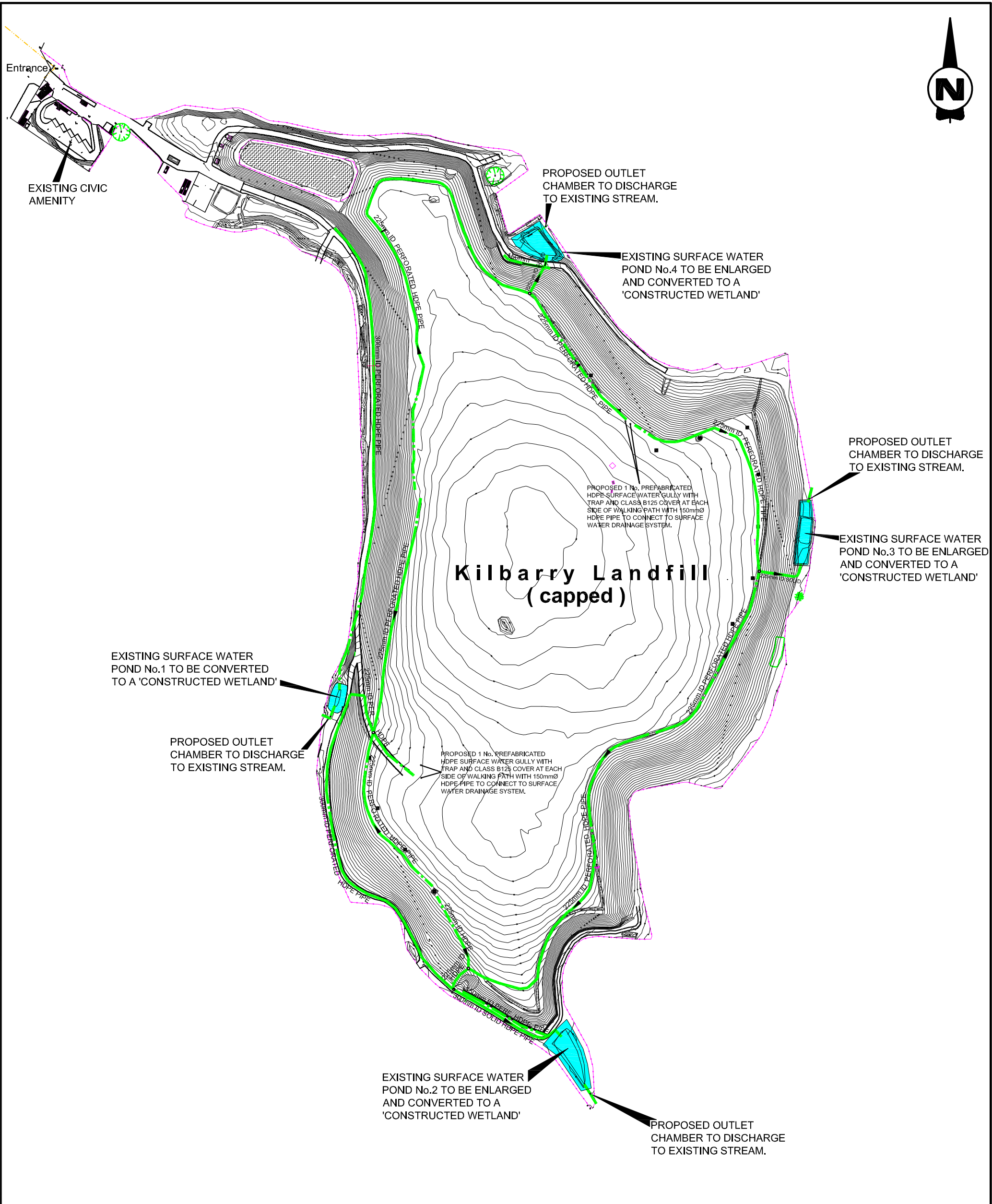
Project
**KILBARRY LANDFILL :
 PERMANENT GAS FLARE CONTRACT**

Title
**LAYOUT PLAN OF LANDFILL
 SHOWING GAS NETWORK**

Drawing Status	Sheet Size	Drawing Scale
For Tender	A1	1:1500

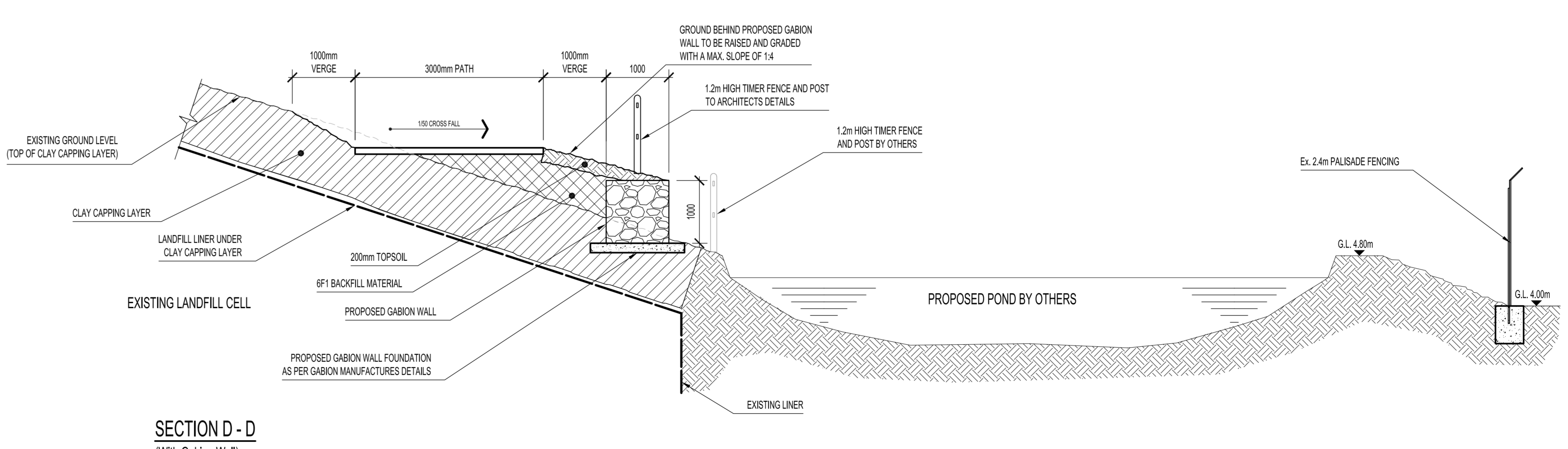
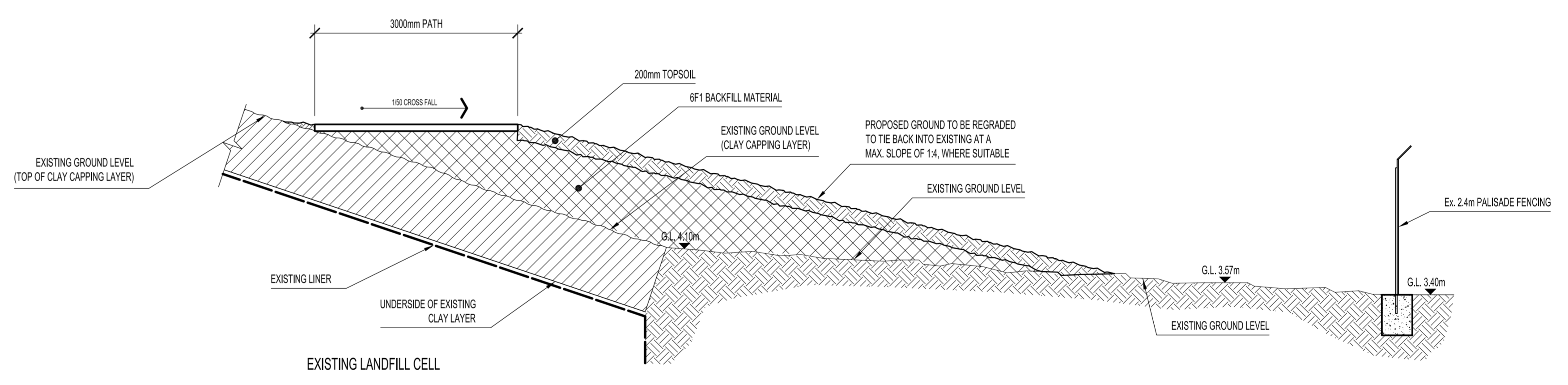
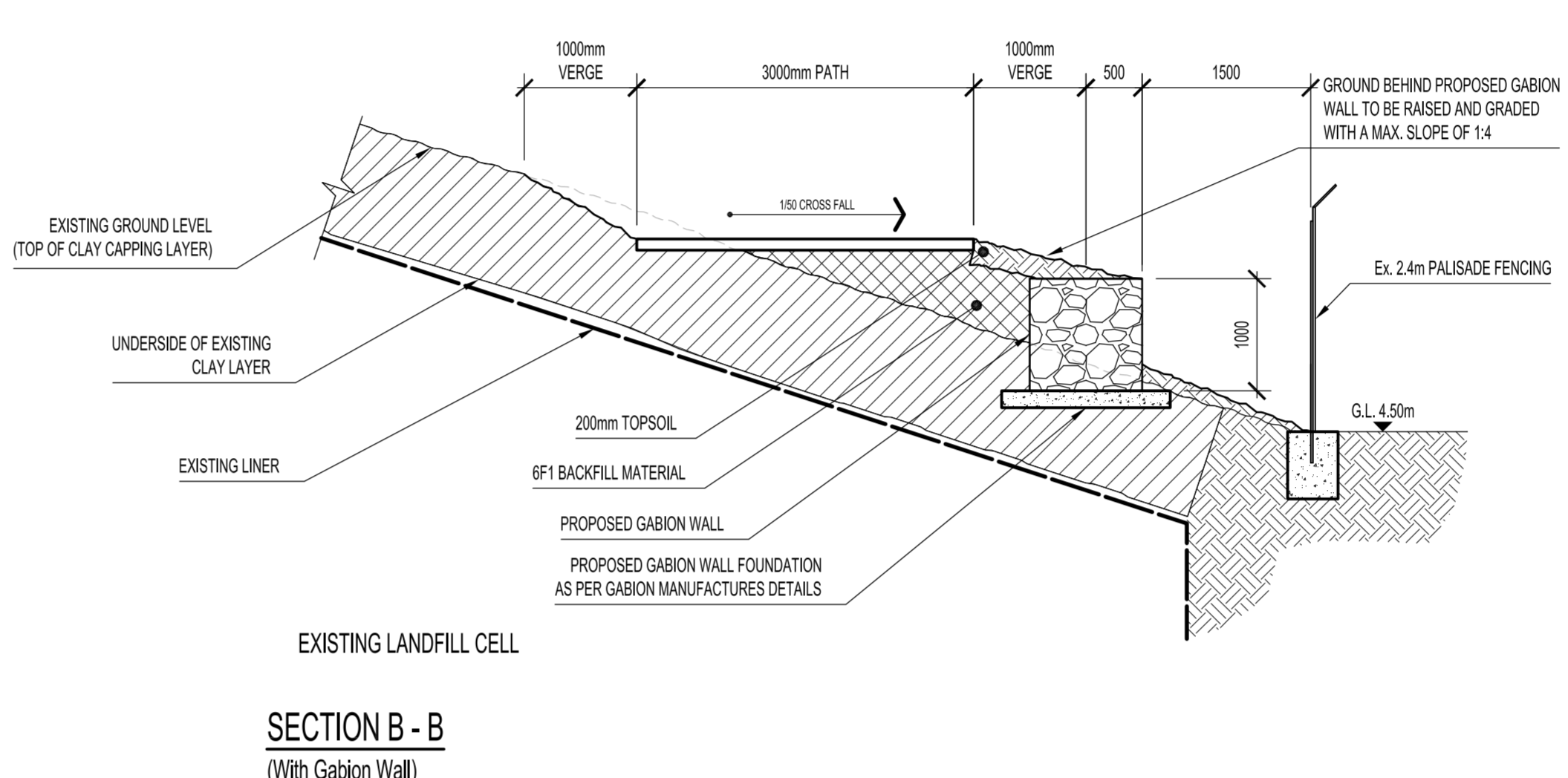
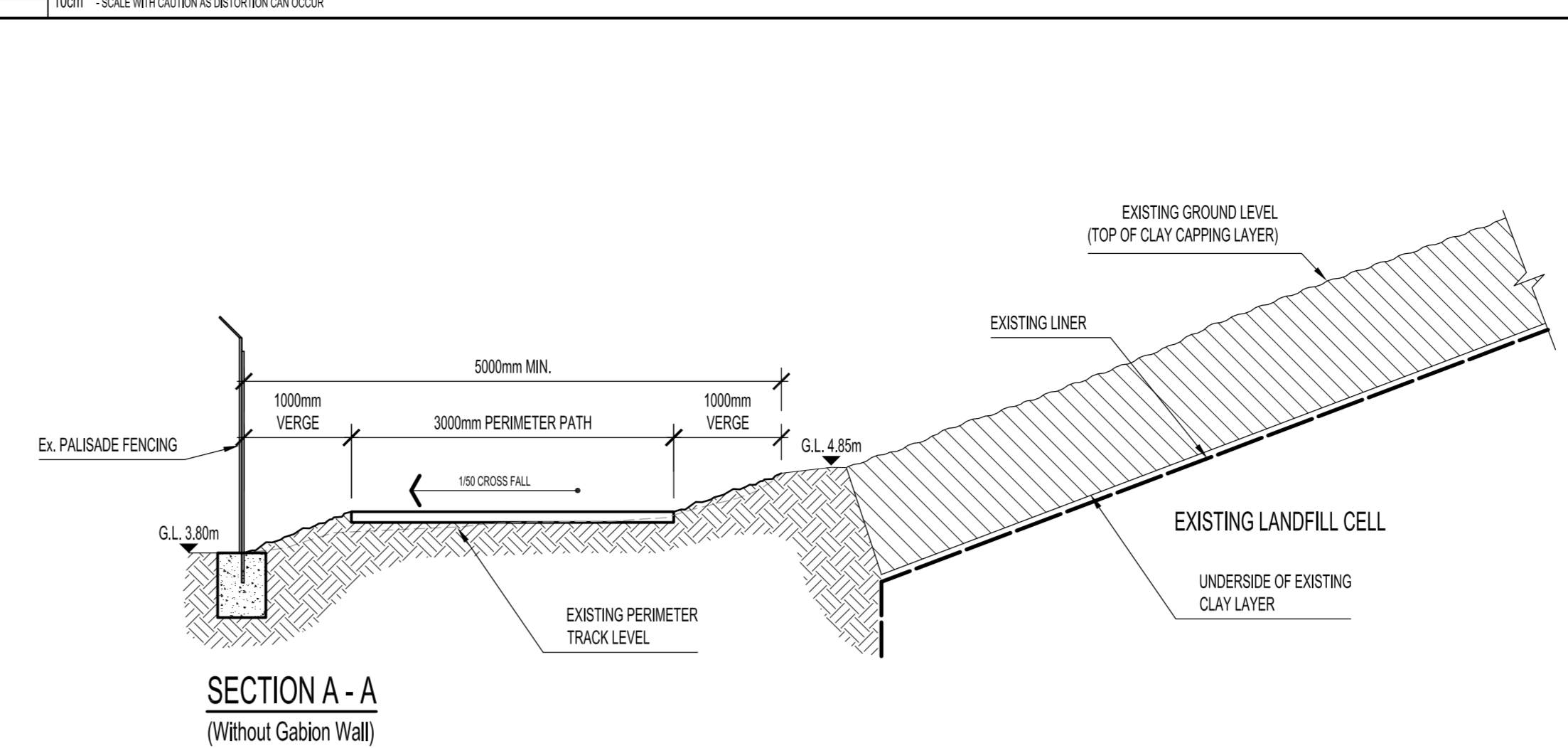
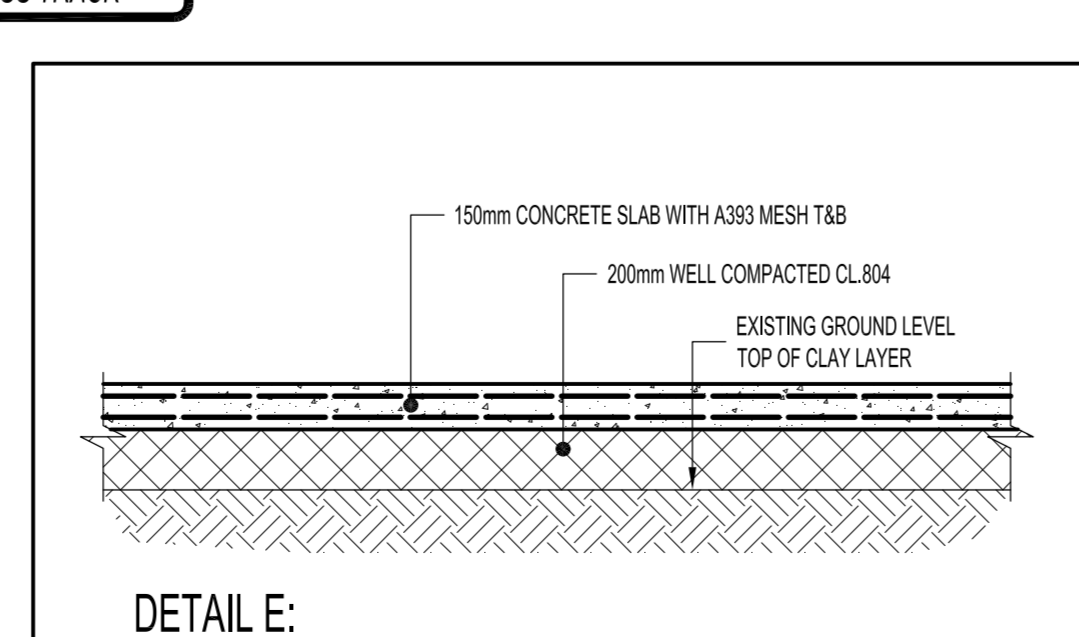
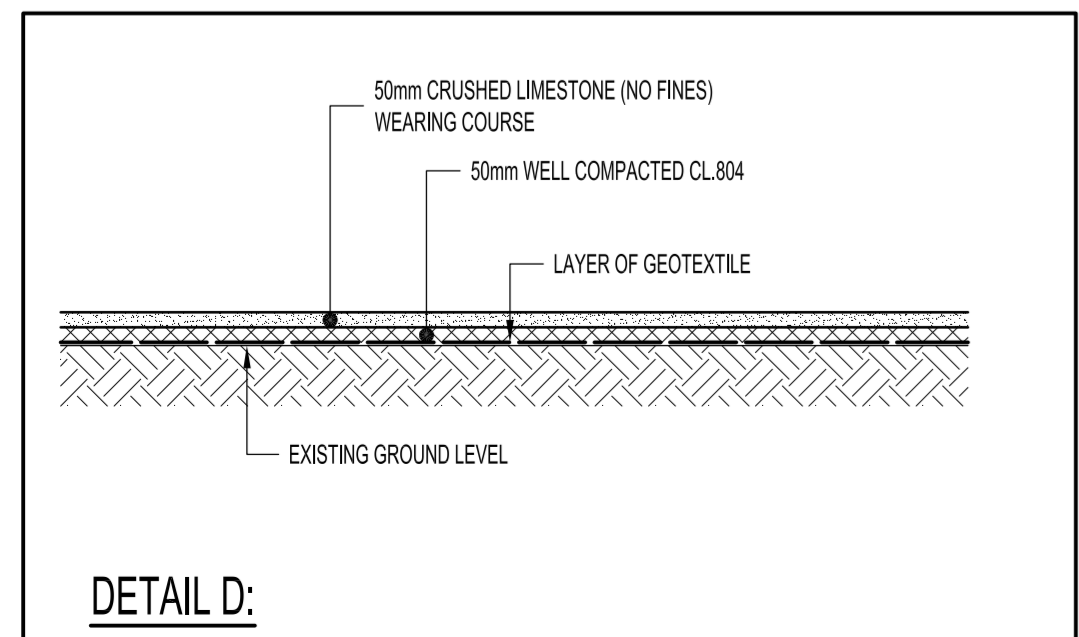
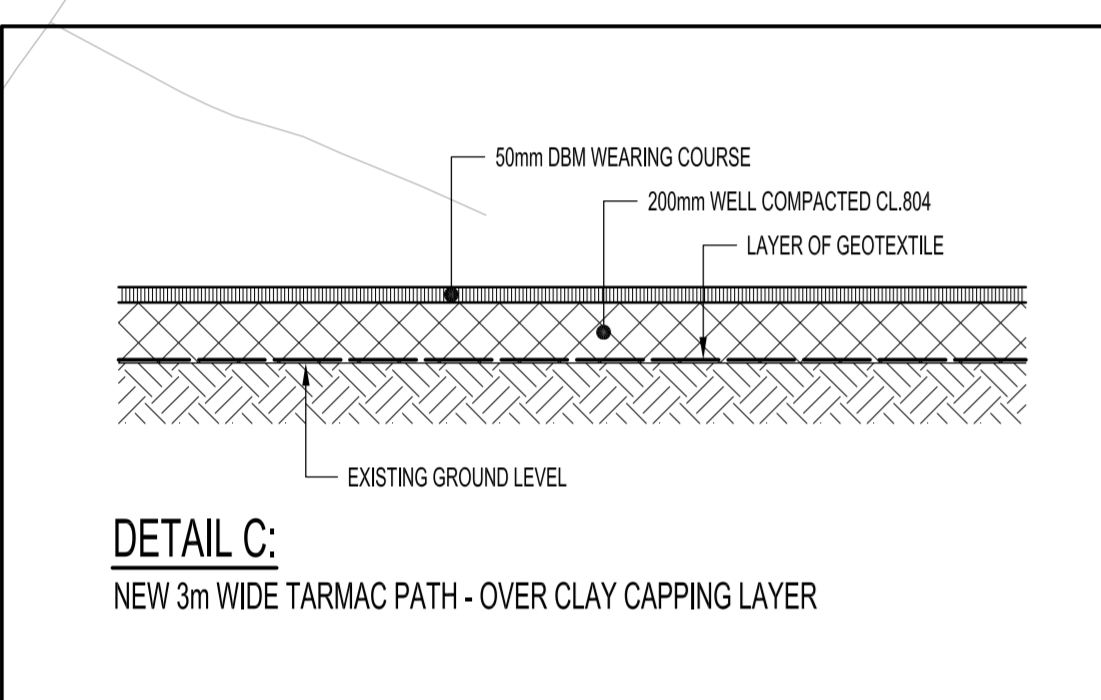
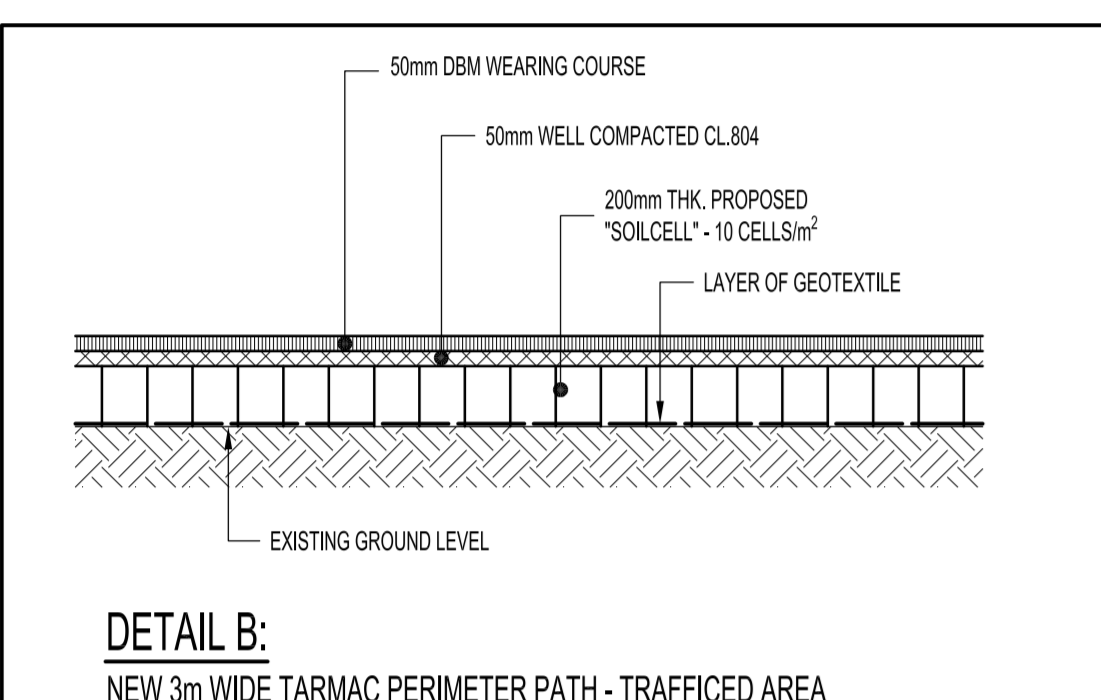
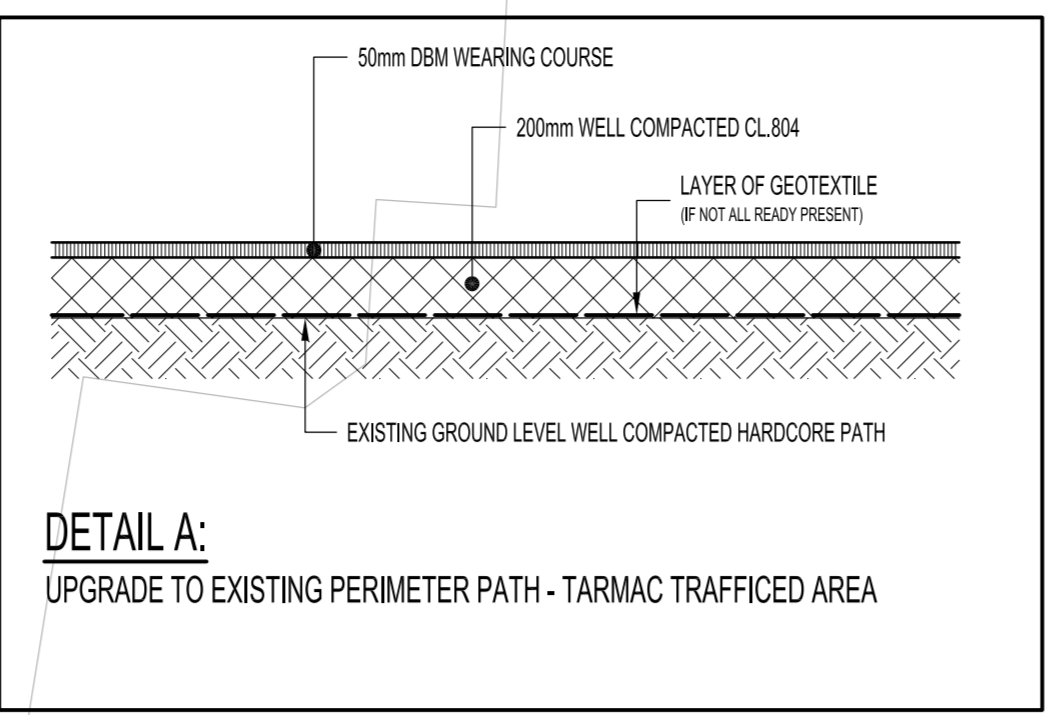
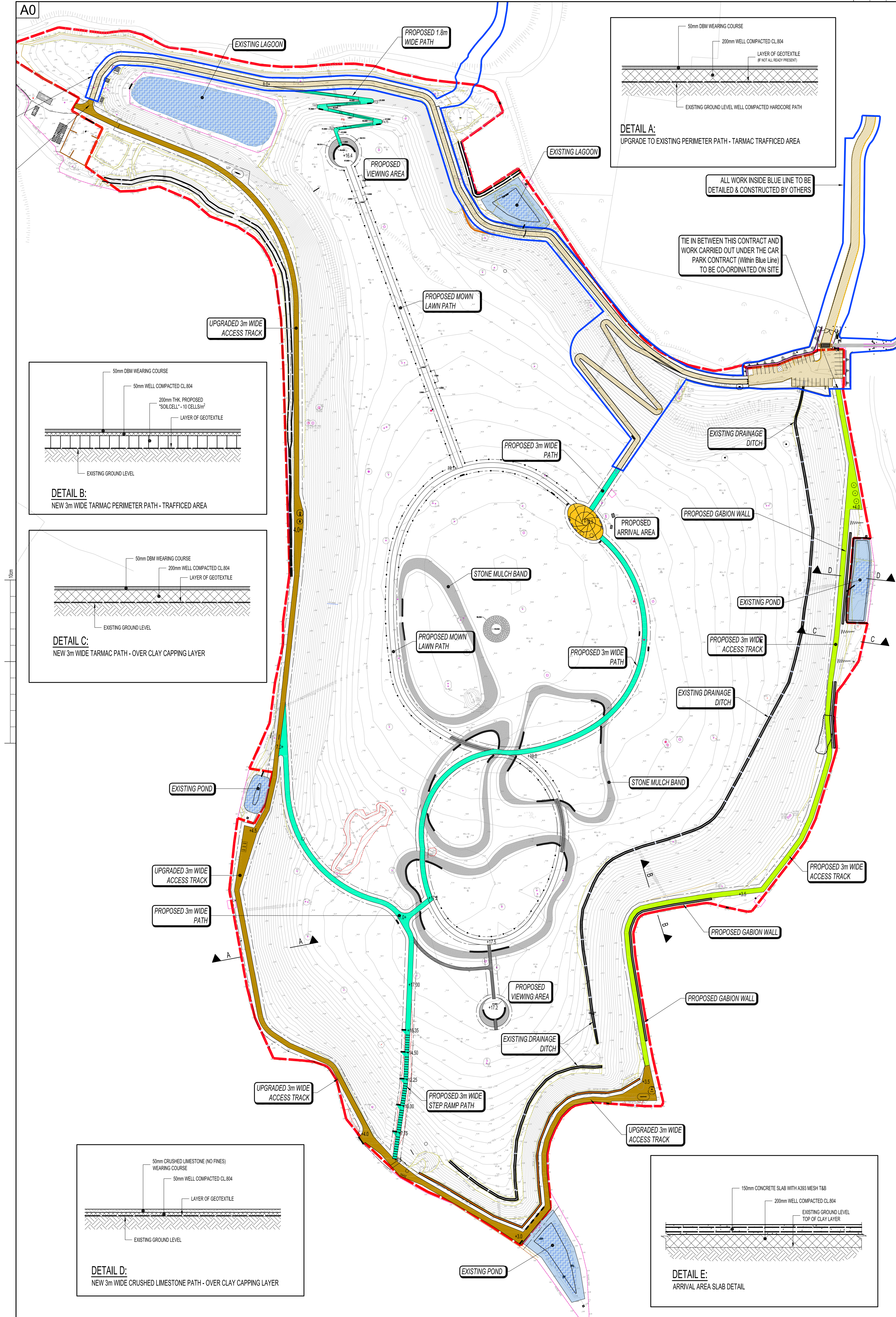
Drawing Number	Rev
MCW0568/02	B01

Drawn By	Checked By	Approved By	Date
JM	CD	KPOS	Nov.08



D01	Mar.'10	JM	CD	DRAFT ISSUE	KPOS
No.	Date	Dr	Chk	Amendment / Issue	App

 Innishmore Ballincollig Co. Cork Ireland T +353 21 4665900 F +353 21 4873742 W www.rpsgroup.com/ireland E ireland@rpsgroup.com	Drawing Number	Rev
	06	D01
Project	KILBARRY LANDFILL - WASTE LICENCE REVIEW	
Client	WATERFORD CITY COUNCIL	
Drawing Status	Sheet Size	Drawing Scale
Draft	A3	-
Drawn By	Checked By	Approved By
JM	CD	KPOS
Date	Jan. 2010	



NOTES:

- EXISTING TOPOGRAPHICAL SURVEY CARRIED OUT BY FOCUS SURVEY LIMITED. ALL LEVELS RELATE TO MAIN HEAD O.D.
- THIS DRAWING MUST BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTURAL DRAWINGS AND SPECIFICATIONS.
- REFER TO ARCHITECTURAL DRAWINGS FOR SETTING OUT DETAILS OF ALL PATHWAYS.
- DO NOT SCALE THIS DRAWING IF IN DOUBT ASK.

LEGEND:

- PROPOSED SITE BOUNDARY
- ALL WORKS WITHIN BLUE LINE CARPARK CONTRACT TO BE DETAILED & CONSTRUCTED BY OTHERS
- TARMAC SURFACE - DETAIL A
- TARMAC SURFACE - DETAIL B
- TARMAC SURFACE - DETAIL C
- CRUSHED LIMESTONE SURFACE - DETAIL D
- STONE MULCH BAND BY ARCHITECTS
- MOWN LAWN PATH BY ARCHITECT

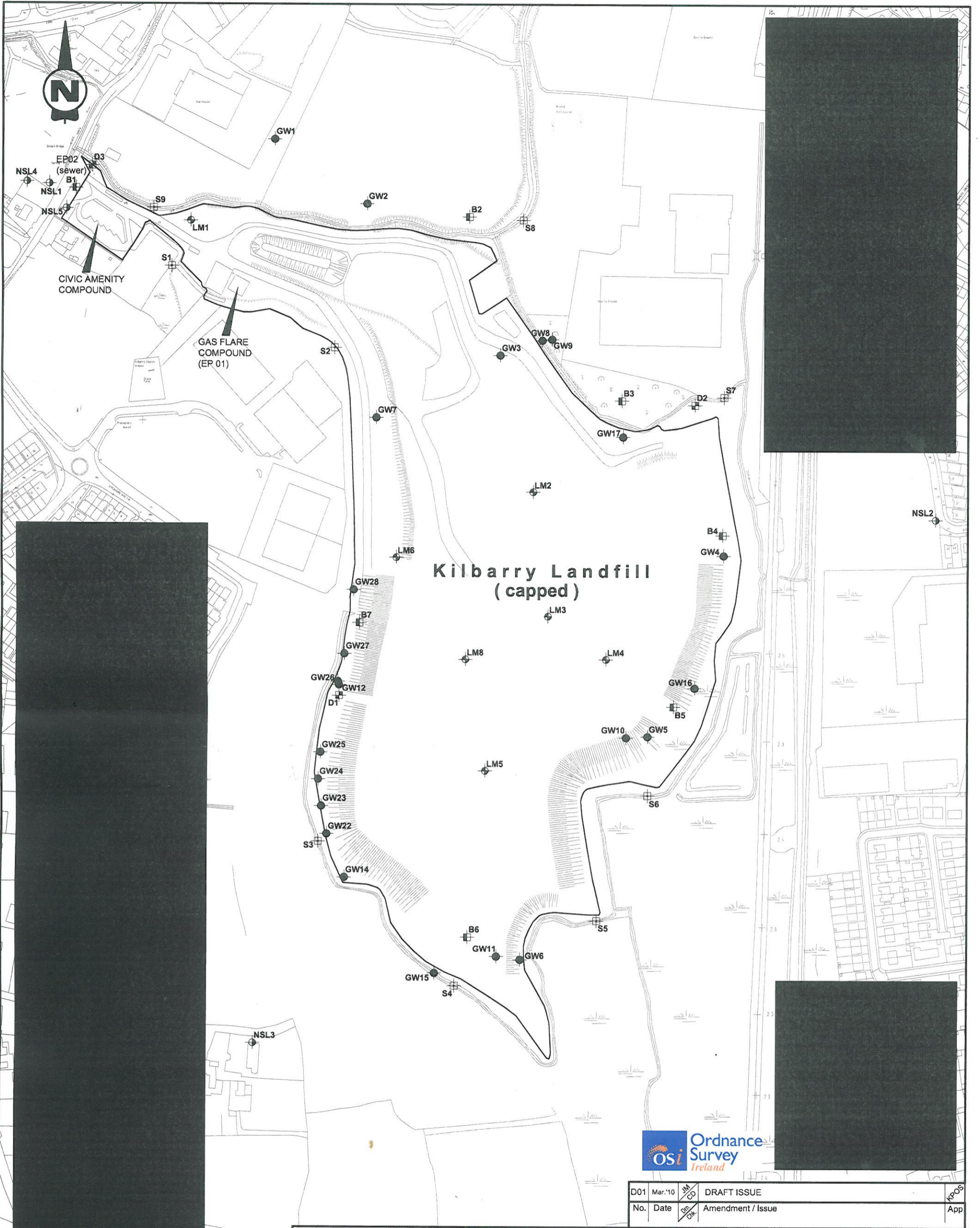
T1	ISSUED FOR TENDER
Rev.	Drawn

TENDER

PROPOSED SITE LAYOUT

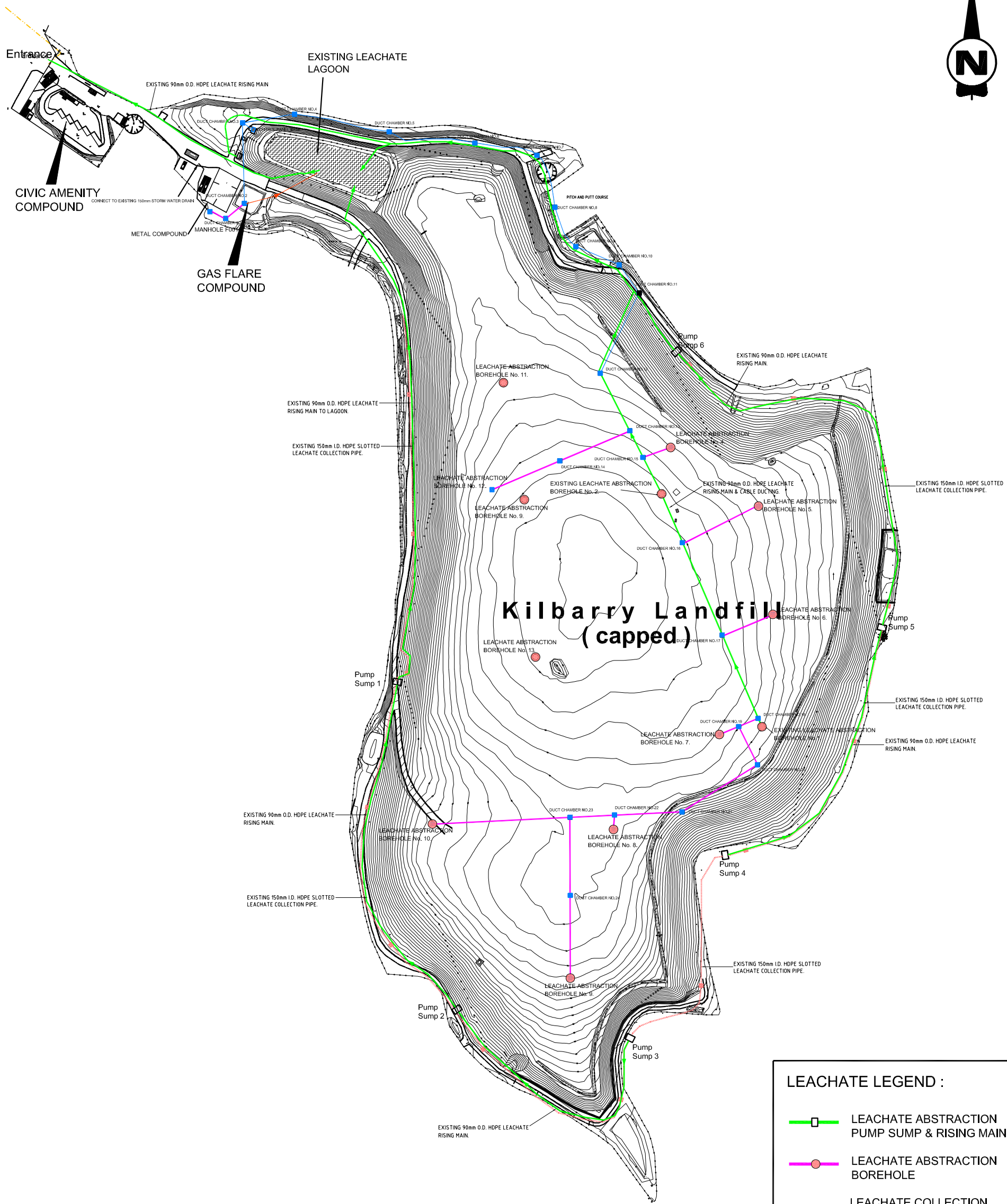
ARUP

15/Blarney Street, Dublin 1
Tel: +353 (0)1 437 2700 Fax: +353 (0)1 437 2749
Email: arup.ie
DUBLIN: CON: LNEYKX
Scale: 1:1000 (Plan), 1:50 (Sections), 1:25 (Details) CHAIN: 7.50/D/L/E
Checked: JMacC Approved: JMacC Date: 05/09/10
JOB No.: 000000000
C2474.10 C001 T1



D01	Mar.'10	JM	CD	DRAFT ISSUE	KPOS
No.	Date	Drn	Chk	Amendment / Issue	App

	Innishmore Ballincollig Co. Cork Ireland	T +353 21 4665900 F +353 21 4873742 W www.rpsgroup.com/ireland E ireland@rpsgroup.com	Drawing Number	Rev		
			10	D01		
Project			Title			
KILBARRY LANDFILL - WASTE LICENCE REVIEW			MONITORING LOCATIONS PLAN			
Client						
WATERFORD CITY COUNCIL						
Drawing Status	Sheet Size	Drawing Scale	Drawn By	Checked By	Approved By	Date
Draft	A3	-	JM	CD	KPOS	Jan. 2010



LEACHATE LEGEND :	
	LEACHATE ABSTRACTION PUMP SUMP & RISING MAIN
	LEACHATE ABSTRACTION BOREHOLE
	LEACHATE COLLECTION PIPEWORK.

D01	Mar.'10	JM	CD	DRAFT ISSUE	KPOS
No.	Date	Dr	Chk	Amendment / Issue	App

Innishmore Ballincollig Co. Cork Ireland T +353 21 4665900 F +353 21 4873742 W www.rpsgroup.com/ireland E ireland@rpsgroup.com	Drawing Number	Rev
	09	D01
Project	Title	
KILBARRY LANDFILL - WASTE LICENCE REVIEW	LEACHATE MANAGEMENT SYSTEM	
Client	WATERFORD CITY COUNCIL	
Drawing Status	Sheet Size	Drawing Scale
Draft	A3	-
Drawn By	Checked By	Approved By
JM	CD	KPOS
Date	Date	
Jan. 2010	Jan. 2010	