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TIER 3 RISK ASSESSMENT

FORMER LANDFILL

GOWRAN

COUNTY KILKENNY

VOL 2 APPENDICES

Prepared For: -

Kilkenny County Council
John Street
Kilkenny

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Prepared By: -

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December 2017

O'Callaghan Moran & Associates Registration/VAT Number: 8272844

APPENDIX 1

Tier 1 Risk Assessment and Tier 2 Risk Assessment Reports

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TIER 1 RISK ASSESSMENT

For

**Historical Landfill,
Gowran ,
Kilkenny.**

Class B – Medium Risk Site

Prepared in accordance with the EPA's Code of Practice for Environmental Risk Assessment for Unregulated Waste Disposal Sites.

Prepared by: Michael Nugent
Environment Section
Kilkenny County Council

07/11/2013
(rev.3)

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SUMMARY

Introduction

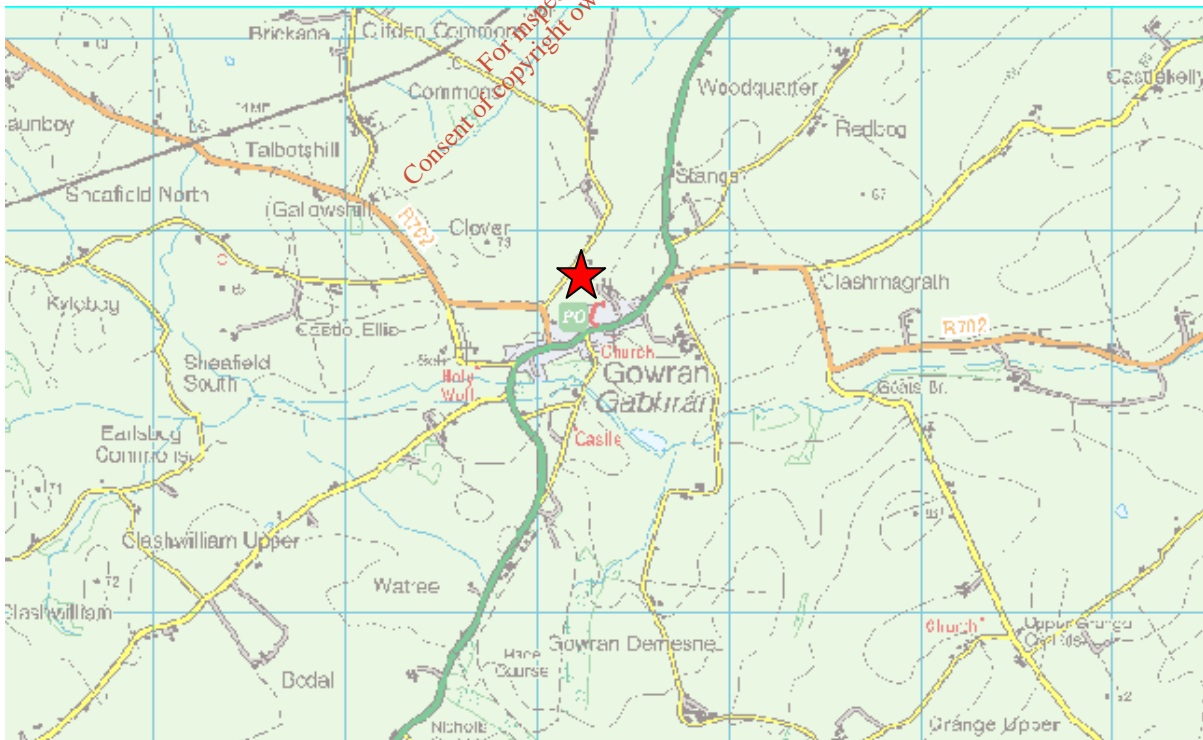
Gowran landfill is located at Gowran, Co. Kilkenny at coordinates X: 263207, Y: 153721. The site was used by Kilkenny County Council for the disposal of municipal waste. The site originally consisted of an old quarry. The council filled the pit and covered the site with soil. The site is owned by Kilkenny County Council.

Walkover

The site is currently in use as a storage yard by the Council. The surrounding area is used for residential and agricultural purposes. The site is approximately 0.09 hectares in area. The land falls in a south westerly direction. There is a new housing estate to the east of the site, the closest house being approximately 17m from the site. There is a well approximately 150m SW of the site. There are no surface water features in the vicinity of the site. There are no visible sources of contamination. There are no visible signs of impact to the environment.

Desk study

The closest surface water feature is a river 524m south of the site. There is a public water supply 2.57Km North West of the site. The aquifer is classified as extremely vulnerable. The aquifer is regionally important and karstified. The subsoil is mainly derived from sandstone and shale tills.



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PHOTOGRAPHS



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Tier 1 Risk Assessment – Historical Landfill, Gowran



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Site outlined in red.

Tier 1 Risk Assessment – Historical Landfill, Gowran



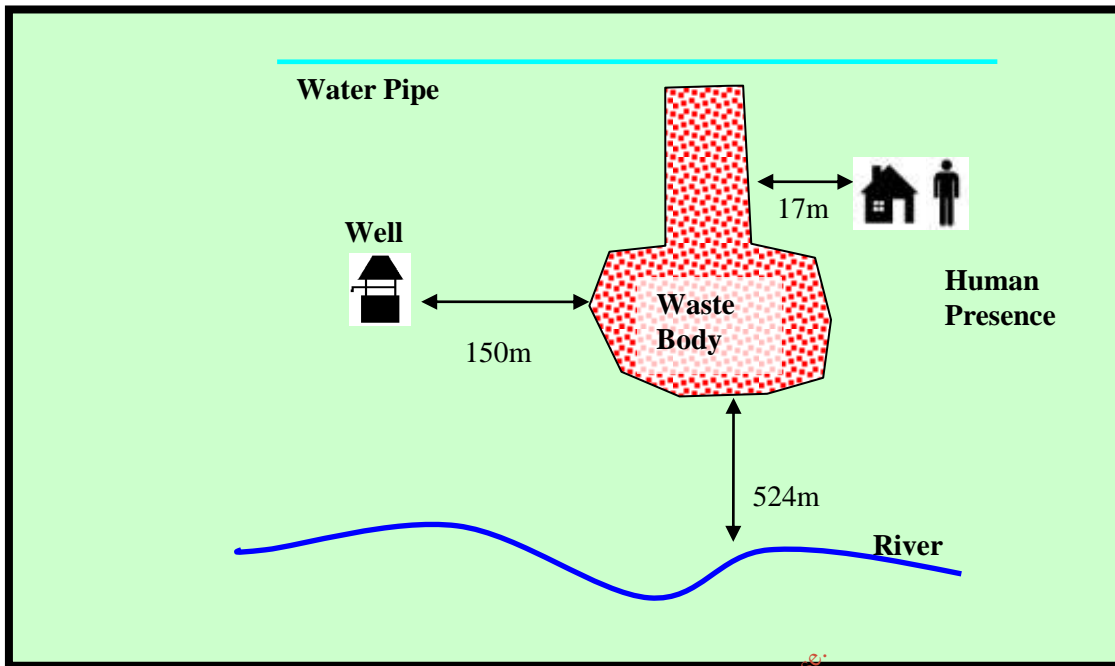
Waterlogged Soil



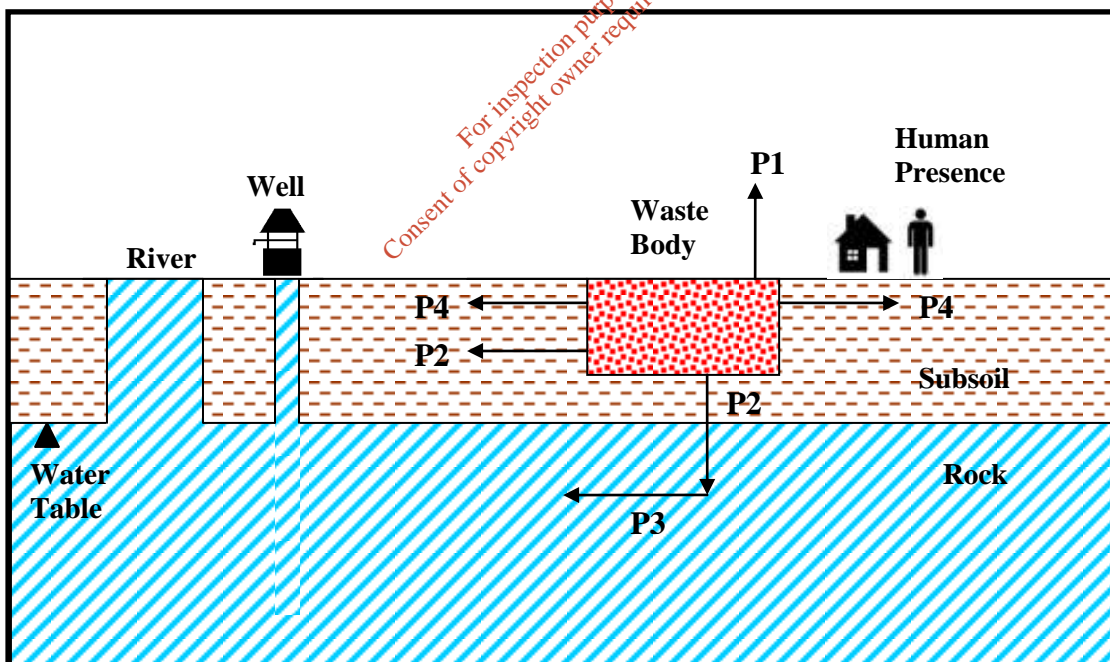
Bare patch

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CONCEPTUAL MODEL



Plan



Cross Section

- P1 – Landfill Gas
- P2 – Leachate Migration – unsaturated zone
- P3 – Leachate Migration – saturated zone
- P4 – Landfill Gas Migration.

WALKOVER SURVEY CHECKLIST

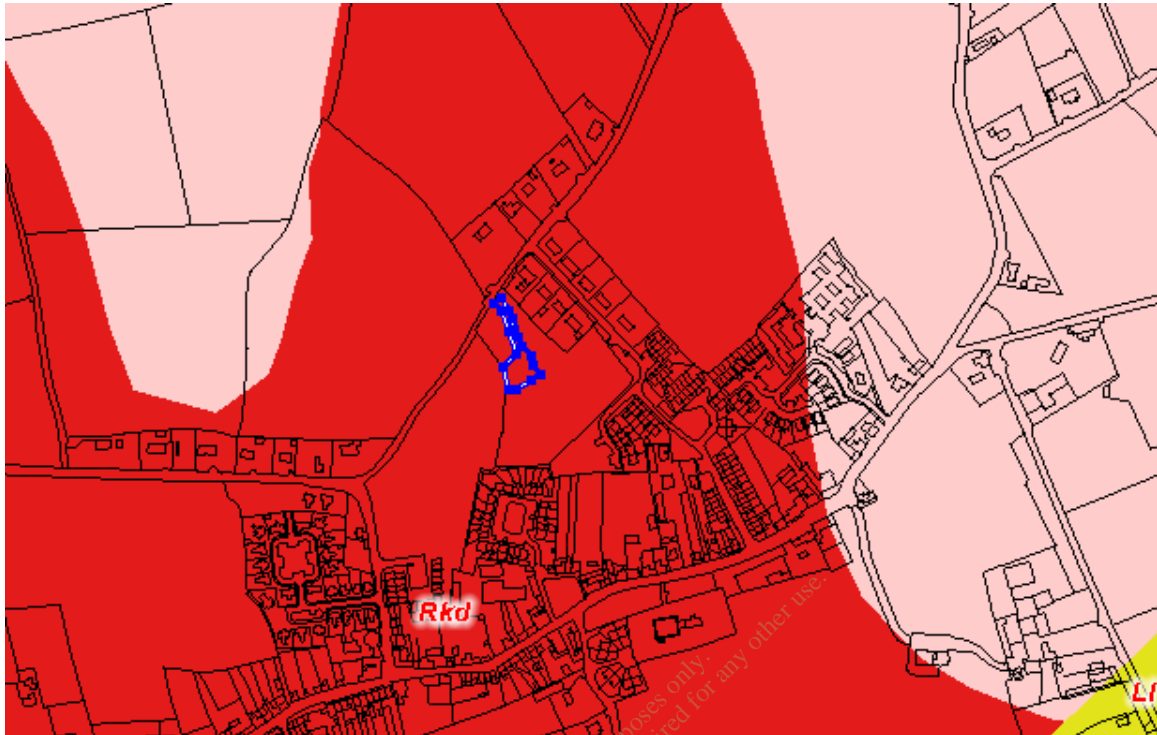
Information	Checked	Comment (include distances from site boundary)
1. What is current Land Use?	✓	Residential/sports/storage yard
2. What are the neighbouring Land Uses?	✓	Residential/agricultural
3. What is the size of the site?	✓	0.087ha
4. What is the topography?	✓	Gentle slope to south west
5. Are there potential receptors (if yes, give details)?	✓	
• Houses	✓	17m east of site
• Surface water features (if yes, distance and direction of flow)	✓	River 524m south of site
• Any wetland or protected areas	✓	None
• Public Water Supplies	✓	2572m north-west of site
• Private Wells	✓	150m
• Services	✓	Water pipe north of site
• Other buildings	✓	Residential
• Other	✓	n/a
6. Are there any potential sources of contamination (if yes, give details)?	✓	
• Surface waste (if yes, what type?)	✓	No (some fly-tipped waste not associated with landfill)
• Surface ponding of leachate	✓	No
• Leachate seepage	✓	No
• Landfill gas odours	✓	No
7. Are there any outfalls to surface water? (If yes, are there discharges and what is the nature of the discharge?)	✓	No
8. Are there any signs of impact on the environment? (If yes, take photographic evidence)	✓	No
• Vegetation die off, bare ground	✓	Yes – some patches of bare ground. See Photo.
• Leachate seepages	✓	No
• Odours	✓	No
• Litter	✓	Yes – not associated with landfill

Tier 1 Risk Assessment – Historical Landfill, Gowran

Information	Checked	Comment (include distances from site boundary)
<ul style="list-style-type: none"> Gas bubbling through water 	✓	No
<ul style="list-style-type: none"> Signs of settlement, subsidence, water logged areas 	✓	No
<ul style="list-style-type: none"> Drainage or hydraulic issues 	✓	Some waterlogged soil on site – most likely due to capping material. See Photo.
<ul style="list-style-type: none"> Downstream water quality appears poorer than upstream water quality 	✓	Not tested
9. Are there any indications of remedial measures? (Provide details)	✓	
<ul style="list-style-type: none"> Capping 	✓	Capped with soil.
<ul style="list-style-type: none"> Landfill gas collection 	✓	No
<ul style="list-style-type: none"> Leachate collection 	✓	No
10. Describe fences and security features (if any)	✓	Fence present – not adequate.
Any other relevant information?		

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AQUIFER

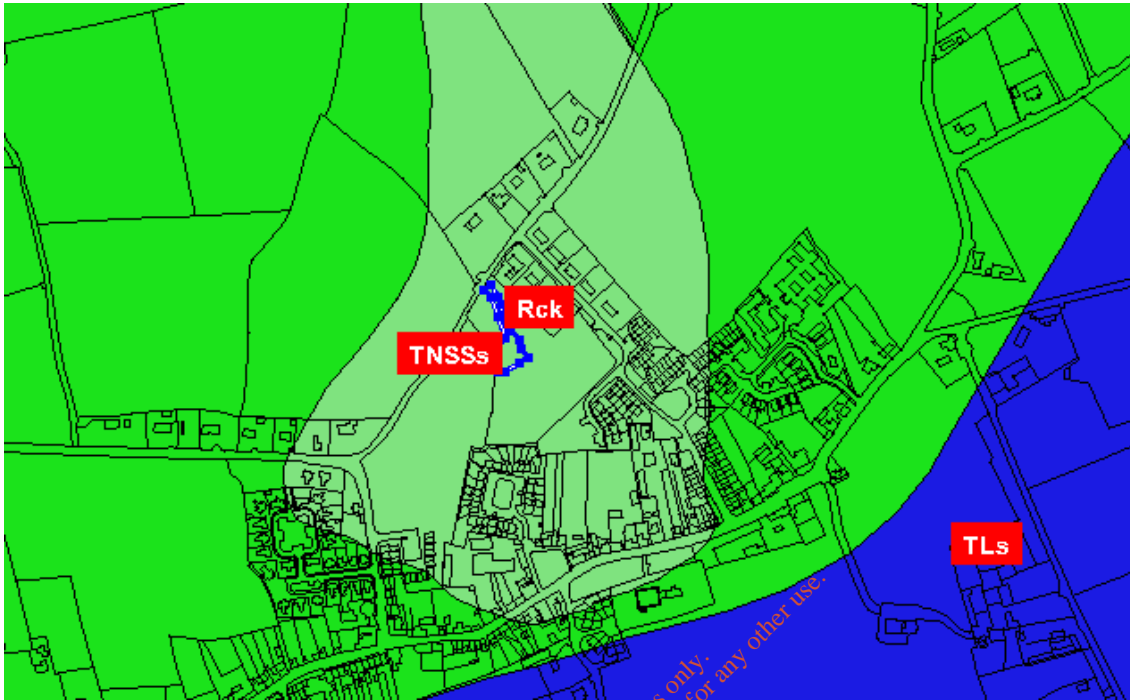


0 197m

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Aquifer type – Rkd – Regionally important karstified aquifer.

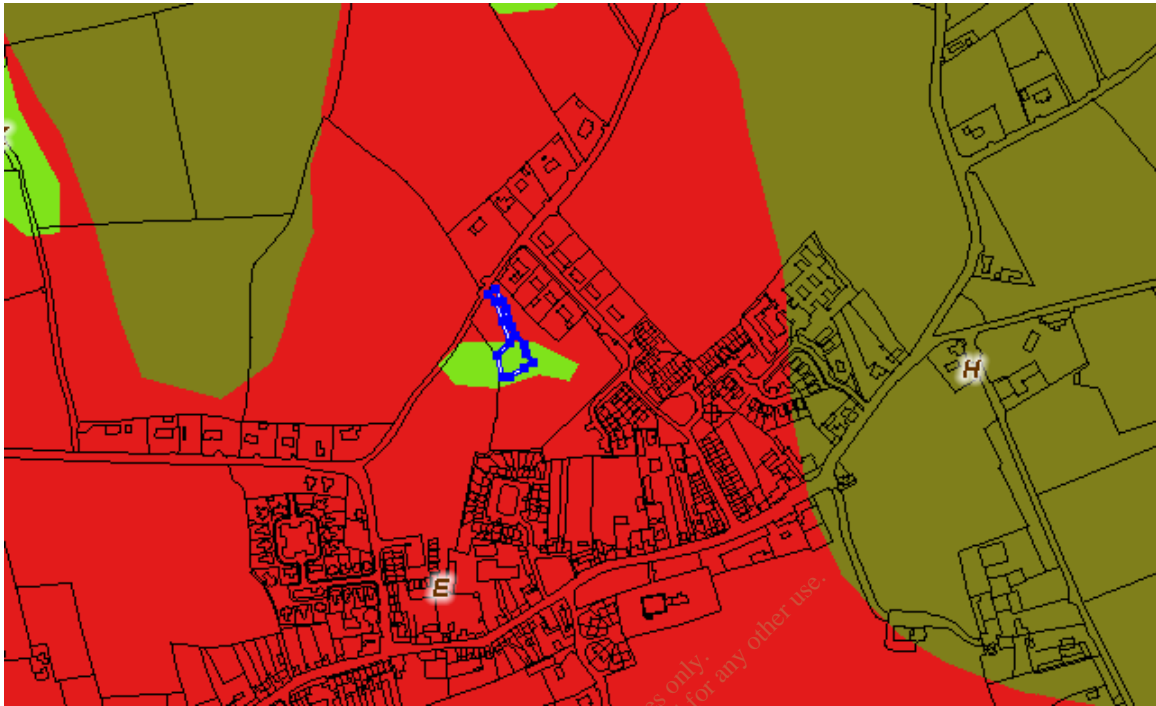
SUBSOIL



0 197m
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Rock
TNSs – Sandstone/shale till

GROUNDWATER VULNERABILITY



0 197m

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Vulnerability – Extreme

- Always extreme with quarry

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HEIGHT CONTOURS

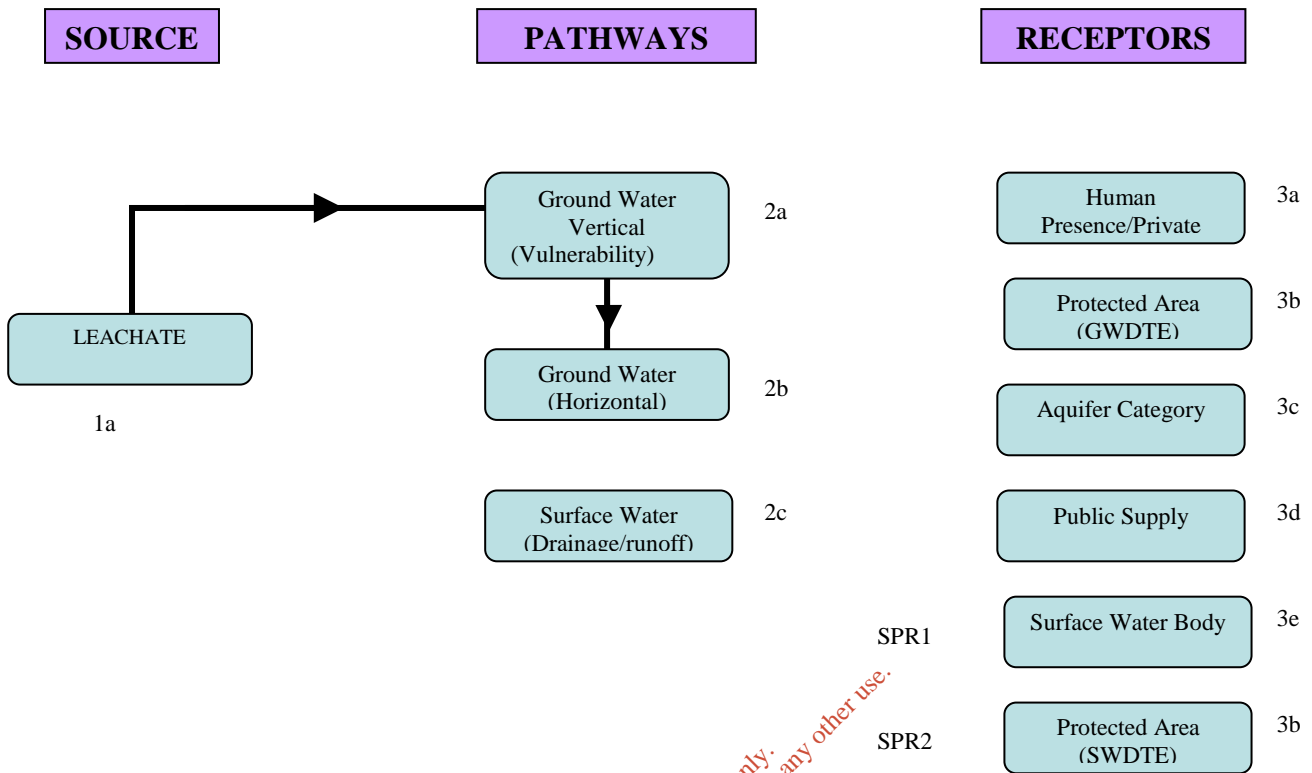


0  252m
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Site slopes in a South Westerly direction.

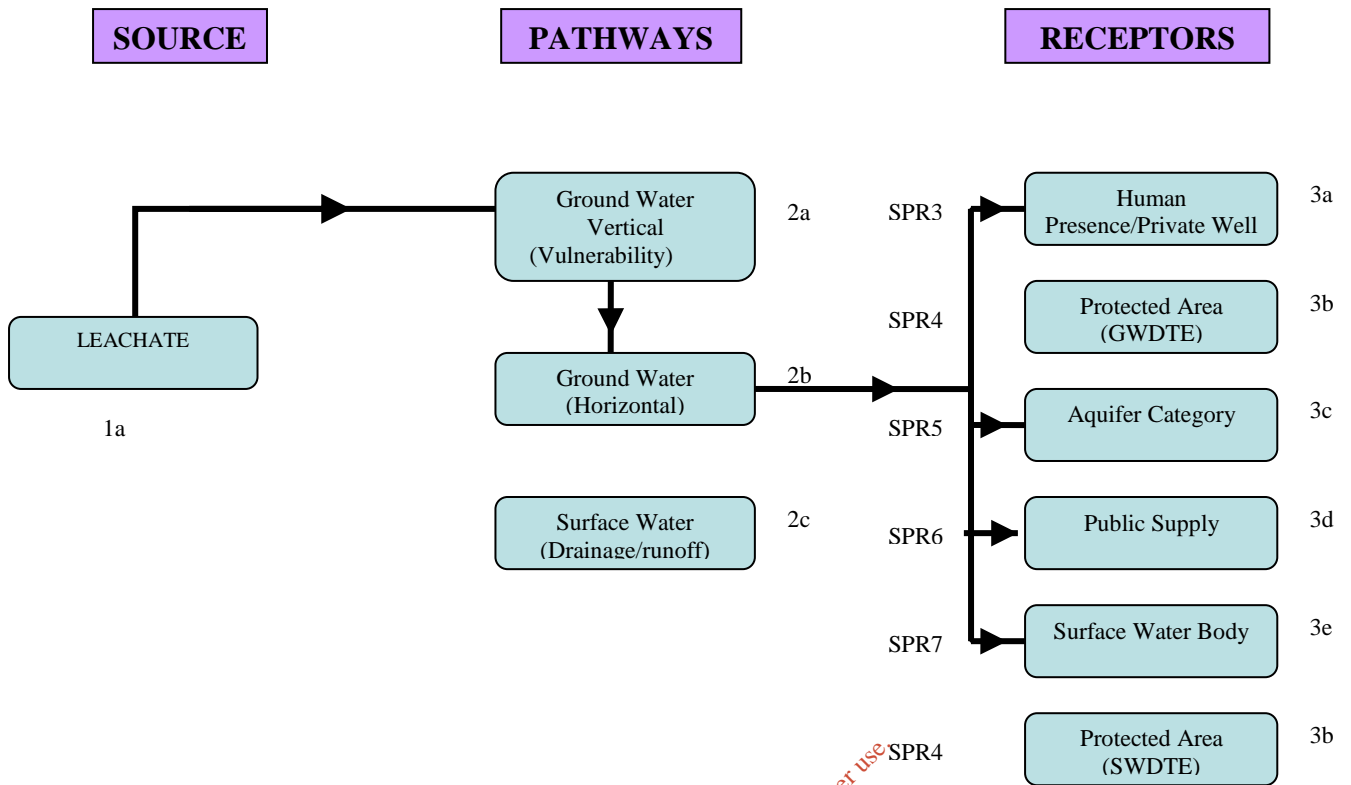
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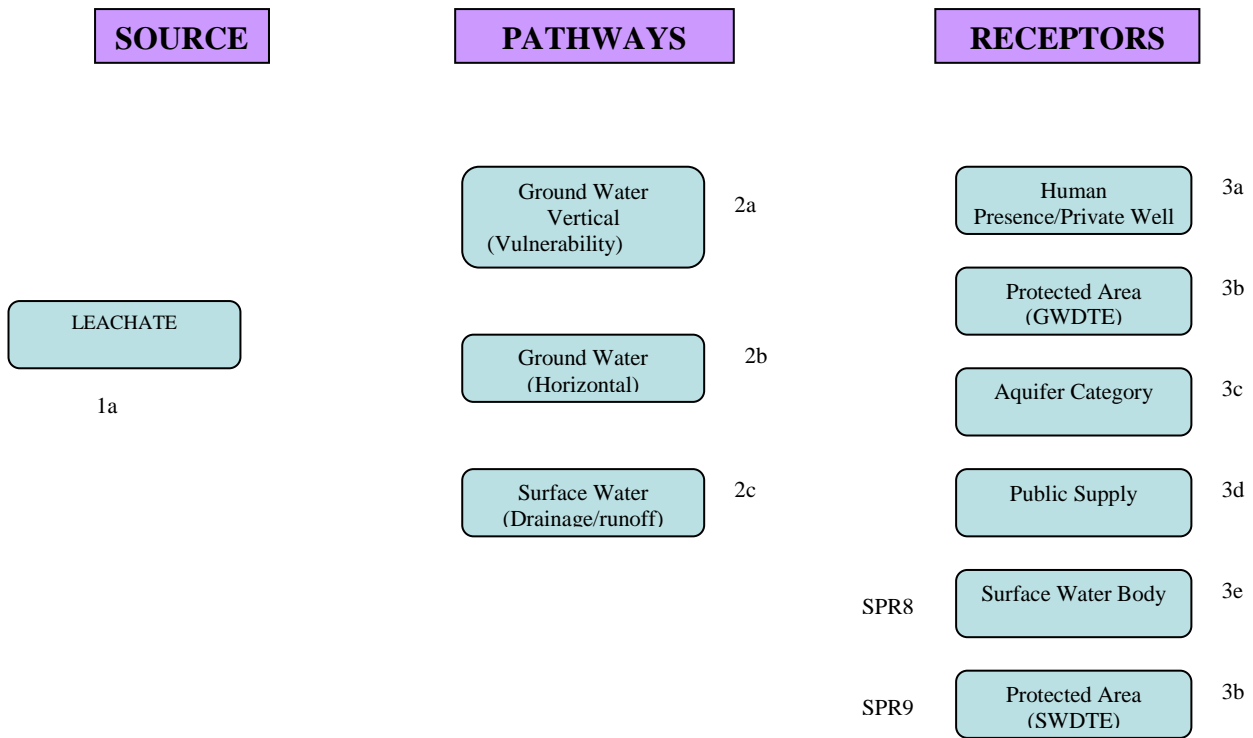
Network Diagram for Leachate Migration through combined groundwater and surface water pathways

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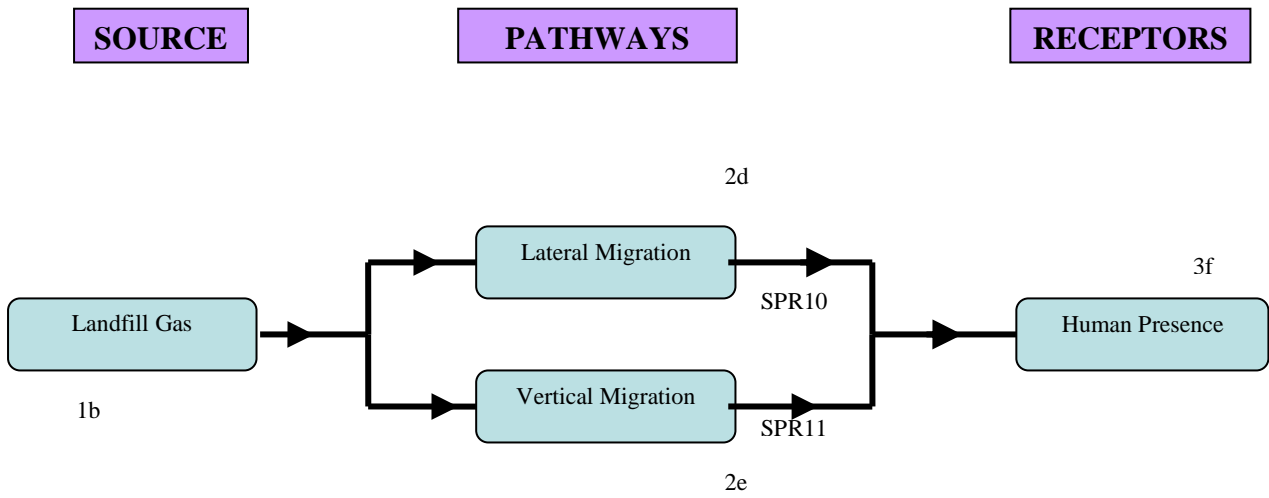
Network Diagram for Leachate Migration through groundwater pathways

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Network Diagram for Leachate Migration through surface water pathways

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Network Diagram for Landfill Gas Migration (Lateral and Vertical)

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RISK SCORING MATRICES

Source

Table 1a: LEACHATE: SOURCE/HAZARD SCORING MATRIX

WASTE TYPE	WASTE FOOTPRINT (ha)		
	≤ 1 ha	> 1 ≤ 5 ha	> 5 ha
C&D ²⁰	0.5	1	1.5
Municipal ²¹	5	7	10
Industrial ²²	5	7	10
Pre 1977 sites ²³	1	2	3
		MAX	10

Table 1b: LANDFILL GAS: SOURCE/HAZARD SCORING MATRIX

WASTE TYPE	WASTE FOOTPRINT (ha)		
	≤ 1 ha	> 1 ≤ 5 ha	> 5 ha
C&D ²⁰	0.5	0.75	1
Municipal ²¹	5	7	10
Industrial ²²	3	5	7
Pre 1977 sites ²³	0.5	0.75	1
		MAX	10

Pathways

Table 2a: LEACHATE MIGRATION: PATHWAYS

Parameters	Points available
GROUNDWATER VULNERABILITY (Vertical pathway)	
Extreme Vulnerability	3
High Vulnerability	2
Moderate Vulnerability	1
Low Vulnerability	0.5
High – Low Vulnerability	2

Table 2b: LEACHATE MIGRATION: PATHWAYS

Parameters	Points available
GROUNDWATER FLOW REGIME (Horizontal pathway)	
Karstified Groundwater Bodies (Rk) ²⁵	5
Productive Fissured Bedrock Groundwater Bodies (Rf and Lm) ²⁵	3
Gravel Groundwater Bodies (Rg and Lg) ²⁵	2
Poorly Productive Bedrock Groundwater Bodies (LI, PI, Pu) ²⁵	1

- Rk Regionally Important Karstified Aquifers
- Rf Regionally Important Fissured Bedrock Aquifers
- Rg Regionally Important Extensive Sand/Gravel Aquifers
- LI Locally Important Sand/Gravel Aquifers
- Lm Locally Important Bedrock Aquifers - Generally Moderately Productive
- Lg Locally Important Bedrock Aquifers - Moderately Productive only in Local Zones
- PI Poor Bedrock Aquifers – Generally Unproductive except for Local Zones
- Pu Poor Bedrock Aquifers – Generally Unproductive

Tier 1 Risk Assessment – Historical Landfill, Gowran

Table 2c: LEACHATE MIGRATION: *PATHWAYS*

Parameters	Points available
SURFACE WATER DRAINAGE^{2b} (surface water pathway)	
Is there a direct connection between drainage ditches associated with the waste body and adjacent surface water body? Yes	2
If no direct connection	0

Table 2d: LANDFILL GAS: *PATHWAY* assuming receptor within 250m of source

Parameters	Points available
LANDFILL GAS LATERAL MIGRATION POTENTIAL	
Sand and Gravel, Made ground, urban, karst	3
Bedrock	2
All other Tills (including limestone, sandstone etc – moderate permeability)	1.5
All Namurian or Irish Sea Tills (low permeability)	1
Clay, Alluvium, Peat	1

Table 2e: LANDFILL GAS: *PATHWAY* assuming receptor located above source.

Parameters	Points available
LANDFILL GAS VERTICAL (UPWARDS) MIGRATION POTENTIAL	
Sand and Gravel, Made ground, urban, karst	5
Bedrock	3
All other Tills (including limestone, sandstone etc – moderate permeability)	2
All Namurian or Irish Sea Tills (low permeability)	1
Clay, Alluvium, Peat	1

Receptors

Table 3a: LEACHATE MIGRATION: *RECEPTORS*

Parameters	Points available
HUMAN PRESENCE (presence of a house indicates potential private wells)	
On or within 50m of the waste body	3
Greater than 50m but less than 250m of the waste body	2
Greater than 250m but less than 1km of the waste body	1
Greater than 1 km of the waste body	0

Table 3b: LEACHATE MIGRATION: *RECEPTORS*

Parameters	Points available
PROTECTED AREAS (SWDTE or GWDTE)	
Within 50m of the waste body	3
Greater than 50m but less than 250m of the waste body	2
Greater than 250m but less than 1km of waste body	1

Tier 1 Risk Assessment – Historical Landfill, Gowran

Greater than 1 km of the waste body	0
Undesignated sites ²⁷ within 50m of site of the waste body	1
Undesignated sites ²⁷ greater than 50m but less than 250m of the waste body	0.5
Undesignated sites ²⁷ greater than 250m of the waste body	0

Table 3c: LEACHATE MIGRATION: *RECEPTORS*

Parameters	Points available
AQUIFER CATEGORY²⁸(resource potential)	
Regionally Important Aquifers (Rk, Rf, Rg)	5
Locally Important Aquifers (Ll, Lm, Lg)	3
Poor Aquifers (Pl, Pu)	1

- Rk Regionally Important Karstified Aquifers
 Rf Regionally Important Fissured Bedrock Aquifers
 Rg Regionally Important Extensive Sand/Gravel Aquifers
 Ll Locally Important Sand/Gravel Aquifers
 Lm Locally Important Bedrock Aquifers - Generally Moderately Productive
 Lg Locally Important Bedrock Aquifers - Moderately Productive only in Local Zones
 Zones
 Pl Poor Bedrock Aquifers – Generally Unproductive except for Local Zones
 Pu Poor Bedrock Aquifers – Generally Unproductive

Table 3d: LEACHATE MIGRATION: *RECEPTORS*

PUBLIC WATER SUPPLIES (other than private wells)	
Within 100m of site boundary	7
Greater than 100m but less than 300m or within Inner SPA (SI) for GW supplies	5
Greater than 300m but less than 1km or within Outer SPA (SO) for GW supplies	3
Greater than 1km (karst aquifer)	3
Greater than 1km (no karst aquifer)	0

Table 3e: LEACHATE MIGRATION: *RECEPTORS*

Parameters	Points available
SURFACE WATER BODIES	
Within 50m of site boundary	3
Greater than 50m but less than 250m	2
Greater than 250m but less than 1km	1
Greater than 1km	0

Table 3f: LANDFILL GAS: *RECEPTOR*

Parameters	Points available
HUMAN PRESENCE	
On site or within 50m of site boundary	5
Greater than 50m but less than 150m	3
Greater than 150m but less than 250m	1
Greater than 250m	0.5

RISK SCREENING

SITE: Gowran

RISK: Medium Risk

TABLE		SCORE	RATIONALE
Source			
Leachate Hazard	1a	5	0.09 ha, municipal
Landfill Gas Hazard	1b	5	0.09 ha
Pathways			
Leachate Migration – Ground Water Vulnerability	2a	3	Extreme Vulnerability
Leachate Migration – Ground Water Flow Regime	2b	5	Regionally Important Karstified GW body
Leachate Migration – Surface Water Drainage	2c	0	No direct connection
Landfill Gas – Lateral Migration	2d	3	Karst
Landfill Gas – Vertical Migration	2e	5	Assuming receptor above.
Receptors			
Leachate Migration – Human Presence	3a	2	Well at 150m.
Leachate Migration – Protected Areas	3b	0	None in vicinity of site
Leachate Migration – Aquifer Category	3c	5	Regionally important Aquifer
Leachate Migration – Public Water Supplies	3d	3	Greater than 1km – karst aquifer
Leachate Migration – Surface Water Bodies	3e	1	River 524m from site
Landfill Gas – Human Presence	3f	5	House 17m from site

SPR LINKAGE SCORE			MAX LINKAGE SCORE	NORMALISED SCORE
SPR 1	1a X (2a + 2b + 2c) X 3e 5(3+5+0)1	40	300	13.3%
SPR 2	1a X (2a + 2b + 2c) X 3b (SWDTE) 5(3+5+0)0	0	300	0%
SPR 3	1a X (2a + 2b) X 3a 5(3+5)2	80	240	33.3%
SPR 4	1a X (2a + 2b) X 3b 5(3+5)0	0	240	0%
SPR 5	1a X (2a + 2b) X 3c 5(3+5)5	200	400	50%
SPR 6	1a X (2a + 2b) X 3d 5(3+5)3	120	560	21.4%
SPR 7	1a X (2a + 2b) X 3e 5(3+5)1	40	240	16.67%
SPR 8	1a X 2c X 3e 5(0)1	0	60	0%
SPR 9	1a X 2c X 3b (SWDTE) 5(0)0	0	60	0%
SPR 10	1b X 2d X 3f 5(3)5	70	150	50%
SPR 11	1b X 2e X 3f 5(5)5	125	250	50%

This site scored a maximum linkage score of 50%. This classifies the site as Class B Medium Risk.

This is due to the size and importance of the underlying aquifer, which is karstified and regionally important.

The presence of the house at 17m poses a medium risk due to lateral migration of landfill gas.



ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

TIER 2 RISK ASSESSMENT

GOWRAN HISTORIC LANDFILL, CO. KILKENNY

May 2014



TIER 2 RISK ASSESSMENT

GORAN HISTORIC LANDFILL, CO. KILKENNY

User is Responsible for Checking The Revision Status Of This Document

Rev. Nr.	Description of Changes	Prepared by:	Checked by:	Approved by:	Date:
0	Issue to Client	NM/MT	ME		12.05.2014

Client: Kilkenny County Council

Keywords: Site Investigation, environmental risk assessment, waste, leachate, soil samples

Abstract: This report presents the findings of a Tier 2 assessment in accordance with the EPA Code of Practice for unregulated landfill sites site investigation conducted at Gowran, Co. Kilkenny.

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PREAMBLE

Fehily Timoney & Co. (FTC) was appointed by Kilkenny County Council (KCC) to complete a Tier 2 risk assessment of a site in accordance with the Environmental Protection Agency (EPA) Code of Practice (CoP) (2007): *Environmental Risk Assessment for Unregulated Waste Disposal Sites*.

The site is located a short distance outside Gowran village, Co. Kilkenny in a rural location, surrounded by agricultural pasture land.

A Tier 1 study was conducted by KCC in 2013 and this concluded that in accordance with the EPA CoP the risk rating was 'Moderate' with potential for environmental contamination. This is due to the size and importance of the underlying aquifer, which is karstified and classified as regionally important as well as the proximity of residential dwellings.

A site walkover was conducted on 21 January 2014 prior to the commencement of the Tier 2 site investigations. Ten trial pits were also excavated on that date and logged by FTC personnel. The trial pit locations were chosen to ascertain the overall extent of the fill material and confirm the initial assumptions of the Tier 1 Assessment. Soil and leachate samples were also taken during trial pitting. Temporary gas monitoring wells were installed whilst backfilling three of the trial pits. Two groundwater wells were subsequently drilled outside of the waste body on the week commencing 24 February 2014 with sampling of the groundwater from these and a number of private wells undertaken 19 March 2014.

At present there are no Irish or EU soil contamination remediation or disposal standards. In the absence of this legislation a best practice approach was adopted for this analysis. This was based upon the EPA's landfill acceptance criteria, the Interim Guideline Values for Groundwater and the *Dutch List*.

The Tier 2 assessment determined that **a moderate risk classification (Class B) can be assigned to the site**. For such a site, the EPA CoP directs that the site be regularised/authorised in accordance with current waste management legislation.

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1. METHODOLOGY

1.1. Background

KCC, are obliged under Section 22 of the Waste Management Acts 1996 as amended, to carry out an inventory and risk assessment of all non-licensed closed landfills (i.e. historic unregulated waste disposal sites) in their county. KCC, having identified all unregulated waste disposal sites in Kilkenny county, began a process of undertaking environmental risk assessments (Tier 1 assessments) of each site in accordance with EPA Code of Practice (CoP) (2007): *Environmental Risk Assessment for Unregulated Waste Disposal Sites*. KCC are in the process of carrying out Tier II investigations at those sites with the highest risk rating and requiring further investigation.

The site at Gowran was identified as one of the sites in Kilkenny with the highest risk rating assigned to it. The subject site area was originally used as a quarry during the early and mid 1900s. Throughout the 1970s, 1980s and 1990s the site, operated by KCC, was backfilled with domestic, commercial and industrial waste arising from the Gowran and Kilkenny City areas. Since its closure in the 1990s, the site has been used as a council yard, with an area reserved for storage of gravel stockpiles, piping and lampposts.

The Tier 1 study was conducted by KCC in 2013 and this concluded that in accordance with the EPA CoP the risk rating was 'Moderate' with potential for environmental contamination. This is due to the size and importance of the underlying aquifer, which is karstified and classified as regionally important as well as the proximity of residential dwellings.

The Tier 1 assessment is included as an appendix to this document.

1.2. Scope of Works and Project Objectives

The scope of work was to undertake the Tier 2 assessment in accordance with the EPA CoP and included:

- Desk study
- Site walkover
- Trial pits
- Soil sampling
- Leachate sampling
- Gas monitoring
- Groundwater well drilling
- Groundwater monitoring.

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As part of the initial desk study, a preliminary assessment of available information was undertaken which included a review of the following literature sources:

- EPA 2003, *Landfill Manuals: Landfill monitoring* (2nd Edition)
- EPA 1999, *Landfill Manuals: Site Investigations*
- CLR Report No. 4 1994 – *Sampling Strategies for Contaminated Land*, DoE, Contaminated Land Research (CLR) Report
- BS 5930: 1999, *Code of Practice for Site Investigations*
- BS 10175: 2000, *Investigation of Potentially Contaminated Sites – Code of Practice*
- BS 6068 Water Quality: Sampling (parts 6.1-6.6 and 6.11-6.12, 6.14)
- BS 8855 Soil analysis (all parts)
- CLM: Ready Reference 2002, Section 3.1 Soil Sampling Strategies
- CLM: Ready Reference 2002, Section 3.2 Groundwater Sampling/Monitoring Strategies
- CLM: Ready Reference 2002, Section 3.3 Gas Sampling/Monitoring Strategies

The Teagasc and Geological Survey of Ireland (GSI) online databases were reviewed to assess the following:

- Aquifer type
- Groundwater bodies
- Vulnerability (full national coverage of extreme vulnerable areas)
- Soil and Subsoil type
- Bedrock type

The National Parks and Wildlife Service (NPWS) online data abase was reviewed to assess the following:

- Proximity of Special Protected Areas (SPAs)
- Proximity Special Areas of Conservation (SACs)

KCC provided details of the site history, location of private wells and OSI maps of the area.

The desktop study was followed by a site walkover. The information gathered from these steps was used to determine the locations of the intrusive investigation.

The intrusive investigations included the excavation of a number of trial pits. The objective of the trial pits was to provide a preliminary assessment of the volume, extent and type of waste infilled at the subject site. Following this, two groundwater boreholes were installed for water quality monitoring purposes.

1.3. Desk Study

This section of the report presents the findings of the desk study.

1.3.1. Site Description & On-Site Conditions

The location of the site is shown on Figure 2.1.

The site is surrounded by agricultural, residential and recreational amenity land.

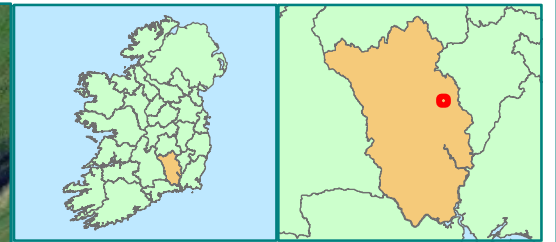
KCC stated that the deposited waste was progressively covered with a layer of clay which has left the site prone to water logging, extensive growth of reeds and poor grass growth differing from the rest of the immediate surrounding land. There is evidence of fly tipping on the site including the burnt out remains of a caravan and bags of general household rubbish.

The site is bound to the south east by a disused playing fields. To the south west is a greenfield land parcel which has received planning permission for a residential development. The lands to the north west of the site are agricultural pasture. Lands to the north and north east of the site are residential. There are further residential properties to the east, south and west, all within 200m of the site boundary. The site is accessed from Rockfield road which runs along the north western boundary of the site.

The nearest houses lie within 20 m of the north eastern site boundary where the border between the property and site consists of a fence and wall and a line of deciduous trees.

The foul sewer servicing the residential development to the east of the site runs along the north eastern boundary of the site and connects into the foul sewer running along the Rockfield road. There are a number of manhole covers along the sewer line within the site.

The closest surface water feature is a stream that lies approximately 0.5km to the south west of the site.



Legend

- Site Boundary
- Boreholes

Date 24/04/2014

Name Of Client
Kilkenny County Council

Name Of Job
Tier II Investigation at
Gowran Historical Landfill

Title Of Figure
Site Location

Scale Used 1 : 6,000 @A3

Figure No.	1	Rev	A
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W: www.fehilytimoney.ie, E: info@ftco.ie

The site slopes falls from south to north with the low point occurring at the entrance of the site.

1.3.2. Geology

The solid geology of the site is described, by GSI website, as visean limestone and calcareous shale with a solid rock outcrop within the Ballyadams Formation of crinoidal whackestone/packstone limestone that lies on the boundary of the Butlersgrove Formation of dolomitised agillaceous limestone.

Teagasc mapping of the area describes the soils as alluvium and till derived chiefly from limestone.

1.3.3. Hydrogeology

An examination of the national bedrock aquifer map published by the GSI identifies that the aquifer underlying the site as a Regionally Important Aquifer - Karstified (diffuse) - Bedrock aquifer, that is capable of supplying regionally important abstractions (e.g. large public water supplies), or 'excellent' yields (>400 m³/d). The continuous aquifer unit generally has an area of >25 km² with groundwater flow predominantly occurring through fractures, fissures and joints.

1.3.4. Details from borehole logs

The log from a deep aquifer water extraction well bored in 2006 for a housing scheme 150 m south east of the site describes a topsoil of red-brown clay and limestone boulders underlain by a bed of weathered dolomite and then dark grey weathered limestone typical of the Butlersgrove Formation.

1.3.5. Groundwater Vulnerability

Groundwater vulnerability, as defined by the GSI, is the term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities. The factors used in assessing groundwater vulnerability include subsoil type and thickness and recharge type as indicated in Table 2.1. The GSI procedure whereby groundwater protection is assessed is outlined in the EPA-GSI publication *Groundwater Protection Schemes* (DELG/EPA/GSI, 1999). The procedure proposes a matrix, which relates vulnerability, source and resource such that a particular site is given a Response (R) to specific activities.

The GSI Online mapping data set identifies that, the groundwater vulnerability for the site is classified as 'Extreme'.

Table 1.1: GSI Guidelines – Aquifer Vulnerability Mapping

Vulnerability Rating	Hydrogeological Conditions		
	<i>Subsoil Permeability (Type) and Thickness</i>		
	High Permeability (Sand/gravel)	Moderate Permeability (e.g. Sandy soil)	Low Permeability (e.g. Clayey subsoil, clay, peat)
Extreme (E)	0 - 3.0 m	0 - 3.0 m	0 - 3.0 m
High (H)	>3.0 m	3.0 -10.0 m	3.0 - 5.0 m
Moderate (M)	N/A	>10.0 m	5.0 - 10.0 m
Low (L)	N/A	N/A	>10 m

Notes:

N/A = Not Applicable

Precise permeability values cannot be given at present

1.3.6. Hydrology

The nearest open watercourse is a small, unnamed, stream that lies approximately 0.5 km to the south. The village of Gowran lies between the site and the stream. The stream is a tributary of the River Barrow, joining the main channel of the Barrow approximately 5 km downstream of the site in an easterly direction.

1.3.7. Designated Sites

The closest Natura 2000 site is the Barrow and River Nore Special Area of Conservation (SAC 002162).

1.4. Site Investigations

Priority Geotechnical Ltd. (Priority) was retained by FTC to carry out the trial pitting and groundwater well drilling elements of the work. Supervision of the trial pitting and drilling works was undertaken by FTC personnel. A Priority Geotechnical engineer was on site to log details of the trial pits and groundwater wells.

1.4.1. Site Walkover

The site walkover was conducted on 21 January 2014 to assess ground conditions and identify suitable locations for the intrusive investigations and drilling of groundwater monitoring wells. The site walkover checklist is included in Appendix 1.

The profile of the site was seen to have the characteristics of made ground with an unnatural variation of the overall topography evident.



Figure 1.2: Site Topography

The site was seen to be of poor quality and poorly drained grass-land with evidence of water logging. At the highest point of the site an area of hardcore can be seen to be used over time by the council as a storage area (Figure 2.3).



Figure 1.3: Subject Site

Based on the information gathered and on the topography of the surrounding area and the unnatural immediate variations of gradient and land quality, a subject site area was established which was assumed to comprise made ground due to the infilling of waste.

1.4.2. Trial Pit Excavations

The objective of the trial pit excavations was to provide an assessment of the type of waste deposited, its approximate age, the volume as well as determining if the soil surrounding and underlying the waste was contaminated.

Ten trial pits were excavated by a 13T Hitachi 360 excavator on 21 January 2014. The trial pit sample locations were chosen to help establish the full extent of the infill material and verify the extent of the infilling. The GPS locations for each of the trial pits along with a description of the excavation is presented in Section 3.

FTC personnel supervised all excavations, recording the ground conditions and noting any staining, waste or odours.

Photographs of the trial pits are presented in Figure 2.4 to Figure 2.22.



Figure 1.4: Trial Pit 1



Figure 1.5: Waste removed Trial Pit 1



Figure 1.6: Trial Pit 2



Figure 1.7: Trial Pit 3



Figure 1.8: Trial Pit 4



Figure 1.9: Trial Pit 5



Figure 1.10: Waste removed Trial Pit 5



Figure 1.11: Trial Pit 6



Figure 1.12: Waste removed Trial Pit 6



Figure 1.13: Trial Pit 7



Figure 1.14: Waste removed Trial Pit 7



Figure 1.15: Trial Pit 8



Figure 1.16: Trial Pit 9



Figure 1.17: Waste removed Trial Pit 9



Figure 1.18: Trial Pit 10



Figure 1.19: Waste removed Trial Pit 10



Figure 1.20: Trial Pit 11



Figure 1.21: Trial Pit 12



Figure 1.22: Waste removed Trial Pit 12

Gas Monitoring Wells

Temporary gas wells were installed at the extent of the waste body to determine if the waste was generating landfill gas and if so, was the gas migrating away from the waste body.

Temporary gas monitoring wells were installed at trial pits 8, 11 and 12. The wells, which were installed as the pits were being backfilled, consisted of 1.5m of 50mm slotted HDPE pipe and 1.5m of 50mm solid HDPE pipe. The top 0.2m to 0.5 m of slotted section was left above ground and sealed using a rubber bung and gas sampling tap.

Photographs of the installed gas wells are presented in Figure 2.23 to Figure 2.25.



Figure 1.23: Gas Well Trial Pit 08



Figure 1.24: Gas Well Trial Pit 11



Figure 1.25: Gas Well Trial Pit 12

Soil Sampling

All samples were taken in the field by FTC personnel using standard sampling methods. Samples were then appropriately containerised, labelled and stored for dispatch to Alcontrol Laboratories under appropriate chain-of-custody procedures. Alcontrol are an accredited and certified laboratory.

A representative waste sample was taken during the trial pit excavation. This sample was tested in accordance with BS EN 12457- 3 with a liquid to solid ratio (L/S) of 10 litres of leachate per dry kilogram of waste (10 l/kg) to determine the composition and leaching behaviour of the sampled material. The analysis results are contained in the Alcontrol Laboratories results presented in Appendix 4.

Leachate Sampling

A grab sample of leachate was undertaken in Trial Pit 12. The liquid was allowed to intrude into the trial pit from the surrounding waste and a sample was taken using an extendable sampling pole. The sample was appropriately bottled (using pre-prepared laboratory bottle ware), labelled and packaged for submission to the laboratory submitted for leachate indicator testing. The analysis results from Alcontrol Laboratories are presented in Appendix 4.

Gas Monitoring

Readings of gas were taken using a GEM5000 Landfill Gas Analyser. The analyser was allowed to run for a 60 second cycle or until the readings stabilised. Readings were noted by FTC for the following:

- Methane (CH₄) levels
- Carbon Dioxide (CO₂) levels
- Oxygen (O₂) levels.

1.4.3. Borehole and monitoring well installation

The results of the Tier 1 assessment and the initial exploratory investigation (the trial pit excavations) informed the placement of the boreholes for the main investigation. Two boreholes were placed outside the known extent of the waste material to assess any potential lateral migration of leachate; that is, to assess the potential for pathway linkages from the waste (source) to receptors.

Drilling took place on the 21 January 2014 using shell and auger. However, due to underlying rock less than 3 m below ground level, drilling could not successfully continue to groundwater level using this method.

Drilling took place on the 25, 26 and 28 of February 2014, using an air rotary drill. Drilling at each location continued until groundwater was encountered. Groundwater strikes were recorded, and are presented in the results section, Table 3.2. Wells were installed in each of the boreholes drilled, to facilitate groundwater sampling and assess potential leaching from the site.

The borehole logs well installation specifications are included in Appendix 3. The locations of the boreholes are shown in Appendix 2. BH1 is located at the south western boundary of the site, outside of the waste body. BH2 is located to the north of the site, inside a field adjacent to the site, again outside the waste body. BH1 is located downstream of the waste body and BH2 upstream of the waste body.

Photographs of the installed groundwater wells are presented in Figure 2.26 to Figure 2.27.



Figure 1.26: Groundwater Well BH1



Figure 1.27: Groundwater Well BH2

Water Sampling

The groundwater level in each borehole was recorded. This was carried out after installation, when groundwater levels had recovered and stabilised. The recorded water levels are presented in the results section in Table 3.2.

A single round of groundwater sampling was undertaken. Purging of groundwater wells was conducted by pumping approximately three borehole volumes of water. Each well was sampled using dedicated tubing installed in each well. This was to prevent cross-contamination of wells during monitoring and sampling.

After purging of groundwater from the wells, groundwater samples were collected in clean plastic and glass bottles, as appropriate for the analysis required. Laboratory analysis of groundwater samples was undertaken by Alcontrol Laboratories. The test parameters for the soil and groundwater samples were determined based on the findings of the preliminary site investigation.

Further samples were taken from three deep private wells within 500 m of the subject site to compliment those taken from the drilled wells. The locations of these wells can be seen in Appendix II.

1.5. Method of Assessment

1.5.1. Remediation and Disposal Criteria

Chemical Assessment Criteria

Cognisance was taken of the following legislative/guidance documents as part of this assessment:

- Dutch Guideline Values (*Dutch List*)¹
- European Communities, Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010)
- European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations, 2012 (S.I. No. 327 of 2012)
- European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (S.I. No. 272 of 2009)
- European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989 (S.I. No. 294/1989).

Other Guidance - Groundwater Interim Guideline Values

Where applicable, surface water and groundwater quality results have been compared with the relevant Interim Guideline Values, (IGV) set out in the EPA's *Groundwater Towards Setting the Guideline Values for the Protection of Groundwater in Ireland*. This document was published in 2003 to provide an interim framework for groundwater quality assessments. Other criteria also used, as outlined above were:

- Irish Drinking Water Regulations, 2007 (S.I. No. 278 of 2007)
- Water Quality (Dangerous Substances) Regulations, 2001 (S.I. No. 12 of 2001)

Dutch List

The *Dutch List* of parameters for the assessment of soil contamination is a comprehensive set of standards devised by the Dutch Government. Although this guidance is specific to conditions in Holland, it is often used elsewhere in Europe as a useful indicator of the relative significance of contamination. The guideline values were derived for both soils and groundwater by the Dutch government research agency (RIVM) using a toxicological risk-based approach (i.e. based on determining the maximum tolerable risk from available toxicity and exposure data). This approach takes into account the risk to the ecosystem as well as risks to human health.

They are not site end-use specific. Nevertheless, they are a useful screening tool for determining the significance of contamination: if a site is found to be uncontaminated with respect to Dutch Guideline Values, further screening is not considered necessary.

¹ Directorate General for Environmental Protection "*Intervention Values and Target Values – Soil Quality Standards*", Department of Soil Protection, The Ministry of Housing, Spatial Planning and Environment, The Netherlands. (a.k.a. The *New Dutch List*).

2. RESULTS OF SITE INVESTIGATIONS

2.1. Introduction

This section of the reports presents the results of the site investigation.

2.2. Ground Conditions

The trial pit investigations across the site confirm that general ground conditions encountered consisted of made ground. The made ground comprises of municipal solid waste (MSW) of varying composition and degrees of degradation overlain by a very shallow layer of topsoil/clay cover material. The depth of waste varied across the site from 2 m to >5 m.

The details of the trial pit logs are included in Appendix 3 and summarised in Table 3.1.

Table 2.1: Summary Description of Trial Pits

Trial Pit No	TP co-ordinates	Brief Description
1	IO 263213.438:153702.558	<ul style="list-style-type: none"> - Capping material of gravel soil and clay from 0 - 0.5mbgl - Waste encountered from 0.5mbgl - 2.3mbgl - Bedrock at 2.3mbgl - Waste – Odorous, dry, mixed domestic and commercial including plastic, glass, burnt material
2	IO 263224.803:153696.395	<ul style="list-style-type: none"> - Natural Ground from 0-0.7mbgl - Bedrock at 0.7mbgl
3	IO 263227.661:153715.284	<ul style="list-style-type: none"> - Natural Ground from 0-0.4mbgl - Bedrock at 0.4mbgl
4	IO 263202.753:153694.569	<ul style="list-style-type: none"> - Natural Ground from 0-0.4mbgl - Bedrock at 0.5mbgl
5	IO 263200.123:153712.658	<ul style="list-style-type: none"> - Capping material of gravel, soil and clay from 0 – 1.2mbgl (permeable membrane at 0.3m) - Waste encountered from 1.2mbgl - 5.1mbgl - Bedrock at 5.1mbgl - Waste – Odorous, dry, mixed domestic and commercial including plastic, glass, newspapers, tyres, burnt material
6	IO 263186.995:153710.404	<ul style="list-style-type: none"> - Capping material of soil and clay from 0 – 1.2mbgl - Waste encountered from 1.2mbgl - 2.8mbgl - Bedrock at 2.8mbgl - Waste – Odorous, dry, mixed domestic and commercial including plastic, glass, textiles, sanitary waste
7	IO 263221.483:153740.700	<ul style="list-style-type: none"> - Capping material of soil and clay from 0 - 0.6mbgl - Waste encountered from 0.6mbgl - 3mbgl - Bedrock at 3mbgl - Waste – Strong odorous, dry, mixed domestic and commercial including plastic, glass, wood, textiles, sanitary waste
8	IO 263202.531:153766.540	<ul style="list-style-type: none"> - Capping material of soil and clay from 0 - 0.7mbgl - Waste encountered from 0.7mbgl - 2.3mbgl - Bedrock at 2.3mbgl - Waste – Dry, mixed domestic and commercial including plastic, glass, wood and gravels

Trial Pit No	TP co-ordinates	Brief Description
9	IO 263182.626:153782.560	<ul style="list-style-type: none"> - Capping material of soil and clay from 0 - 0.7mbgl - Waste encountered from 0.7mbgl – 1.5mbgl - Natural ground at 1.5mbgl - Leachate/surface water from 1.4mbgl - Waste – Odorous, wet, mixed domestic and commercial including plastic, textiles
10	IO 263167.640:153757.567	<ul style="list-style-type: none"> - Capping material of soil and clay from 0 - 0.4mbgl - Waste encountered from 0.4mbgl - 4mbgl - Natural ground at 2.3mbgl - Waste – Odorous, wet, mixed domestic and commercial including plastic, textiles, leather and tyres
11	IO 263170.802:153736.452	<ul style="list-style-type: none"> - Capping material of stone, soil and clay from 0 – 2.4mbgl - Waste encountered from 2.4mbgl – 3.2mbgl - Bedrock at 3.2mbgl - Waste – Dry, mixed domestic and commercial including plastic, tyres, textiles, glass, newspapers, sanitary waste
12	IO 263182.398:153741.194	<ul style="list-style-type: none"> - Capping material of soil and clay from 0 - 0.5mbgl - Waste encountered from 0.5mbgl – 5.5mbgl (could dig no deeper with excavator) - Leachate/surface water from 5mbgl - Waste – Odorous, wet, mixed domestic and commercial including plastic, glass, burnt material, tyres, textiles, glass, newspapers, sanitary waste

* = mbgl = metres below ground level

The edges of the waste was found at boreholes TP2, TP3, TP4, TP6, TP7, TP8, TP9 and TP11 and the maximum depth of waste was found to be approximately 5 mbgl.

The extent of waste is defined based on an area of approximately 4,000 m² and a presumed maximum depth of 5 m of waste and other inert infill material. In so far as can be determined, the volume of waste is approximately 20,000 m³. This is a conservative estimation as the depth of waste determined through trial pits is considerably less in some areas of the site and greater in other areas.

2.3. Groundwater levels

The levels at which groundwater was initially encountered during drilling is recorded on the boreholes logs in Appendix 3. Following installation of the groundwater wells, the wells were left for a period of time to recover and the groundwater levels were subsequently recorded again. The results are presented in Table 3.2.

Table 2.2: Groundwater levels

Borehole ID	Total Well Depth	Casing Height	Total Well Depth	Water level (Drilling)	Water level 27/02/2014	Water level 10/03/2014	Water level 19/03/2014
	<i>mBGL</i> *	<i>m</i>	<i>mBTOC</i> †	<i>mBTOC</i>	<i>mBTOC</i>	<i>mBTOC</i>	<i>mBTOC</i>
BH1	10.02	0.34	9.68	7.40	7.29	7.73	8.52
BH2	11.13	0.26	10.87	19.6	-	5.19	6.02

* = mBGL = metres below ground level

† = mBTOC – meters below top of casing

2.4. Results of Laboratory Analysis

This section of the reports presents the results of the chemical analysis of samples taken during the site investigation.

2.4.1. Chemical Results for Soil Samples

Soil samples are assessed against the *Dutch List – soil criteria* and are presented in Tables 3.2.

A representative soil sample intermixed with waste was collected from TP5 and TP10 and tested for leachability analysis in accordance with BS EN 12457- 3 at L/S 10 l/kg. This was to determine the composition and leaching behaviour of the infill material. Results of analysis are compared to the landfill waste acceptance criteria for an inert landfill for benchmarking purposes. Results are presented in Table 3.3.

Table 2.3: Soil Sampling Results – Solid Waste analysis

Parameter	Units	Inert Waste Landfill Criteria	Soil Quality Criteria - Dutch List		Sampling Results - Sample ID	
			Optimum	Action	TP5	TP10
Benzene	mg/kg	--	0.05	2	<0.0010	<0.0010
Toluene	mg/kg	--	0.05	130	0.00615	0.0116
Ethylbenzene	mg/kg	--	0.05	50	0.0283	0.276
Xylene	mg/kg	--	0.05	25	0.0345	0.426
BTEX (sum of above)	mg/kg	6	--	--	0.069	0.714
Total Organic Carbon	%	3	--	--	5.12	2.52
Moisture Content	%	--	--	--		
Moisture Content ratio	%		--	--	19	23
Mineral Oil	mg/kg	500	50	5,000	212	247
MTBE	ug/kg	--	--	--	<5	<5
PCBs (Sum of 7)	mg/kg	1	0.02	1	<0.021	<0.021
PAH (Sum of 17)	mg/kg	--*	1	40	<10	<10
pH	pH units	>6 or <9	--	--	8.11	7.84

Table 2.4: Soil Sampling Results - Leachability Analysis Results compared to Article 16 of Annex II to Directive 1999/31/EC

Parameter (CEN 10:1 Leachate)	Units L/S = 10 l/kg	Inert Landfill Criteria	Sampling Results - Sample ID	
			TP5	TP10
Arsenic	mg/kg	0.5	0.0728	0.0524
Chromium	mg/kg	0.5	0.0343	0.0223
Copper	mg/kg	2	0.0939	0.024
Nickel	mg/kg	0.4	0.114	0.0135
Zinc	mg/kg	4	0.0685	0.0273
Mercury	mg/kg	0.01	0.00154	<0.001
Lead	mg/kg	0.5	0.0211	0.00359
Barium	mg/kg	20	0.136	0.268
Cadmium	mg/kg	0.04	<0.001	<0.001
Selenium	mg/kg	0.1	0.0327	0.0203
Antimony	mg/kg	0.06	0.088	0.0694
Chloride	mg/kg	800	1360	150
Fluoride	mg/kg	10	<5	<5
Sulphate	mg/kg	1,000	431	566
Molybdenum	mg/kg	0.5	0.868	0.346
Dissolved Organic Carbon	mg/kg	500	502	180
Total Dissolved Solids	mg/kg	4,000	5990	3140
Total Monohydric Phenols	mg/kg	1	<0.16	<0.16

2.4.2. Chemical Results for Leachate Sample

The results of the chemical analysis for the leachate sample taken from TP12 is presented in Table 3.5 and are compared to the "Typical Leachate Composition of 30 Samples from UK/Irish Landfills accepting mainly domestic waste" published in Landfill Operational Practices by Environmental Protection Agency, 1997.

Table 2.5: Leachate Sampling Results

Parameter	Units	Overall Range ¹			Sampling Results - Sample ID
		Min	Max	Mean	LI-FT-TP3
Suspended Solids, Total	mg/l	-	-	-	-
Ammoniacal Nitrogen	mg/l	<0.2	1700	491	382
Biological oxygen demand	mg/l	4.5	>4800	798	588
Chloride	mg/l	27	3410	1256	434
Conductivity	µs/cm	503	19200	7789	4,370
Sulphate	mg/l	<5	739	136	<2
Sodium	mg/l	12	3000	904	285
Potassium	mg/l	2.7	1480	491	291
pH	pH units	6.4	8.0	7.2	7.94

¹Typical Leachate Composition of 30 Samples from UK/Irish Landfills accepting mainly domestic Waste, Landfill Operational Practices, Environmental Protection Agency, 1997

2.4.3. Chemical Results for Groundwater Samples

The results of the chemical analysis for the groundwater samples taken from the installed boreholes and private wells sampling analysis are presented in Table 3.6. Results of analysis are compared to the relevant Interim Guideline Values, (IGV) set out in the EPA (2003) *Towards Setting the Guideline Values for the Protection of Groundwater in Ireland*. In the absence of IGV levels the European Communities Environmental Objectives (Groundwater) Regulations 2010 and the Quality of Surface Water Intended for the Abstraction of Drinking Water Regulations 1989 are referred to.

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Table 2.6: Groundwater Sampling Results

Parameter	Units	IGV Criteria*	Sampling Results - Sample ID				
			BH1	BH2	Farm	Housing Estate	Nursing Home
pH	Ph Units	≥ 6.5 and ≤ 9.5	7.42	7.38	7.79	7.89	7.48
pH (<i>in situ</i>)	Ph Units	≥ 6.5 and ≤ 9.5	7.15	7.12	7.42	7.64	7.52
Conductivity	ms/cm	1	0.965	0.696	0.806	0.621	0.643
Conductivity (<i>in-situ</i>)	μ s/cm	1	1.217	0.778	0.894	0.683	0.715
Ammoniacal Nitrogen	mg/l	(0.2 mg/l for A1 water) to 4mg/l for A3 water) Note 2	<0.2	<0.2	3.78	<0.2	<0.2
Biological oxygen demand	mg/l	5 Note 2	<1	<1	<1	<1	<1
Chloride	mg/l	30 mg/l (187.5 Note 1)	11.7	28.9	50.3	17.9	21.6
Sulphate	mg/l	250 mg/l	115	22.9	18.1	26.8	11.5
Sodium	mg/l	150 mg/l	9.54	13.2	19.7	9.23	10.8
Potassium	mg/l	12 mg/l	<1	7.48	25.9	3.34	<1

* = IGV criteria = EPA, 2003. Interim Guideline Values, (IGV) – Towards Setting The Guideline Values for the Protection of Groundwater in Ireland

Note 1: European Communities, Environmental Objectives (Groundwater) Regulations 2010 (S.I. No. 9 of 2010);

Note 2: S.I. No. 294/1989 — European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989.

2.5. Landfill Gas Sampling Results

Landfill gas monitoring was also conducted at the three trial pit monitoring locations (TP8, TP11 and TP12).

Results of landfill gas monitoring conducted at these three locations are presented in Tables 3.7 and 3.8. No landfill gas was detected.

Table 2.7: Landfill gas sampling results (26/02/2014)

Borehole ID	Methane % v/v	Carbon Dioxide % v/v	Oxygen % v/v
TP8	0.0	6.0	13.7
TP11	0.0	2.8	17.8
TP12	0.0	0.1	11.3

Table 2.8: Landfill gas sampling results (19/03/2014)

Borehole ID	Methane % v/v	Carbon Dioxide % v/v	Oxygen % v/v
TP8	0.0	0.0	20.3
TP11	0.0	0.0	20.3
TP12	0.0	0.0	20.3

2.6. Interpretation of Results

2.6.1. Solid Soil Analysis

The soil samples collected from TP5 and TP10 were submitted for laboratory analysis. All levels are within the inert landfill acceptance criteria with the exception of Total Organic Carbon (TOC) at TP5. TOC was however below the hazardous limit for landfills (6%). TOC is the carbon (C) stored in soil organic matter. Organic carbon enters the soil through the decomposition of plant and animal residues, root exudates, living and dead microorganisms, and soil biota and would therefore indicate that the waste mass is stable and that the rate of decay for any organic material is minimal.

The results of the analysis therefore indicate that if this soil was excavated it would require disposal at a non-hazardous MSW licensed landfill.

2.6.2. Leachability Analysis

The results of leachability analysis indicated that antimony was detected at levels of 0.088 mg/kg and 0.0694 mg/kg in TP5 and TP10 respectively. These levels are above the inert landfill criteria of 0.06 mg/kg for antimony. Antimony can be released in water from the break down of a number of waste materials, including PET bottles, electrical products and batteries, all of which were found in the landfilled waste from the site.

Chloride was detected at a level of 1,360 mg/kg in TP5. This is above the inert landfill criteria of 800 mg/kg for Chloride. The level at TP10 was below the inert landfill criteria. Chloride is highly soluble in water and originates in most forms of domestic and commercial wastes, especially in the form of cleaning and processing agents, food preservatives and fertilisers.

Molybdenum was detected at a level of 0.868 mg/kg in TP5. This is above the inert landfill criteria of 0.5 mg/kg for molybdenum. The level at TP10 was below the inert landfill criteria. Molybdenum is not easily dissolved in water and originates from the steel alloy industry and is also found in fertilisers.

Dissolved organic carbon was detected at a level of 502 mg/kg in TP5. This is above the inert landfill criteria of 500 mg/kg for dissolved organic carbon. The level at TP10 was below the inert landfill criteria. Dissolved organic carbon compounds are a result of decomposition processes from dead organic matter such as plants and in landfills originate from decaying food and garden green waste and other organic sources.

Total dissolved solids (TDS) were detected at a level of 5,990 mg/kg in TP5. This too is above the inert landfill criteria of 4,000 mg/kg for TDS. Total dissolved solids (TDS) comprise the total mass of contaminating, organic and inorganic, substances contained in the soil/waste, including trace heavy metals.

It is clear from the leachability analysis that the material deposited does not meet the waste acceptance criteria for inert landfills. This is backed up by the visual examination of the waste during the trial pit investigations.

2.6.3. Groundwater Analysis

Ammoniacal nitrogen was detected at levels of 3.78 mg/l at the Farm well (off-site private well), over the limit of 0.2 mg/l derived from S.I. No. 294/1989 — European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989 for A1 water bodies, but below the limit of 4 mg/l for A3 water bodies. Recorded levels of ammoniacal nitrogen at all other locations were below the IGVs.

Chloride levels over the IGV level of 30 mg/l was also recorded at this location, but under the European Communities, Environmental Objectives (Groundwater) Regulations 2010 level of 187.5 mg/l Cl. Recorded levels of chloride at all other locations were below the IGVs.

Potassium levels over the IGV level of 12 mg/l was recorded at the Farm well. Recorded levels of potassium at all other locations were below the IGVs.

Recorded levels for pH, conductivity, biological oxygen demand, sulphate and sodium were below the IGVs at all locations.

Overall the groundwater results would suggest that the site is not impacting on groundwater quality. Elevated levels of ammoniacal nitrogen, chloride and potassium at the Farm well are not likely to be as a result of contamination from the subject site due to the distance from the site (500 m), the depth of the well (approximately 100 m) and the the farm well is upgradient of the site. Therefore, the minor contamination at the farm well is likely to be influenced by a localised source.

2.6.4. Landfill Gas Analysis

Levels of carbon dioxide were detected in TP8 and TP11 monitoring wells during the February sampling event. These levels are most likely as a result of the wet, water logged soils and the decaying vegetation on account of the disturbance of the soils during digging of the trial pits. These levels had returned to 0% during the March sampling event.

No methane gas was detected in the boreholes during sampling. This indicates that there is no landfill gas migration from the site to the boreholes.

3. RISK ASSESSMENT

3.1. Introduction

Risk assessment considers the likelihood of occurrence and the consequence of occurrence of an event (Royal Society 1992 ²). It is based on a conceptual model which is used to determine the exposure to a vulnerable receptor in relation to waste as the Source – Pathway – Receptor model (Daly 2004 ³), or S-P-R.

This conceptual model takes the source of the contamination as the material making up the made ground. The pathway in the model involves landfill gas and groundwater, with the ultimate receptor being the underling aquifer and surrounding residential dwellings.

3.2. Potential Pathways and Receptors

A pathway is a mechanism or route by which a contaminant comes into contact with, or otherwise affects, a receptor. The potential pathways associated with the site are:

- Groundwater/leachate migration
- Landfill gas migration

3.2.1. Groundwater/Leachate Migration

According to the EPA CoP, there are three main pathways for leachate migration. These are:

- Vertically to the water table or top of an aquifer, where groundwater is the receptor
- Vertically to an aquifer and then horizontally in the aquifer to a receptor such as a well, spring or stream
- Horizontally at the ground surface or at shallow depth to a surface receptor

The migration and attenuation of leachate from the site depends on the permeability and thickness of subsoil and on both the bedrock permeability value and type. These elements are encompassed in groundwater vulnerability, groundwater flow regime and surface water drainage. The main receptors to leachate migration from this site are:

- Aquifer
- Drinking water supplies within 1,000 m
- Protected areas, such as groundwater dependent or surface water dependent ecosystems, flood plains, Special Protected Areas (SPAs), Natural Heritage Areas (NHAs)
- Special Areas of Conservation (SACs), and bathing waters within 1,000 m of the site boundary
- Wetlands
- Surface water bodies

3.2.2. Landfill Gas Migration

Landfill gas migration can move along pathways of least resistance. In the case of old rock quarries such as the subject site at Gowran, these pathways can include subsoil and bedrock. Other relevant pathways include underground services, drainage systems and manholes.

Human Presence is considered to be the principal sensitive receptor in respect of landfill gas due to the potential for the build up of gas within confined areas such as schools, houses, etc.

² Royal Society 1992, Risk: Analysis, Perception and Management. The Royal Society, London (ISBN 0-85403-467-6).

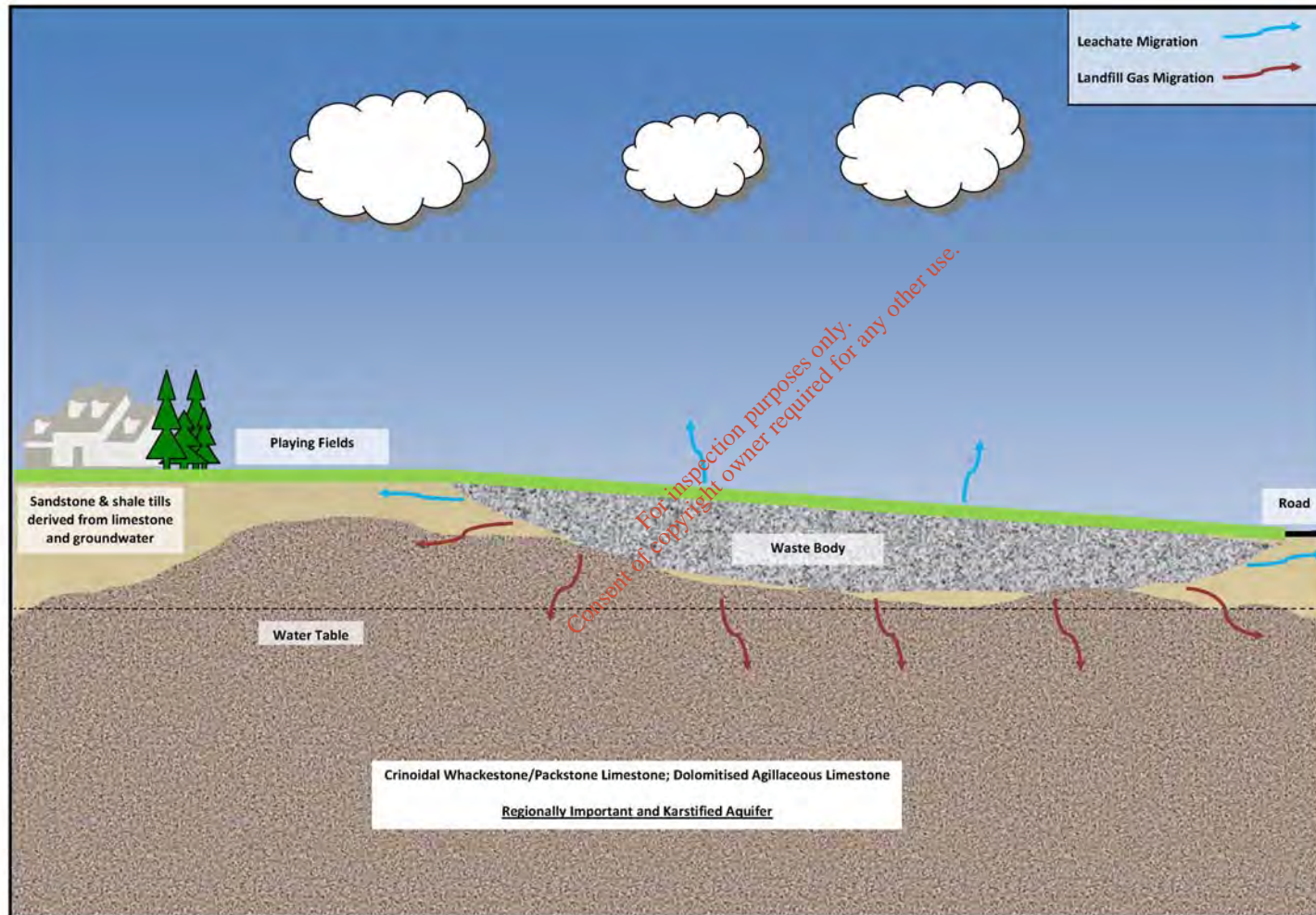
³ Daly, D. 2004, Groundwater at Risk in Ireland - Putting Geoscientific Information and Maps at the Core of Land Use and Environmental Decision-making, John Jackson Memorial Lecture, Royal Dublin Society, November 2004.

3.3. Conceptual Site Model

The investigations are designed to enable an assessment of the risk to be made and to confirm the source – pathway – receptor (S-P-R) linkages identified in the preliminary investigation. Based on the results and analysis of the investigation a conceptual model is presented as Figure 4.1.

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Figure 3.1: Conceptual Site Model



3.4. Risk Prioritisation

Risk prioritisation enables resources to be prioritised on the highest risk facilities and on the highest source – pathway – receptor linkage potential.

The risk prioritisation process assigns a score to each linkage and the overall score is the maximum of the individual linkages for the site. The higher the score a site/linkage receives the higher the risk.

In order to classify the risk, scores will be applied to the information obtained during the site investigation. Where there is insufficient information available (i.e. where there is a high degree of uncertainty) the highest score is assumed.

In accordance with the EPA CoP (2007) the scoring matrixes are as follows:

- Leachate: source/hazard scoring matrix, based on waste footprint
- Landfill gas: Source/hazard scoring matrix based on waste footprint
- Leachate migration: Pathway (Vertical)
- Leachate migration: Pathway (Horizontal)
- Leachate migration: Pathway (Surface water drainage)
- Landfill gas: Pathway (Surface water drainage)
- Landfill gas: Pathway (Lateral migration potential)
- Landfill gas: Pathway (Upwards migration potential)
- Leachate migration: Receptor (Surface water drainage)
- Leachate migration: Receptor (Human presence)
- Leachate migration: Receptor (Protected areas – SWDTE or GWDTE) (Surface water/groundwater dependent terrestrial ecosystems)
- Leachate migration: Receptor (Aquifer category – Resource potential)
- Leachate migration: Receptor (Public water supplies – other than private wells)
- Leachate migration: Receptor (Surface water bodies)
- Landfill gas: Receptor (Human presence)

Table 4.1, Risk classification calculation, calculates the points awarded to each of the headings listed above. The following are the risk classifications applied:

- Highest Risk (Class A) Greater than 70 for any individual SPR linkage
- Moderate Risk (Class B) 41-69 for any individual SPR linkage
- Lowest Risk (Class C) Less than 40 for any individual SPR linkage

Table 3.1: Risk Classification Calculation

EPA Ref	Risk	Points	Rationale
1a	Leachate; source/hazard scoring matrix, based on waste footprint.	5	Based on waste footprint of <1 ha and predominance of typically non hazardous domestic waste with potentially small hazardous waste fraction.
1b	Landfill gas; source/hazard scoring matrix, based on waste footprint.	5	Based on waste footprint of <1 ha and predominance of typically non hazardous domestic waste with potentially small hazardous waste fraction.
2a	Leachate migration: Pathway (Vertical)	3	GSI describes the groundwater vulnerability as Extremely Vulnerable

EPA Ref	Risk	Points	Rationale
2b	Leachate migration: Pathway (Horizontal)	5	The bedrock is classified by the GSI as a Regionally Important Karstified Groundwater Body
2c	Leachate migration: Pathway (Surface water drainage)	0	No direct connection between the waste body and surface waters.
2d	Landfill gas: Pathway (Lateral migration potential)	3	Made ground, Karst
2e	Landfill gas: Pathway (Upwards migration potential)	0	No buildings or enclosed spaces above waste body.
3a	Leachate migration: Receptor (Human presence)	2	Domestic wells located at 150m, 400m and 500m.
3b	Leachate migration: Receptor (Protected areas – SWDTE or GWDTE) (Surface water/ groundwater dependent terrestrial ecosystems)	0	None in vicinity of site.
3c	Leachate migration: Receptor (Aquifer category – Resource potential)	5	The aquifer is classified by the GSI as a Regionally Important Aquifer.
3d	Leachate migration: Receptor (Public water supplies – other than private wells)	3	Greater than 1 km, karstified aquifer.
3e	Leachate migration: Receptor (Surface water bodies)	1	Surface water bodies >500m of site.
3f	Landfill Gas: Receptor (Human presence)	5	Houses within 20 m of the site boundary.

Table 4.2 shows the maximum S-P-R scoring for the site is 50%. Based on this the site can be classified as a moderate risk Class B risk classification.

Table 3.2: Normalised Score of S-P-R Linkages

Calculator	S-P-R Values	Maximum Score	Linkage	Normalised Score	
Leachate migration through combined groundwater and surface water pathways					
SPR1	$1a \times (2a + 2b + 2c) \times 3e$	$5 \times (3+5+0) \times 1 = 40$	300	Leachate => surface water	13.3%
SPR2	$1a \times (2a + 2b + 2c) \times 3b$	$5 \times (3+5+0) \times 0 = 0$	300	Leachate => SWDTE	0%
Leachate migration through groundwater pathway					
SPR3	$1a \times (2a + 2b) \times 3a$	$5 \times (3+5) \times 2 = 80$	240	Leachate => human presence	33.3%

Calculator		S-P-R Values	Maximum Score	Linkage	Normalised Score
SPR4	$1a \times (2a + 2b) \times 3b$	$5 \times (3+5) \times 0 = 0$	240	Leachate => GWDTE	0%
SPR5	$1a \times (2a + 2b) \times 3c$	$5 \times (3+5) \times 5 = 200$	400	Leachate => Aquifer	50%
SPR6	$1a \times (2a + 2b) \times 3d$	$5 \times (3+5) \times 3 = 120$	560	Leachate => Surface Water	21.4%
SPR7	$1a \times (2a + 2b) \times 3e$	$5 \times (3+5) \times 1 = 40$	240	Leachate => SWDTE	16.67%
Leachate migration through surface water pathway					
SPR8	$1a \times 2c \times 3e$	$5 \times 0 \times 1 = 0$	60	Leachate => Surface Water	0%
SPR9	$1a \times 2c \times 3b$	$5 \times 0 \times 0 = 0$	60	Leachate => SWDTE	0%
Landfill gas migration pathway (lateral & vertical)					
SPR10	$1b \times 2d \times 3f$	$5 \times 3 \times 5 = 75$	150	Landfill Gas => Human Presence	50%
SPR11	$1b \times 2e \times 3f$	$5 \times 0 \times 5 = 0$	250	Landfill Gas => Human Presence	0%
Site maximum S-P-R Score					50%
Risk Classification					B - Moderate

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4. CONCLUSIONS & RECOMMENDATIONS

The Tier 1 study conducted by KCC concluded that the Risk Rating for the site was 'Moderate' based on the findings of the initial risk assessment with little potential for environmental contamination.

A Tier 2 assessment was subsequently conducted by FTC which included the excavation of trial pits, soil, groundwater, leachate and gas sampling.

Site observations indicated that there were no buildings or enclosed spaces above the assumed area of the waste body and the landfill gas risk (assigned in the Tier 1 assessment) was subsequently revised. This reduced the SPR score for SPR11.

The results of the Tier 2 assessment and the refined SPR conceptual model indicate that the site is a Class B - **Moderate Risk**. For a moderate risk site the CoP directs that the site be regularised/authorised in accordance with current waste management legislation (i.e. a waste licence or permit).

Following this Tier 2 Assessment it is the opinion of FTC that a Tier 3 Assessment of this site should be undertaken based cumulatively on the risk classification as presented.

FTC recommend that the Tier 3 investigation include further site investigations and sampling including, but not limited to, installation of further shallow upstream and downstream groundwater boreholes. The results of the investigation should further inform the development of the quantitative risk assessment model for the site and remediation measures if required.

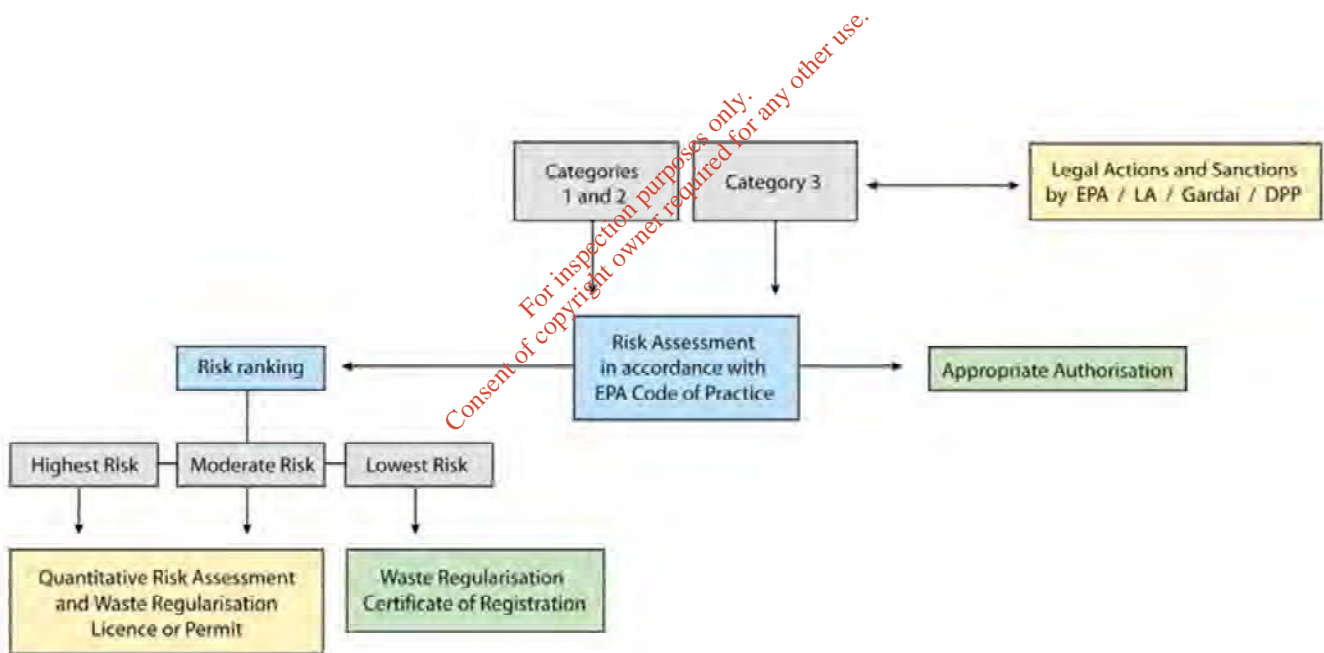


Figure 4.1: Extract from Section 1.3 of the EPA Code of Practice

Appendix I

Site Walkover Checklist

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Walkover Survey Checklist

21st January 2014

Walkover Survey Checklist		
Information	Checked	Comment (include distances from Site Boundary)
1. What is the current land use?	✓	Council storage yard
2. What are the neighbouring land uses?	✓	Agricultural Lands Residential Recreational
3. What is the size of the site?	✓	Circa 0.087ha
4. What is the topography?	✓	Gentle slope from south to north
5. Are there potential receptors (if yes, give details)?	✓	Groundwater, open watercourses adjoining, nearby residence
Houses	✓	17m to north east of site boundary, 50m to north of site and further larger developments within 200m of east, south and west of site
Surface water features (if yes, distance and direction of flow)?	✓	Small river on far side of Gowran village, approximately 500 to the South of the site flowing from West to East towards river Barrow
Any wetland or protected areas?	✓	None
Public water supplies?	✓	Mains water supply to nearby residence Main supply 2.5km north west of site
Private wells?	✓	One 150m to south west of site
Services?	✓	Foul sewer 5m inside north east boundary of site Overhead power lines along north west boundary
Other buildings?	✓	None
Other?	✓	None
6. Are there any potential sources of contamination (if yes, give details)?	✓	Possible buried waste
Surface waste (if yes, what type)?	✓	Some fly tipped waste and burnt out remains of caravan
Surface ponding of leachate	✓	None
Leachate seepage	✓	None
Landfill gas odours	✓	None
7. Are there any outfalls to surface water? (If yes, are there discharges and what is the nature of the discharge?)	✓	No evidence

Walkover Survey Checklist

21st January 2014

8. Are there any signs of impact on the environment? (if yes, take photographic evidence)	✓	Photos in main report
Vegetation die off, bare ground	✓	Some evidence of bare ground in north west corner of site
Leachate seepages	✓	None noted
Odours	✓	None Noted
Litter	✓	Yes – as per question 6, evidence of fly tipping
Gas bubbling through water	✓	None noted
Signs of settlement	✓	None noted
Subsidence, water logged areas	✓	Water logging evident in areas – poor drainage
Drainage or hydraulic issues	✓	Channels dug in places to improve run-off
Downstream water quality appears poorer than upstream water quality	✓	Not tested
9. Are there any indications of remedial measures? (Provide details)	✓	Yes
Capping	✓	Capped with clay/soil
Landfill gas collection	✓	No – not applicable
Leachate collection	✓	No – not applicable
10. Describe fences and security features (if any)	✓	Site is open to playing fields to South. Fence along road not adequate and gate not kept locked
Any other relevant information?		NA

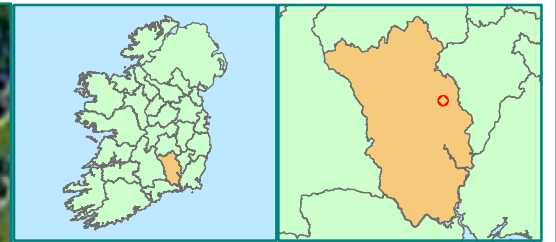
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Appendix II

Site Investigation & Monitoring Location Map

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Legend

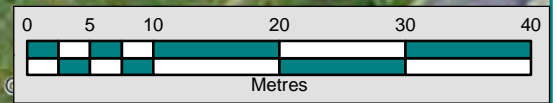
- Site Boundary
- Extent of Waste
- Boreholes
- Trial Pit

Date	24/04/2014	
Name Of Client	Kilkenny County Council	
Name Of Job	Tier II Investigation at Gowran Historical Landfill	
Title Of Figure	Site Layout	
Scale Used	1 : 600 @A3	
Figure No.	2	Rev A



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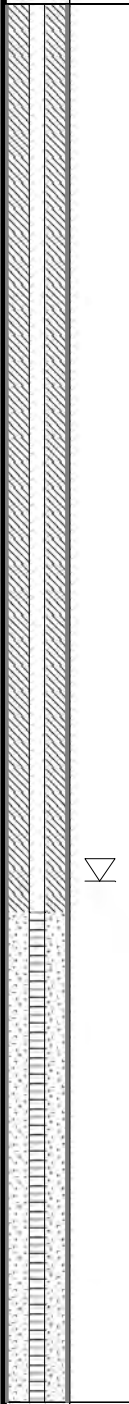
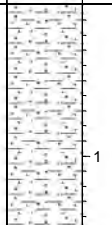
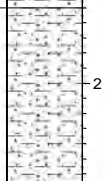
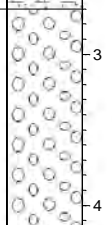
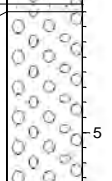
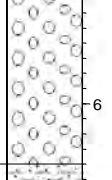

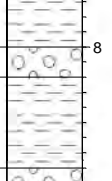
Appendix III

Site Investigation – Trial Pit & Borehole Logs

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Project Name: Gowran Landfill	Project No. P14004	Co-ords: -	Hole Type RO
Client: Kilkenny Co Co	Dates: 25/02/2014	Level: -	Scale 1:50

Well / Backfill	Water Strikes	Samples & In Situ Testing			Casing / Flush	Level (m AOD)	Depth (m)	Stratum Description	Legend
		Depth (m)	Type	Results					
						1.50	Open hole boring. Driller described: Gravelly CLAY.		
						2.70	Open hole boring. Driller described: Boulder CLAY.		
						4.15 4.20	Open hole boring. Driller described: SAND. Open hole boring. Driller described: BOULDER.		
						6.40	Open hole boring. Driller described: Boulder CLAY.		
						7.20 7.40	Open hole boring. Driller described: BOULDER. Open hole boring. Driller described: CLAY.		
						8.00 8.20	Open hole boring. Driller described: BOULDER. Open hole boring. Driller described: CLAY.		
						8.80	Open hole boring. Driller described: BOULDER.		

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Water	Depth (m)	Type	Results	Casing	Level	Depth	Continued next sheet
-------	-----------	------	---------	--------	-------	-------	----------------------

Groundwater: Struck 5.80m Rose to - After - Sealed - Comment See shift data.					Hole Information: Hole Depth 11.80m Hole Diameter 131mm Casing Diameter 131mm			Chiselling: Depths (m) to Time (hhmm) Tool		
--	--	--	--	--	---	--	--	--	--	--

Remarks: Borehole terminated at required depth. 50mm dia standpipe installed, response zone from 11.8m to 6.0m.	Shift Data:	Groundwater	Shift (dd/mm/yyyy)	Casing depth	Remarks
		-	25/02/2014	0.00m	Start of Borehole
		10.80m	25/02/2014	11.00m	End of shift
		6.85m	26/02/2014	11.00m	Start of shift
		7.95m	26/02/2014	11.80m	End of Borehole

Equipment & Methods: Soil Mech PSM 8G



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 Tel: 021 4631600
 Fax: 021 4638690
 www.prioritygeotechnical.ie

Drilled By
 WD
 Logged By
 -

Borehole No
GW01
 Sheet 2 of 2

Project Name: Gowran Landfill	Project No.: P14004	Co-ords: -	Hole Type: RO
Client: Kilkenny Co Co	Dates: 25/02/2014	Level: -	Scale: 1:50

Well / Backfill	Water Strikes	Samples & In Situ Testing			Casing / Flush	Level (m AOD)	Depth (m)	Stratum Description	Legend
		Depth (m)	Type	Results					
							Open hole boring. Driller described: BOULDER.		
						9.80	Open hole boring. Driller described: CLAY.		
						10.20	Open hole boring. Driller described: BOULDER.		
						11.00	Open hole boring. Driller described: CLAY with boulder content.		
					11.80	11.80	End of Borehole at 11.80 m		

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Water	Depth (m)	Type	Results	Casing	Level	Depth	Chiselling:	Time (hhmm)	Tool
Struck	5.80m	Rose to	-	After	-	Sealed	-	Comment	See shift data.
							Hole Depth	Hole Diameter	Casing Diameter
							11.80m	131mm	131mm

Remarks: Borehole terminated at required depth. 50mm dia standpipe installed, response zone from 11.8m to 6.0m.	Shift Data:	Groundwater	Shift (dd/mm/yyyy)	Casing depth	Remarks
		-	25/02/2014	0.00m	Start of Borehole
		10.80m	25/02/2014	11.00m	End of shift
		6.85m	26/02/2014	11.00m	Start of shift
		7.95m	26/02/2014	11.80m	End of Borehole

Equipment & Methods: Soil Mech PSM 8G



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Borehole No
GW02
Sheet 1 of 2

Project Name: Gowran Landfill	Project No.: P14004	Co-ords: -	Hole Type: RO
Client: Kilkenny Co Co	Dates: 28/02/2014	Level: -	Scale: 1:50

Well / Backfill	Water Strikes	Samples & In Situ Testing			Casing / Flush	Level (m AOD)	Depth (m)	Stratum Description	Legend
		Depth (m)	Type	Results					
							Open hole boring. Driller described: Gravelly CLAY with boulder content.		
						1.50	Open hole boring. Driller described: CLAY with boulder content.		
						3.00	Open hole boring. Driller described: CLAY.		
						3.40	Open hole boring. Driller described: BOULDER.		
						4.40	Open hole boring. Driller described: CLAY with boulder content.		
						6.20	Open hole boring. Driller described: CLAY.		
						7.00	Open hole boring. Driller described: Rock.		
						8.50	Open hole boring. Driller described: CLAY.		
						8.70	Open hole boring. Driller described: Rock.		

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Water Depth (m) Type Results Casing Level Depth Continued next sheet

Groundwater:					Hole Information:			Chiselling:		
Struck	Rose to	After	Sealed	Comment	Hole Depth	Hole Diameter	Casing Diameter	Depths (m)	Time (hhmm)	Tool
8.60m	-	-	-	See shift data.	11.00m	131mm	131mm	to		
10.00m										

Remarks: Borehole terminated at required depth. 50mm dia standpipe installed, response zone from 11.0m to 6.0m.	Shift Data:	Groundwater	Shift (dd/mm/yyyy)	Casing depth	Remarks
		4.50m	28/02/2014	0.00m to 11.00m	Start of Borehole End of Borehole

Equipment & Methods: Soil Mech PSM 8G



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-

Borehole No
GW02
Sheet 2 of 2

Project Name: Gowran Landfill	Project No. P14004	Co-ords: -	Hole Type RO
Client: Kilkenny Co Co	Dates: 28/02/2014	Level: -	Scale 1:50

Well / Backfill	Water Strikes	Samples & In Situ Testing			Casing / Flush	Level (m AOD)	Depth (m)	Stratum Description	Legend
		Depth (m)	Type	Results					
					11.00	9.70	Open hole boring. Driller described: Rock.		
						10.00	Open hole boring. Driller described: CLAY.		
						10.00	Open hole boring. Driller described: Rock.		
						11.00	End of Borehole at 11.00 m		

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Water	Depth (m)	Type	Results	Casing	Level	Depth	Chiselling:			
Struck	Rose to	After	Sealed	Comment	Hole Depth	Hole Diameter	Casing Diameter	Depths (m)	Time (hhmm)	Tool
8.60m	-	-	-	See shift data.	11.00m	131mm	131mm	to		
10.00m										

Remarks: Borehole terminated at required depth. 50mm dia standpipe installed, response zone from 11.0m to 6.0m.	Shift Data:	Groundwater	Shift (dd/mm/yyyy)	Casing depth	Remarks
		4.50m	28/02/2014	0.00m to 11.00m	Start of Borehole to End of Borehole

Equipment & Methods: Soil Mech PSM 8G



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Trial Pit No
TP01
 Sheet 1 of 1

Project Name:

Gowran Landfill

Project No.:

P14004

Co-ords: -

Level: -

Date:

20/01/2014

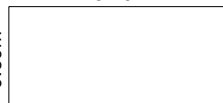
Location: Gowran, Co Kilkenny

Dimensions: 3.20m

Depth

2.30m

0.60m



Scale:

1:25

Client: Kilkenny Co Co

Logged By
 ID

Samples & In Situ Testing				Level (m AOD)	Depth (m)	Stratum Description	Legend
Water	Depth (m)	Type	Results				
					0.50	<p>Topsoil: Light brown, slightly sandy slightly gravelly CLAY with MSW. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded.</p>	
					2.30	<p>Waste: Soft, light brown, slightly sandy slightly gravelly SILT with low cobble content, low boulder content and MSW. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded, 60-200mm dia. Boulders are subangular to subrounded, 200-350mm dia.</p>	
						<p>Trial pit completed at 2.30 m</p>	

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Stability: Poor

Plant: Tracked Excavator

Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated due to obstruction.

H:\EPA\2018\2018-03-22\2018-03-22\Standard Trialpit Log v2.dwg 27th Nov 03



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Trial Pit No

TP03

Sheet 1 of 1

Project Name:

Gowran Landfill

Project No.

P14004

Co-ords: -

Level: -

Date

20/01/2014

Location: Gowran, Co Kilkenny

Dimensions:

2.80m

Depth

0.40m

0.60m



Scale

1:25

Logged By

ID

Client: Kilkenny Co Co

Samples & In Situ Testing				Level (m AOD)	Depth (m)	Stratum Description	Legend
Water	Depth (m)	Type	Results				
					0.20	Topsoil: Dark brown, slightly sandy slightly gravly SILT with occasional rootlets. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded.	
					0.40	Light brown, slightly sandy SILT with low cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded, 60-100mm dia.	
						Trial pit completed at 0.40 m	
<p style="color: red; transform: rotate(-45deg); font-size: 1.2em;">For inspection purposes only. Consent of copyright owner required for any other use.</p>							
							1
							2
							3

<p>Stability: Moderate Plant: Tracked Excavator Backfill: Arisings.</p>	<p>Groundwater: None encountered.</p>
--	--

Remarks: Trial pit terminated due to obstruction.

HOREBASE III (B1-42) (3B) Standard Trialpit Log v2 dated 27th Nov 03



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Trial Pit No
TP05

Sheet 1 of 2

Project Name:

Gowran Landfill

Project No.

P14004

Co-ords: -

Level: -

Date

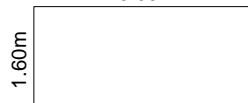
20/01/2014

Location: Gowran, Co Kilkenny

Dimensions: 3.00m

Depth

5.10m



Scale

1:25

Client: Kilkenny Co Co

Logged By
ID

Samples & In Situ Testing				Level (m AOD)	Depth (m)	Stratum Description	Legend
Water	Depth (m)	Type	Results				
					0.30	Grey, slightly sandy gravelly SILT with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are angular to subangular, 60-100mm dia.	
					1.20	Soft, light grey, slightly sandy slightly gravelly SILT with low cobble content. Sand is fine to coarse, subangular to subrounded, 60-200mm dia. 0.3m: Membrane.	
						MSW (Municipal Solid Waste).	

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Water Depth (m) Type Results Level Depth Continued next sheet

Stability: Poor

Plant: Tracked Excavator

Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at required depth.

HobBASE III (B1-42) (3/9) Standard Trialpit Log v2.dwg 27th Nov 03



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Trial Pit No
TP05
 Sheet 2 of 2

Project Name: Gowran Landfill	Project No. P14004	Co-ords: - Level: -	Date 20/01/2014
Location: Gowran, Co Kilkenny		Dimensions: 3.00m Depth 5.10m 1.60m	Scale 1:25
Client: Kilkenny Co Co			Logged By ID

Samples & In Situ Testing				Level (m AOD)	Depth (m)	Stratum Description	Legend
Water	Depth (m)	Type	Results				
					5.10	MSW (Municipal Solid Waste). Trial pit completed at 5.10 m	5
							6
							7

Stability: Poor Plant: Tracked Excavator Backfill: Arisings.	Groundwater: None encountered.
---	---------------------------------------

Remarks: Trial pit terminated at required depth.

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Trial Pit No

TP06

Sheet 1 of 1

Project Name:

Gowran Landfill

Project No.

P14004

Co-ords: -

Level: -

Date

20/01/2014

Location: Gowran, Co Kilkenny

Dimensions:

5.00m

Depth

2.80m

1.20m



Scale

1:25

Client: Kilkenny Co Co

Logged By

ID

Samples & In Situ Testing				Level (m AOD)	Depth (m)	Stratum Description	Legend
Water	Depth (m)	Type	Results				
					0.20	<p>Topsoil: Soft, light brown, slightly sandy slightly gravelly SILT with occasional rootlets. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded.</p> <p>Soft, light brown, slightly sandy slightly gravelly SILT with low cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded, 60-200mm dia. Boulders are subangular to subrounded, 200-500mm dia.</p>	
					1.20	MSW (Municipal Solid Waste).	
					2.80	Trial pit completed at 2.80 m	

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Stability: Poor

Plant: Tracked Excavator

Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at required depth.

HobBASE III (B1-42) (3B) Standard Trialpit Log v2 dated 27th Nov 03



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Trial Pit No
TP07
 Sheet 1 of 1

Project Name:

Gowran Landfill

Project No.:

P14004

Co-ords: -

Level: -

Date:

20/01/2014

Location: Gowran, Co Kilkenny

Dimensions:

8.70m

Depth

3.00m

0.80m



Scale:

1:25

Client: Kilkenny Co Co

Logged By
 ID

Samples & In Situ Testing				Level (m AOD)	Depth (m)	Stratum Description	Legend
Water	Depth (m)	Type	Results				
					0.20	Topsoil: Soft, light brown, slightly sandy slightly gravelly SILT with some rootlets. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded.	
					0.60	Light brown, slightly sandy SILT with low cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded, 60-200mm dia.	
					0.60	MSW (Municipal Solid Waste).	
					3.00	Trial pit completed at 3.00 m	

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Stability: Poor

Plant: Tracked Excavator

Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at required depth.



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Trial Pit No
TP08
 Sheet 1 of 1

Project Name:

Gowran Landfill

Project No.

P14004

Co-ords: -

Level: -

Date

20/01/2014

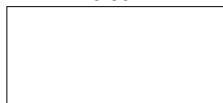
Location: Gowran, Co Kilkenny

Dimensions: 5.80m

Depth

2.30m

0.90m



Scale
1:25

Client: Kilkenny Co Co

Logged By
ID

Samples & In Situ Testing				Level (m AOD)	Depth (m)	Stratum Description	Legend
Water	Depth (m)	Type	Results				
					0.20	Topsoil: Soft, light brown, slightly sandy slightly gravelly SILT with occasional rootlets. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded.	
					0.70	Soft, light brown, slightly sandy slightly gravelly SILT with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded, 60-200mm dia.	
					0.70	MSW (Municipal Solid Waste).	
					2.30	Trial pit completed at 2.30 m	

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Stability: Poor

Plant: Tracked Excavator

Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at required depth. Gas well installed.

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Trial Pit No
TP10
 Sheet 1 of 1

Project Name:

Gowran Landfill

Project No.

P14004

Co-ords: -

Level: -

Date

20/01/2014

Location: Gowran, Co Kilkenny

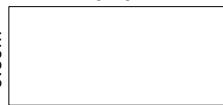
Dimensions:

5.20m

Depth

4.00m

0.60m



Scale

1:25

Client: Kilkenny Co Co

Logged By
ID

Samples & In Situ Testing				Level (m AOD)	Depth (m)	Stratum Description	Legend
Water	Depth (m)	Type	Results				
	0.20	B			0.20	Topsoil: Soft, light brown, slightly sandy slightly gravelly SILT with some rootlets. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded.	
					0.40	Dark grey, slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded, 60-120mm dia. MSW (Municipal Solid Waste).	
					4.00	Trial pit completed at 4.00 m	

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Stability: Poor

Plant: Tracked Excavator

Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at required depth.

HOREBASE III (B1 42/03) Standard Trialpit Log v2 dated 27th Nov 03



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Trial Pit No

TP11

Sheet 1 of 1

Project Name:

Gowran Landfill

Project No.

P14004

Co-ords: -

Level: -

Date

20/01/2014

Location: Gowran, Co Kilkenny

Dimensions:

4.80m

Depth

3.20m

0.60m



Scale

1:25

Logged By

ID

Client: Kilkenny Co Co

Samples & In Situ Testing				Level (m AOD)	Depth (m)	Stratum Description	Legend
Water	Depth (m)	Type	Results				
					0.20	<p>Topsoil: Soft, light brown, slightly sandy slightly gravelly SILT with some rootlets. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded.</p> <p>Soft, light brown, slightly sandy slightly gravelly SILT with low cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded, 60-100mm dia. Boulders are subangular to subrounded, 200-1000mm dia.</p>	
					2.40	MSW (Municipal Solid Waste).	
					3.20	Trial pit completed at 3.20 m	

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Stability: Moderate

Plant: Tracked Excavator

Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at required depth. Gas well installed.

H:\BASE III (B1-42) (B3) Standard Trialpit Log v2.dwg 27th Nov 03



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Trial Pit No

TP12

Sheet 1 of 2

Project Name:

Gowran Landfill

Project No.

P14004

Co-ords: -

Level: -

Date

20/01/2014

Location: Gowran, Co Kilkenny

Dimensions:

4.50m

Depth

5.50m

1.50m



Scale

1:25

Client: Kilkenny Co Co

Logged By

ID

Samples & In Situ Testing				Level (m AOD)	Depth (m)	Stratum Description	Legend
Water	Depth (m)	Type	Results				
					0.20	Topsoil: Soft, light brown, slightly sandy slightly gravelly SILT with some rootlets. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded.	
					0.50	Soft, dark grey, slightly sandy slightly gravelly SILT with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded, 60-200mm dia.	
						MSW (Municipal Solid Waste) with low boulder content. Boulders are subangular to subrounded, 200-400mm dia.	
							1
							2
							3

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Water Depth (m) Type Results Level Depth Continued next sheet

Stability: Poor

Plant: Tracked Excavator

Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at required depth. Gas well installed.

H:\BASE III (B1-42) (39) Standard Trialpit Log v2.dwg 27th Nov 03



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Trial Pit No
TP12
 Sheet 2 of 2

Project Name:

Gowran Landfill

Project No.:

P14004

Co-ords: -

Level: -

Date:

20/01/2014

Location: Gowran, Co Kilkenny

Dimensions:

4.50m

Depth

5.50m



Scale:

1:25

Client: Kilkenny Co Co

Logged By
ID

Samples & In Situ Testing				Level (m AOD)	Depth (m)	Stratum Description	Legend
Water	Depth (m)	Type	Results				
					5.50	MSW (Municipal Solid Waste) with low boulder content. Boulders are subangular to subrounded, 200-400mm dia.	
						Trial pit completed at 5.50 m	

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Stability: Poor
Plant: Tracked Excavator
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at required depth. Gas well installed.

Appendix IV

Laboratory Analysis Certificates

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Fehily Timoney
Core House
Pouladuff Road
Cork

Attention: Neil Menzies

PRELIMINARY/INTERIM REPORT

Date: 28 January 2014
Customer: D_FTIM_CRK
Sample Delivery Group (SDG): 140121-33
Your Reference: LW13-112-01
Location: Gowran Landfill
Report No: 257997

We received 4 samples on Monday January 20, 2014 and 4 of these samples were scheduled for analysis which was completed on Tuesday January 28, 2014. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

This is a preliminary report which has not had final authorisation.

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Approved By:



SDG: 140121-33
Job: D_FTIM_CRK-43
Client Reference: LW13-112-01

Location: Gowran Landfill
Customer: Fehily Timoney
Attention: Neil Menzies

Order Number: 5734
Report Number: 257997
Superseded Report:

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
8719227	LEACHATE 1		0.00 - 0.00	20/01/2014
8719228	LEACHATE 2		0.00 - 0.00	20/01/2014
8719221	TP5		0.00 - 0.00	20/01/2014
8719226	TP10		0.00 - 0.00	20/01/2014

Only received samples which have had analysis scheduled will be shown on the following pages.

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SDG: 140121-33
 Job: D_FTIM_CRK-43
 Client Reference: LW13-112-01

Location: Gowran Landfill
 Customer: Fehily Timoney
 Attention: Neil Menzies

Order Number: 5734
 Report Number: 257997
 Superseded Report:

LIQUID Results Legend X Test N No Determination Possible	Lab Sample No(s)	8719228	
	Customer Sample Reference	LEACHATE 2	
	AGS Reference		
	Depth (m)	0.00 - 0.00	
	Container	NaOH (ALE245) H2SO4 (ALE244) Dissolved Metals Pr 1 plastic (ALE221)	
Acid Herbicides (W)	All	NDPs: 0 Tests: 1	X
Ammoniacal Nitrogen	All	NDPs: 0 Tests: 1	X
Anions by Kone (w)	All	NDPs: 0 Tests: 1	X
BOD True Total	All	NDPs: 0 Tests: 1	X
COD Unfiltered	All	NDPs: 0 Tests: 1	X
Conductivity (at 20 deg.C)	All	NDPs: 0 Tests: 1	X
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 1	X
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 1	X
Fluoride	All	NDPs: 0 Tests: 1	X
Mercury Dissolved	All	NDPs: 0 Tests: 1	X
Metals by iCap-OES Dissolved (W)	All	NDPs: 0 Tests: 1	X
OC, OP Pesticides and Triazine Herb	All	NDPs: 0 Tests: 1	X
Organotins in Aqueous Samples	All	NDPs: 0 Tests: 1	X
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 1	X
pH Value	All	NDPs: 0 Tests: 1	X

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PRELIMINARY/INTERIM REPORT

Preliminary

SDG: 140121-33
Job: D_FTIM_CRK-43
Client Reference: LW13-112-01

Location: Gowran Landfill
Customer: Fehily Timoney
Attention: Neil Menzies

Order Number: 5734
Report Number: 257997
Superseded Report:

LIQUID Results Legend <input checked="" type="checkbox"/> Test <input type="checkbox"/> No Determination Possible	Lab Sample No(s)		8719228	
	Customer Sample Reference		LEACHATE 2	
	AGS Reference			
	Depth (m)		0.00 - 0.00	
	Container		NaOH (ALE245) H2SO4 (ALE244) Dissolved Metals Pr 1plastic (ALE221)	
Phenols by HPLC (W)	All	NDPs: 0 Tests: 1	<input checked="" type="checkbox"/>	
SVOC MS (W) - Aqueous	All	NDPs: 0 Tests: 1	<input checked="" type="checkbox"/>	
Total Metals by ICP-MS	All	NDPs: 0 Tests: 1	<input checked="" type="checkbox"/>	
VOC MS (W)	All	NDPs: 1 Tests: 0	<input type="checkbox"/>	

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SDG: 140121-33
 Job: D_FTIM_CRK-43
 Client Reference: LW13-112-01

Location: Gowran Landfill
 Customer: Fehily Timoney
 Attention: Neil Menzies

Order Number: 5734
 Report Number: 257997
 Superseded Report:

SOLID Results Legend <input checked="" type="checkbox"/> Test <input checked="" type="checkbox"/> No Determination Possible	Lab Sample No(s)	8719221	8719226
	Customer Sample Reference	TP5	TP10
	AGS Reference		
	Depth (m)	0.00 - 0.00	0.00 - 0.00
	Container	250g Amber Jar (AL 400g Tub (ALE214)	1kg TUB - 60g VOC (ALE215)
ANC at pH4 and ANC at pH 6	All	NDPs: 0 Tests: 2	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
Anions by Kone (w)	All	NDPs: 0 Tests: 2	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 2	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
CEN 2:1 Readings	All	NDPs: 0 Tests: 2	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
CEN 8:1 Readings	All	NDPs: 0 Tests: 2	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 2	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
Dissolved Organic/Inorganic Carbon	All	NDPs: 0 Tests: 2	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
Fluoride	All	NDPs: 0 Tests: 2	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
GRO by GC-FID (S)	All	NDPs: 0 Tests: 2	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
Loss on Ignition in soils	All	NDPs: 2 Tests: 0	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
Mercury Dissolved	All	NDPs: 0 Tests: 2	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
Mineral Oil	All	NDPs: 0 Tests: 2	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
PAH Value of soil	All	NDPs: 0 Tests: 2	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
PCBs by GCMS	All	NDPs: 0 Tests: 2	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
pH	All	NDPs: 0 Tests: 2	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>

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PRELIMINARY/INTERIM REPORT

Preliminary

SDG: 140121-33
Job: D_FTIM_CRK-43
Client Reference: LW13-112-01

Location: Gowran Landfill
Customer: Fehily Timoney
Attention: Neil Menzies

Order Number: 5734
Report Number: 257997
Superseded Report:

SOLID Results Legend <input checked="" type="checkbox"/> Test <input checked="" type="checkbox"/> No Determination Possible	Lab Sample No(s)		8719221	8719226
	Customer Sample Reference		TP5	TP10
	AGS Reference			
	Depth (m)		0.00 - 0.00	0.00 - 0.00
	Container		250g Amber Jar (AL 400g Tub (ALE214) 60g VOC (ALE215) 1kg TUB	250g Amber Jar (AL 60g VOC (ALE215)
Phenols by HPLC (W)	All	NDPs: 0 Tests: 2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Sample description	All	NDPs: 0 Tests: 2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Total Dissolved Solids	All	NDPs: 0 Tests: 2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Total Organic Carbon	All	NDPs: 0 Tests: 2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

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PRELIMINARY/INTERIM REPORT

SDG: 140121-33
Job: D_FTIM_CRK-43
Client Reference: LW13-112-01

Location: Gowran Landfill
Customer: Fehily Timoney
Attention: Neil Menzies

Order Number: 5734
Report Number: 257997
Superseded Report:

Sample Descriptions

Grain Sizes

Grain size classification bar with categories: very fine (<0.063mm), fine (0.063mm - 0.1mm), medium (0.1mm - 2mm), coarse (2mm - 10mm), very coarse (>10mm)

Table with 9 columns: Lab Sample No(s), Customer Sample Ref., Depth (m), Colour, Description, Grain size, Inclusions, Inclusions 2. Contains two rows of sample data.

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

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SDG: 140121-33
Job: D_FTIM_CRK-43
Client Reference: LW13-112-01

Location: Gowran Landfill
Customer: Fehily Timoney
Attention: Neil Menzies

Order Number: 5734
Report Number: 257997
Superseded Report:

Results Legend		Customer Sample R	LEACHATE 2	TP5	TP10			
#	ISO17025 accredited.	Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00			
M	mCERTS accredited.		Water(GW/SW)	Soil/Solid	Soil/Solid			
aq	Aqueous / settled sample.		20/01/2014	20/01/2014	20/01/2014			
diss.filt	Dissolved / filtered sample.							
tot.unfilt	Total / unfiltered sample.							
*	Subcontracted test.							
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery							
(F)	Trigger breach confirmed							
1-4&*\$@	Sample deviation (see appendix)							
Component	LOD/Units	Method						
BOD, unfiltered	<1 mg/l	TM045	588	#				
Ammoniacal Nitrogen as N	<0.2 mg/l	TM099	382	#				
Fluoride	<0.5 mg/l	TM104	<0.5	#				
COD, unfiltered	<7 mg/l	TM107	20800	#				
Conductivity @ 20 deg.C	<0.005 mS/cm	TM120	4.37	#				
Arsenic (diss.filt)	<0.12 µg/l	TM152	30.1	#				
Boron (diss.filt)	<9.4 µg/l	TM152	906	#				
Cadmium (diss.filt)	<0.1 µg/l	TM152	<0.1	#				
Copper (diss.filt)	<0.85 µg/l	TM152	1.83	#				
Lead (diss.filt)	<0.02 µg/l	TM152	0.864	#				
Manganese (diss.filt)	<0.04 µg/l	TM152	131	#				
Nickel (diss.filt)	<0.15 µg/l	TM152	28.1	#				
Zinc (diss.filt)	<0.41 µg/l	TM152	3.52	#				
Mercury (diss.filt)	<0.01 µg/l	TM183	<0.01	#				
Sulphate	<2 mg/l	TM184	<2	#				
Chloride	<2 mg/l	TM184	434	#				
Phosphate (ortho) as P	<0.02 mg/l	TM184	0.0365	#				
Total Oxidised Nitrogen as N	<0.1 mg/l	TM184	<0.1	#				
Chromium (tot.unfilt)	<3 µg/l	TM191	10800	#				
Cyanide, Total	<0.05 mg/l	TM227	<0.05	#				
Calcium (diss.filt)	<0.012 mg/l	TM228	38.2	#				
Sodium (diss.filt)	<0.076 mg/l	TM228	285	#				
Magnesium (diss.filt)	<0.036 mg/l	TM228	72.1	#				
Potassium (diss.filt)	<1 mg/l	TM228	291	#				
Iron (diss.filt)	<0.019 mg/l	TM228	3.84	#				
pH	<1 pH Units	TM256	7.94	#				
Phenols, Total Detected monohydric	<0.016 mg/l	TM259	<0.016	#				
Dibutyl tin	<5 ng/l	TM328	1670					
Tributyl tin	<1 ng/l	TM328	9940					
Tetrabutyl tin	<2 ng/l	TM328	<600					
Triphenyl tin	<1 ng/l	TM328	<300					
Surrogate	%	TM328	50.4					

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PRELIMINARY/INTERIM REPORT

SDG: 140121-33
Job: D_FTIM_CRK-43
Client Reference: LW13-112-01

Location: Gowran Landfill
Customer: Fehily Timoney
Attention: Neil Menzies

Order Number: 5734
Report Number: 257997
Superseded Report:

Results Legend		Customer Sample R	LEACHATE 2	TP5	TP10		
#	ISO17025 accredited.	Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00		
M	mCERTS accredited.		Water(GW/SW)	Soil/Solid	Soil/Solid		
aq	Aqueous / settled sample.		20/01/2014	20/01/2014	20/01/2014		
diss.filt	Dissolved / filtered sample.						
tot.unfilt	Total / unfiltered sample.						
*	Subcontracted test.						
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery						
(F)	Trigger breach confirmed						
1-4&\$@	Sample deviation (see appendix)						
				8719228	8719221	8719226	
Component	LOD/Units	Method					
Moisture Content Ratio	%	PM024		19	23		
Mineral oil >C10-C40	<1 mg/kg	TM061		212	247	#	#
Organic Carbon, Total	<0.2 %	TM132		5.12	2.52	#	#
pH	1 pH Units	TM133		8.11	7.84	M	M
PCB congener 28	<3 µg/kg	TM168		4.96	3.73	M	M
PCB congener 52	<3 µg/kg	TM168		<3	<3	M	M
PCB congener 101	<3 µg/kg	TM168		<3	<3	M	M
PCB congener 118	<3 µg/kg	TM168		<3	<3	M	M
PCB congener 138	<3 µg/kg	TM168		<3	<3	M	M
PCB congener 153	<3 µg/kg	TM168		<3	<3	M	M
PCB congener 180	<3 µg/kg	TM168		<3	<3	M	M
Sum of detected PCB 7 Congeners	<21 µg/kg	TM168		<21	<21		
ANC @ pH 4	<0.03 mol/kg	TM182		0.213	0.2		
ANC @ pH 6	<0.03 mol/kg	TM182		0.0824	0.0724		
Polyaromatic hydrocarbons, Total 17	<10 mg/kg	TM213		<10	<10		

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PRELIMINARY/INTERIM REPORT

Preliminary

SDG: 140121-33
Job: D_FTIM_CRK-43
Client Reference: LW13-112-01

Location: Gowran Landfill
Customer: Fehily Timoney
Attention: Neil Menzies

Order Number: 5734
Report Number: 257997
Superseded Report:

GRO by GC-FID (S)

Table with columns: Results Legend, Customer Sample R, TP5, TP10, Component, LOD/Units, Method. Rows include GRO Surrogate % recovery, Methyl tertiary butyl ether (MTBE), Benzene, Toluene, Ethylbenzene, m,p-Xylene, o-Xylene, sum of detected mpo xylene by GC, sum of detected BTEX by GC.

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SDG: 140121-33
 Job: D_FTIM_CRK-43
 Client Reference: LW13-112-01

Location: Gowran Landfill
 Customer: Fehily Timoney
 Attention: Neil Menzies

Order Number: 5734
 Report Number: 257997
 Superseded Report:

PAH Spec MS - Aqueous (W)

Results Legend		Customer Sample R	LEACHATE 2				
#	ISO17025 accredited.	Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference	0.00 - 0.00 Water(GW/SW) 20/01/2014 . 20/01/2014 140121-33 8719228				
M	mCERTS accredited.						
aq	Aqueous / settled sample.						
diss.filt	Dissolved / filtered sample.						
tot.unfilt	Total / unfiltered sample.						
*	Subcontracted test.						
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery						
(F)	Trigger breach confirmed						
1-4&*\$@	Sample deviation (see appendix)						
Component	LOD/Units			Method			
Naphthalene (aq)	<0.1 µg/l	TM178	16.7	#			
Acenaphthene (aq)	<0.015 µg/l	TM178	11.2	#			
Acenaphthylene (aq)	<0.011 µg/l	TM178	1.16	#			
Fluoranthene (aq)	<0.017 µg/l	TM178	68.4	#			
Anthracene (aq)	<0.015 µg/l	TM178	8.89	#			
Phenanthrene (aq)	<0.022 µg/l	TM178	45.2	#			
Fluorene (aq)	<0.014 µg/l	TM178	12.3	#			
Chrysene (aq)	<0.013 µg/l	TM178	36	#			
Pyrene (aq)	<0.015 µg/l	TM178	68.3	#			
Benzo(a)anthracene (aq)	<0.017 µg/l	TM178	24.5	#			
Benzo(b)fluoranthene (aq)	<0.023 µg/l	TM178	26.3	#			
Benzo(k)fluoranthene (aq)	<0.027 µg/l	TM178	35.6	#			
Benzo(a)pyrene (aq)	<0.009 µg/l	TM178	31.4	#			
Dibenzo(a,h)anthracene (aq)	<0.016 µg/l	TM178	4.26	#			
Benzo(g,h,i)perylene (aq)	<0.016 µg/l	TM178	21.6	#			
Indeno(1,2,3-cd)pyrene (aq)	<0.014 µg/l	TM178	15.1	#			
PAH, Total Detected USEPA 16 (aq)	<0.344 µg/l	TM178	427	#			

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SDG: 140121-33
Job: D_FTIM_CRK-43
Client Reference: LW13-112-01

Location: Gowran Landfill
Customer: Fehily Timoney
Attention: Neil Menzies

Order Number: 5734
Report Number: 257997
Superseded Report:

SVOC MS (W) - Aqueous

Results Legend		Customer Sample R	LEACHATE 2						
#	ISO17025 accredited.	Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference	0.00 - 0.00 Water(GW/SW) 20/01/2014 . 20/01/2014 140121-33 8719228						
M	mCERTS accredited.								
aq	Aqueous / settled sample.								
diss.filt	Dissolved / filtered sample.								
tot.unfilt	Total / unfiltered sample.								
*	Subcontracted test.								
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery								
(F)	Trigger breach confirmed								
1-4&*\$@	Sample deviation (see appendix)								
Component	LOD/Units			Method					
1,2,4-Trichlorobenzene (aq)	<1 µg/l			TM176	<4	#			
1,2-Dichlorobenzene (aq)	<1 µg/l			TM176	<4	#			
1,3-Dichlorobenzene (aq)	<1 µg/l			TM176	<4	#			
1,4-Dichlorobenzene (aq)	<1 µg/l			TM176	<4	#			
2,4,5-Trichlorophenol (aq)	<1 µg/l	TM176	<4	#					
2,4,6-Trichlorophenol (aq)	<1 µg/l	TM176	<4	#					
2,4-Dichlorophenol (aq)	<1 µg/l	TM176	<4	#					
2,4-Dimethylphenol (aq)	<1 µg/l	TM176	<4	#					
2,4-Dinitrotoluene (aq)	<1 µg/l	TM176	<4	#					
2,6-Dinitrotoluene (aq)	<1 µg/l	TM176	<4	#					
2-Chloronaphthalene (aq)	<1 µg/l	TM176	<4	#					
2-Chlorophenol (aq)	<1 µg/l	TM176	<4	#					
2-Methylnaphthalene (aq)	<1 µg/l	TM176	<4	#					
2-Methylphenol (aq)	<1 µg/l	TM176	<4	#					
2-Nitroaniline (aq)	<1 µg/l	TM176	<4	#					
2-Nitrophenol (aq)	<1 µg/l	TM176	<4	#					
3-Nitroaniline (aq)	<1 µg/l	TM176	<4	#					
4-Bromophenylphenylether (aq)	<1 µg/l	TM176	<4	#					
4-Chloro-3-methylphenol (aq)	<1 µg/l	TM176	<4	#					
4-Chloroaniline (aq)	<1 µg/l	TM176	<4	#					
4-Chlorophenylphenylether (aq)	<1 µg/l	TM176	<4	#					
4-Methylphenol (aq)	<1 µg/l	TM176	<4	#					
4-Nitroaniline (aq)	<1 µg/l	TM176	<4	#					
4-Nitrophenol (aq)	<1 µg/l	TM176	<4	#					
Azobenzene (aq)	<1 µg/l	TM176	<4	#					
Acenaphthylene (aq)	<1 µg/l	TM176	<4	#					
Acenaphthene (aq)	<1 µg/l	TM176	<4	#					
Anthracene (aq)	<1 µg/l	TM176	<4	#					
bis(2-Chloroethyl)ether (aq)	<1 µg/l	TM176	<4	#					
bis(2-Chloroethoxy)methane (aq)	<1 µg/l	TM176	<4	#					
bis(2-Ethylhexyl) phthalate (aq)	<2 µg/l	TM176	67.6	#					
Butylbenzyl phthalate (aq)	<1 µg/l	TM176	<4	#					

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SDG: 140121-33
 Job: D_FTIM_CRK-43
 Client Reference: LW13-112-01

Location: Gowran Landfill
 Customer: Fehily Timoney
 Attention: Neil Menzies

Order Number: 5734
 Report Number: 257997
 Superseded Report:

SVOC MS (W) - Aqueous

Results Legend		Customer Sample R	LEACHATE 2			
#	ISO17025 accredited.	Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference	0.00 - 0.00 Water(GW/SW) 20/01/2014 20/01/2014 140121-33 8719228			
M	mCERTS accredited.					
aq	Aqueous / settled sample.					
dis.filt	Dissolved / filtered sample.					
tot.unfilt	Total / unfiltered sample.					
*	Subcontracted test.					
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery					
(F)	Trigger breach confirmed					
1-4&*\$@	Sample deviation (see appendix)					
Component	LOD/Units			Method		
Benzo(a)anthracene (aq)	<1 µg/l	TM176	<4	#		
Benzo(b)fluoranthene (aq)	<1 µg/l	TM176	<4	#		
Benzo(k)fluoranthene (aq)	<1 µg/l	TM176	<4	#		
Benzo(a)pyrene (aq)	<1 µg/l	TM176	<4	#		
Benzo(g,h,i)perylene (aq)	<1 µg/l	TM176	<4	#		
Carbazole (aq)	<1 µg/l	TM176	<4	#		
Chrysene (aq)	<1 µg/l	TM176	<4	#		
Dibenzofuran (aq)	<1 µg/l	TM176	<4	#		
n-Dibutyl phthalate (aq)	<1 µg/l	TM176	<4	#		
Diethyl phthalate (aq)	<1 µg/l	TM176	<4	#		
Dibenzo(a,h)anthracene (aq)	<1 µg/l	TM176	<4	#		
Dimethyl phthalate (aq)	<1 µg/l	TM176	<4	#		
n-Dioctyl phthalate (aq)	<5 µg/l	TM176	<20	#		
Fluoranthene (aq)	<1 µg/l	TM176	<4	#		
Fluorene (aq)	<1 µg/l	TM176	<4	#		
Hexachlorobenzene (aq)	<1 µg/l	TM176	<4	#		
Hexachlorobutadiene (aq)	<1 µg/l	TM176	<4	#		
Pentachlorophenol (aq)	<1 µg/l	TM176	<4	#		
Phenol (aq)	<1 µg/l	TM176	<4	#		
n-Nitroso-n-dipropylamine (aq)	<1 µg/l	TM176	<4	#		
Hexachloroethane (aq)	<1 µg/l	TM176	<4	#		
Nitrobenzene (aq)	<1 µg/l	TM176	<4	#		
Naphthalene (aq)	<1 µg/l	TM176	<4	#		
Isophorone (aq)	<1 µg/l	TM176	<4	#		
Hexachlorocyclopentadiene (aq)	<1 µg/l	TM176	<4	#		
Phenanthrene (aq)	<1 µg/l	TM176	<4	#		
Indeno(1,2,3-cd)pyrene (aq)	<1 µg/l	TM176	<4	#		
Pyrene (aq)	<1 µg/l	TM176	<4	#		

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SDG: 140121-33
 Job: D_FTIM_CRK-43
 Client Reference: LW13-112-01

Location: Gowran Landfill
 Customer: Fehily Timoney
 Attention: Neil Menzies

Order Number: 5734
 Report Number: 257997
 Superseded Report:

CEN 10:1 CUMULATIVE TWO STAGE BATCH TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/3

Client Reference		Site Location	Gowran Landfill
Mass Sample taken (kg)	0.262	Natural Moisture Content (%)	49.5
Mass of dry sample (kg)	0.175	Dry Matter Content (%)	66.9
Particle Size <4mm	>95%		

Case		Landfill Waste Acceptance Criteria Limits		
SDG	140121-33	Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Lab Sample Number(s)	8719221			
Sampled Date	20-Jan-2014			
Customer Sample Ref.	TP5			
Depth (m)	0.00 - 0.00			

Solid Waste Analysis

Total Organic Carbon (%)	5.12	3	5	6
Loss on Ignition (%)	-	-	-	-
Sum of BTEX (mg/kg)	0.069	6	-	-
Sum of 7 PCBs (mg/kg)	<0.021	1	-	-
Mineral Oil (mg/kg)	212	500	-	-
PAH Sum of 17 (mg/kg)	<10	100	-	-
pH (pH Units)	8.11	-	<6 or >9	-
ANC to pH 6 (mol/kg)	0.0824	-	-	-
ANC to pH 4 (mol/kg)	0.213	-	-	-

Eluate Analysis	C2	C8	A2	A2-10	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	Conc ⁿ in 2:1 eluate	Conc ⁿ in 8:1 eluate	2:1 conc ⁿ leached	Cumulative conc ⁿ leached	mg/l	mg/kg	
Arsenic	0.0229	0.00532	0.0458	0.0728	0.5	2	25
Barium	0.0205	0.0127	0.041	0.136	20	100	300
Cadmium	0.000764	<0.0001	0.00153	<0.001	0.04	1	5
Chromium	0.0104	0.00255	0.0208	0.0343	0.5	10	70
Copper	0.0314	0.00664	0.0627	0.0939	2	50	100
Mercury Dissolved (CVAF)	0.0000104	0.000172	0.0000208	0.00154	0.01	0.2	2
Molybdenum	0.503	0.0346	1	0.868	0.5	10	30
Nickel	0.0668	0.00444	0.133	0.114	0.4	10	40
Lead	0.00439	0.00183	0.00876	0.0211	0.5	10	50
Antimony	0.0139	0.00817	0.0277	0.088	0.06	0.7	5
Selenium	0.0104	0.00238	0.0208	0.0327	0.1	0.5	7
Zinc	0.026	0.00445	0.052	0.0685	4	50	200
Chloride	196	128	392	1360	800	15000	25000
Fluoride	<0.5	<0.5	<0.999	<5	10	150	500
Sulphate (soluble)	337	6.2	673	431	1000	20000	50000
Total Dissolved Solids	1840	443	3670	5990	4000	60000	100000
Total Monohydric Phenols (W)	0.02	<0.016	0.04	<0.16	1	-	-
Dissolved Organic Carbon	238	24.8	475	502	500	800	1000

Leach Test Information	2:1	8:1
Date Prepared	22-Jan-2014	22-Jan-2014
pH (pH Units)	8.116	7.984
Conductivity (µS/cm)	2,430.00	581.00
Temperature (°C)	20.30	18.90
Volume Leachant (Litres)	0.263	1.400
Volume of Eluate VE1 (Litres)	0.195	

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
 Stated limits are for guidance only and ALcontrol cannot be held responsible for any discrepancies with current legislation
 Mcerts Certification does not apply to leachates
 28/01/2014 16:29:33

SDG: 140121-33
 Job: D_FTIM_CRK-43
 Client Reference: LW13-112-01

Location: Gowran Landfill
 Customer: Fehily Timoney
 Attention: Neil Menzies

Order Number: 5734
 Report Number: 257997
 Superseded Report:

CEN 10:1 CUMULATIVE TWO STAGE BATCH TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/3

Client Reference		Site Location	Gowran Landfill
Mass Sample taken (kg)	0.243	Natural Moisture Content (%)	39
Mass of dry sample (kg)	0.175	Dry Matter Content (%)	72
Particle Size <4mm	>95%		

Case		Landfill Waste Acceptance Criteria Limits		
SDG	140121-33	Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Lab Sample Number(s)	8719226			
Sampled Date	20-Jan-2014			
Customer Sample Ref.	TP10			
Depth (m)	0.00 - 0.00			

Solid Waste Analysis

Total Organic Carbon (%)	2.52	3	5	6
Loss on Ignition (%)	-	-	-	-
Sum of BTEX (mg/kg)	0.714	6	-	-
Sum of 7 PCBs (mg/kg)	<0.021	1	-	-
Mineral Oil (mg/kg)	247	500	-	-
PAH Sum of 17 (mg/kg)	<10	100	-	-
pH (pH Units)	7.84	-	<6 or >9	-
ANC to pH 6 (mol/kg)	0.0724	-	-	-
ANC to pH 4 (mol/kg)	0.2	-	-	-

Eluate Analysis	C ₂ Conc ⁿ in 2:1 eluate	C ₈ Conc ⁿ in 8:1 eluate	A ₂ 2:1 conc ⁿ leached	A ₂₋₁₀ Cumulative conc ⁿ leached	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	mg/l		mg/kg				
Arsenic	0.0106	0.00451	0.0212	0.0524	0.5	2	25
Barium	0.052	0.0234	0.104	0.268	20	100	300
Cadmium	0.000227	<0.0001	0.000454	<0.001	0.04	1	5
Chromium	0.0049	0.00187	0.0098	0.0223	0.5	10	70
Copper	0.02	<0.00085	0.0401	0.024	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.00002	<0.0001	0.01	0.2	2
Molybdenum	0.13	0.0216	0.261	0.346	0.5	10	30
Nickel	0.0113	<0.00015	0.0225	0.0135	0.4	10	40
Lead	0.001	0.000272	0.002	0.00359	0.5	10	50
Antimony	0.00509	0.00719	0.0102	0.0694	0.06	0.7	5
Selenium	0.00606	0.00148	0.0121	0.0203	0.1	0.5	7
Zinc	0.0166	0.000838	0.0333	0.0273	4	50	200
Chloride	69.6	7.5	139	150	800	15000	25000
Fluoride	<0.5	<0.5	<1	<5	10	150	500
Sulphate (soluble)	54.8	56.8	110	566	1000	20000	50000
Total Dissolved Solids	788	249	1580	3140	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.032	<0.16	1	-	-
Dissolved Organic Carbon	72.7	10.5	146	180	500	800	1000

Leach Test Information	2:1	8:1
Date Prepared	22-Jan-2014	22-Jan-2014
pH (pH Units)	8.270	8.118
Conductivity (µS/cm)	970.00	349.00
Temperature (°C)	20.40	19.20
Volume Leachant (Litres)	0.282	1.400
Volume of Eluate VE1 (Litres)	0.210	

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
 Stated limits are for guidance only and ALcontrol cannot be held responsible for any discrepancies with current legislation
 Mcerts Certification does not apply to leachates
 28/01/2014 16:29:33

SDG: 140121-33
Job: D_FTIM_CRK-43
Client Reference: LW13-112-01

Location: Gowran Landfill
Customer: Fehily Timoney
Attention: Neil Menzies

Order Number: 5734
Report Number: 257997
Superseded Report:

Notification of NDPs (No determination possible)

Date Received : 21/01/2014 10:12:30

Sample No	Customer Sample Ref.	Depth (m)	Test	Comment
8719221	TP5	0.00 - 0.00	Loss on Ignition in soils	Unsuitable for analysis due to potential Asbestos
8719226	TP10	0.00 - 0.00	Loss on Ignition in soils	Unsuitable for analysis due to potential Asbestos
8719228	LEACHATE 2	0.00 - 0.00	VOC MS (W)	Insufficient Sample

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SDG: 140121-33
Job: D_FTIM_CRK-43
Client Reference: LW13-112-01

Location: Gowran Landfill
Customer: Fehily Timoney
Attention: Neil Menzies

Order Number: 5734
Report Number: 257997
Superseded Report:

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample ¹	Surrogate Corrected
ASB_PREP				
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
PM114		Leaching Procedure for CEN Two Stage Batch Test 2:1/8:1 Cumulative		
TM018	BS 1377: Part 3 1990	Determination of Loss on Ignition		
TM045	MEWAM BOD5 2nd Ed.HMSO 1988 / Method 5210B, AWWA/APHA, 20th Ed., 1999; SCA Blue Book 130	Determination of BOD5 (ATU) Filtered by Oxygen Meter on liquids		
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM061	Method for the Determination of EPH, Massachusetts Dept. of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water		
TM099	BS 2690: Part 7:1968 / BS 6068: Part 2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser		
TM104	Method 4500F, AWWA/APHA, 20th Ed., 1999	Determination of Fluoride using the Kone Analyser		
TM107	ISO 6060-1989	Determination of Chemical Oxygen Demand using COD Dr Lange Kit		
TM120	Method 2510B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part 9:1970	Determination of Electrical Conductivity using a Conductivity Meter		
TM123	BS 2690: Part 121:1981	The Determination of Total Dissolved Solids in Water		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990; BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM168	EPA Method 8082, Polychlorinated Biphenyls by Gas Chromatography	Determination of WHO12 and EC7 Polychlorinated Biphenyl Congeners by GC-MS in Soils		
TM176	EPA 8270D Semi-Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)	Determination of SVOCs in Water by GCMS		
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters		
TM182	CEN/TC 292 - WI 292046-characterization of waste-leaching Behaviour Tests- Acid and Base Neutralization Capacity Test	Determination of Acid Neutralisation Capacity (ANC) Using Autotitration in Soils		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers		
TM186	Determination of Acidic Herbicides in Groundwater and Potable Water by LC/MSD Using Selective Ion Monitoring. Agilent Technologies Inc. Application Note 5988-5882EN.	The Determination of Acid Herbicides in Environmental Water Samples and Leachates by LC/MS QQQ.		
TM191	Standard Methods for the examination of waters and wastewaters 16th Edition, ALPHA, Washington DC, USA. ISBN 0-87553-131-8.	Determination of Unfiltered Metals in Water Matrices by ICP-MS		
TM208	Modified: US EPA Method 8260b & 624	Determination of Volatile Organic Compounds by Headspace / GC-MS in Waters		
TM213	In-house Method	Rapid Determination of PAHs by GC-FID		
TM227	Standard methods for the examination of waters and wastewaters 20th Edition, AWWA/APHA Method 4500.	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate		
TM228	US EPA Method 6010B	Determination of Major Cations in Water by iCap 6500 Duo ICP-OES		
TM231	Agilent 6890 Gas Chromatograph system using an Agilent 5973 Mass Selective Detector (MSD)	Determination of Organochlorine and Organophosphorus Pesticides and Triazine Herbicides by GCMS		
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter		
TM259	by HPLC	Determination of Phenols in Waters and Leachates by HPLC		
TM328				

¹ Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.



SDG: 140121-33
Job: D_FTIM_CRK-43
Client Reference: LW13-112-01

Location: Gowran Landfill
Customer: Fehily Timoney
Attention: Neil Menzies

Order Number: 5734
Report Number: 257997
Superseded Report:

Test Completion Dates

Lab Sample No(s)	8719228	8719221	8719226
Customer Sample Ref.	LEACHATE 2	TP5	TP10
AGS Ref.			
Depth	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00
Type	LIQUID	SOLID	SOLID
Acid Herbicides (W)	28-Jan-2014		
Ammoniacal Nitrogen	27-Jan-2014		
ANC at pH4 and ANC at pH 6		27-Jan-2014	27-Jan-2014
Anions by Kone (w)	27-Jan-2014	27-Jan-2014	27-Jan-2014
BOD True Total	26-Jan-2014		
CEN 2:1 Leachate (2 Stage)		22-Jan-2014	22-Jan-2014
CEN 2:1 Readings		24-Jan-2014	24-Jan-2014
CEN 8:1 Leachate (2 Stage)		24-Jan-2014	24-Jan-2014
CEN 8:1 Readings		24-Jan-2014	24-Jan-2014
COD Unfiltered	22-Jan-2014		
Conductivity (at 20 deg.C)	24-Jan-2014		
Cyanide Comp/Free/Total/Thiocyanate	28-Jan-2014		
Dissolved Metals by ICP-MS	27-Jan-2014	27-Jan-2014	27-Jan-2014
Dissolved Organic/Inorganic Carbon		27-Jan-2014	27-Jan-2014
Fluoride	27-Jan-2014	27-Jan-2014	27-Jan-2014
GRO by GC-FID (S)		27-Jan-2014	27-Jan-2014
Mercury Dissolved	27-Jan-2014	28-Jan-2014	28-Jan-2014
Metals by iCap-OES Dissolved (W)	24-Jan-2014		
Mineral Oil		28-Jan-2014	28-Jan-2014
OC, OP Pesticides and Triazine Herb	28-Jan-2014		
Organotins in Aqueous Samples	24-Jan-2014		
PAH Spec MS - Aqueous (W)	28-Jan-2014		
PAH Value of soil		28-Jan-2014	28-Jan-2014
PCBs by GCMS		28-Jan-2014	28-Jan-2014
pH		24-Jan-2014	24-Jan-2014
pH Value	24-Jan-2014		
Phenols by HPLC (W)	28-Jan-2014	28-Jan-2014	28-Jan-2014
Sample description		22-Jan-2014	22-Jan-2014
SVOC MS (W) - Aqueous	28-Jan-2014		
Total Dissolved Solids		27-Jan-2014	27-Jan-2014
Total Metals by ICP-MS	28-Jan-2014		
Total Organic Carbon		28-Jan-2014	28-Jan-2014

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SDG: 140121-33
Job: D_FTIM_CRK-43
Client Reference: LW13-112-01

Location: Gowran Landfill
Customer: Fehily Timoney
Attention: Neil Menzies

Order Number: 5734
Report Number: 257997
Superseded Report:

Appendix General

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** -Most of our organic methods include surrogates, the recovery of which is monitored and reported. For EPH, MO, PAH, GRO and VOCs on soils the result is not surrogate corrected, but a percentage recovery is quoted. Acceptable limits for most organic methods are 70 -130 %.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill /made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Sampled on date not provided
6	Sample holding time exceeded in laboratory
7	Sample holding time exceeded due to sampled on date
8	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthrophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than:

Trace -Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.



Fehily Timoney
3rd Floor
North Park Offices
North Park Business Park
North Road
Dublin
Dublin 11

Attention: Neil Menzies

CERTIFICATE OF ANALYSIS

Date: 01 April 2014
Customer: D_FTIM_DUB
Sample Delivery Group (SDG): 140320-70
Your Reference: LW13-112-01
Location: Tier II Assesment, Gowran, Co. Kilkenny
Report No: 265147

This report has been revised and directly supersedes 264487 in its entirety.

We received 5 samples on Wednesday March 19, 2014 and 5 of these samples were scheduled for analysis which was completed on Wednesday March 26, 2014. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager



SDG: 140320-70
Job: D_FTIM_DUB-116
Client Reference: LW13-112-01

Location: Tier II Assesment, Gowran, Co. Kilkenny
Customer: Fehily Timoney
Attention: Neil Menzies

Order Number: 5776
Report Number: 265147
Superseded Report: 264487

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
9010354	BH1			19/03/2014
9010359	BH2			19/03/2014
9010362	Farm			19/03/2014
9010367	Housing Estate			19/03/2014
9010364	Nursing Home			19/03/2014

Only received samples which have had analysis scheduled will be shown on the following pages.

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SDG: 140320-70
 Job: D_FTIM_DUB-116
 Client Reference: LW13-112-01

Location: Tier II Assessment, Gowran, Co. Kilkenny
 Customer: Fehily Timoney
 Attention: Neil Menzies

Order Number: 5776
 Report Number: 265147
 Superseded Report: 264487

LIQUID Results Legend X Test N No Determination Possible	Lab Sample No(s)	9010354	9010359	9010362	9010367	9010364	
	Customer Sample Reference	BH1	BH2	Farm	Housing Estate	Nursing Home	
	AGS Reference						
	Depth (m)						
	Container	1l plastic (ALE244)	1l plastic (ALE221)	1l plastic (ALE244)	1l plastic (ALE221)	1l plastic (ALE244)	1l plastic (ALE221)
Ammoniacal Nitrogen	All	NDPs: 0 Tests: 5	X	X	X	X	X
Anions by Kone (w)	All	NDPs: 0 Tests: 5	X	X	X	X	X
BOD True Total	All	NDPs: 0 Tests: 5	X	X	X	X	X
Conductivity (at 20 deg.C)	All	NDPs: 0 Tests: 5	X	X	X	X	X
Metals by iCap-OES Dissolved (W)	All	NDPs: 0 Tests: 5	X	X	X	X	X
pH Value	All	NDPs: 0 Tests: 5	X	X	X	X	X

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SDG: 140320-70
Job: D_FTIM_DUB-116
Client Reference: LW13-112-01

Location: Tier II Assesment, Gowran, Co. Kilkenny
Customer: Fehily Timoney
Attention: Neil Menzies

Order Number: 5776
Report Number: 265147
Superseded Report: 264487

Table with columns: Results Legend, Customer Sample Ref., BH1, BH2, Farm, Housing Estate, Nursing Home. Rows include BOD, Ammoniacal Nitrogen, Conductivity, Sulphate, Chloride, Sodium, Potassium, and pH.

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SDG: 140320-70
Job: D_FTIM_DUB-116
Client Reference: LW13-112-01

Location: Tier II Assesment, Gowran, Co. Kilkenny
Customer: Fehily Timoney
Attention: Neil Menzies

Order Number: 5776
Report Number: 265147
Superseded Report: 264487

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample ¹	Surrogate Corrected
TM045	MEWAM BOD5 2nd Ed.HMSO 1988 / Method 5210B, AWWA/APHA, 20th Ed., 1999; SCA Blue Book 130	Determination of BOD5 (ATU) Filtered by Oxygen Meter on liquids		
TM099	BS 2690: Part 7:1968 / BS 6068: Part2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser		
TM120	Method 2510B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part 9:1970	Determination of Electrical Conductivity using a Conductivity Meter		
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers		
TM228	US EPA Method 6010B	Determination of Major Cations in Water by iCap 6500 Duo ICP-OES		
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter		

¹ Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

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SDG: 140320-70
Job: D_FTIM_DUB-116
Client Reference: LW13-112-01

Location: Tier II Assessment, Gowran, Co. Kilkenny
Customer: Fehily Timoney
Attention: Neil Menzies

Order Number: 5776
Report Number: 265147
Superseded Report: 264487

Test Completion Dates

Lab Sample No(s)	9010354	9010359	9010362	9010367	9010364
Customer Sample Ref.	BH1	BH2	Farm	Housing Estate	Nursing Home
AGS Ref.					
Depth					
Type	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID
Ammoniacal Nitrogen	24-Mar-2014	24-Mar-2014	24-Mar-2014	24-Mar-2014	24-Mar-2014
Anions by Kone (w)	26-Mar-2014	25-Mar-2014	25-Mar-2014	25-Mar-2014	25-Mar-2014
BOD True Total	26-Mar-2014	26-Mar-2014	26-Mar-2014	26-Mar-2014	26-Mar-2014
Conductivity (at 20 deg.C)	24-Mar-2014	24-Mar-2014	24-Mar-2014	24-Mar-2014	24-Mar-2014
Metals by iCap-OES Dissolved (W)	26-Mar-2014	26-Mar-2014	26-Mar-2014	26-Mar-2014	26-Mar-2014
pH Value	21-Mar-2014	21-Mar-2014	24-Mar-2014	24-Mar-2014	21-Mar-2014

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SDG: 140320-70
Job: D_FTIM_DUB-116
Client Reference: LW13-112-01

Location: Tier II Assessment, Gowran, Co. Kilkenny
Customer: Fehily Timoney
Attention: Neil Menzies

Order Number: 5776
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Appendix General

- Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.
- Samples will be run in duplicate upon request, but an additional charge may be incurred.
- If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.
- With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.
- We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.
- When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.
- If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.
- If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.
- NDP -No determination possible due to insufficient/unsuitable sample.
- Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.
- Results relate only to the items tested.
- LODs for wet tests reported on a dry weight basis are not corrected for moisture content.
- Surrogate recoveries** -Most of our organic methods include surrogates, the recovery of which is monitored and reported. For EPH, MO, PAH, GRO and VOCs on soils the result is not surrogate corrected, but a percentage recovery is quoted. Acceptable limits for most organic methods are 70 -130 %.
- Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.
- Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).
- Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).
- Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.
- In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.
- Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

- For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.
- For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.
- We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill /made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.
- Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5 -C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before preservation was performed
\$	Sampled on date not provided
	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than:
 Trace -Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

Appendix V

Tier 1 Assessment

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TIER 1 RISK ASSESSMENT

For

**Historical Landfill,
Gowran ,
Kilkenny.**

Class B – Medium Risk Site

Prepared in accordance with the EPA's Code of Practice for Environmental Risk Assessment for Unregulated Waste Disposal Sites.

Prepared by: Michael Nugent
Environment Section
Kilkenny County Council

07/11/2013
(rev.3)

Contents

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- Page 2 - 5 : Photographs of site
- Page 6 : Conceptual model
- Page 7 - 8 : Walkover survey checklist
- Page 9 : Aquifer Map
- Page 10 : Subsoil map
- Page 11 : Groundwater vulnerability map
- Page 12 : Height contour map
- Page 13 : Network Diagram for Leachate Migration through combined groundwater and surface water pathways
- Page 14 : Network Diagram for Leachate Migration through groundwater pathways
- Page 15 : Network Diagram for Leachate Migration through surface water pathways
- Page 16 : Network Diagram for Landfill Gas Migration (Lateral and Vertical)
- Page 17 - 19 : Risk Scoring Matrices
- Page 20 – 21 : Risk Screening

SUMMARY

Introduction

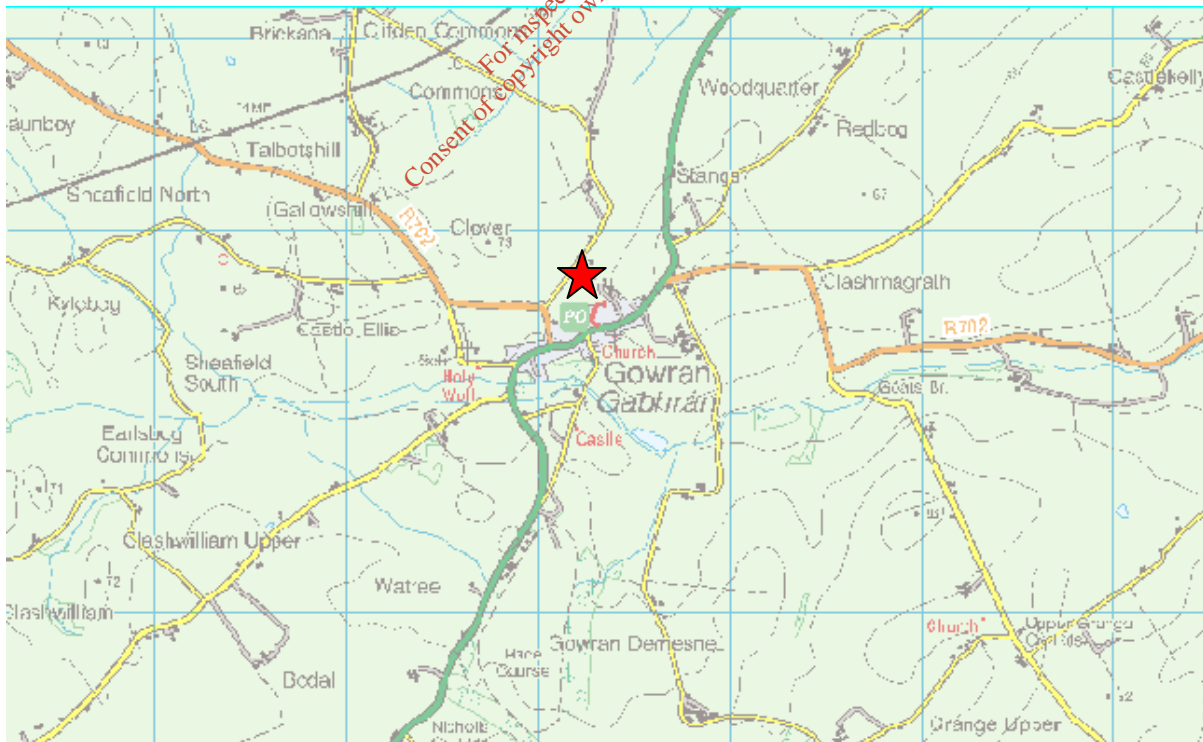
Gowran landfill is located at Gowran, Co. Kilkenny at coordinates X: 263207, Y: 153721. The site was used by Kilkenny County Council for the disposal of municipal waste. The site originally consisted of an old quarry. The council filled the pit and covered the site with soil. The site is owned by Kilkenny County Council.

Walkover

The site is currently in use as a storage yard by the Council. The surrounding area is used for residential and agricultural purposes. The site is approximately 0.09 hectares in area. The land falls in a south westerly direction. There is a new housing estate to the east of the site, the closest house being approximately 17m from the site. There is a well approximately 150m SW of the site. There are no surface water features in the vicinity of the site. There are no visible sources of contamination. There are no visible signs of impact to the environment.

Desk study

The closest surface water feature is a river 524m south of the site. There is a public water supply 2.57Km North West of the site. The aquifer is classified as extremely vulnerable. The aquifer is regionally important and karstified. The subsoil is mainly derived from sandstone and shale tills.



Map Data Based on Ordnance Survey of Ireland Map, License No. Kilkenny CCMA 03-07

PHOTOGRAPHS



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Tier 1 Risk Assessment – Historical Landfill, Gowran



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Site outlined in red.

Tier 1 Risk Assessment – Historical Landfill, Gowran



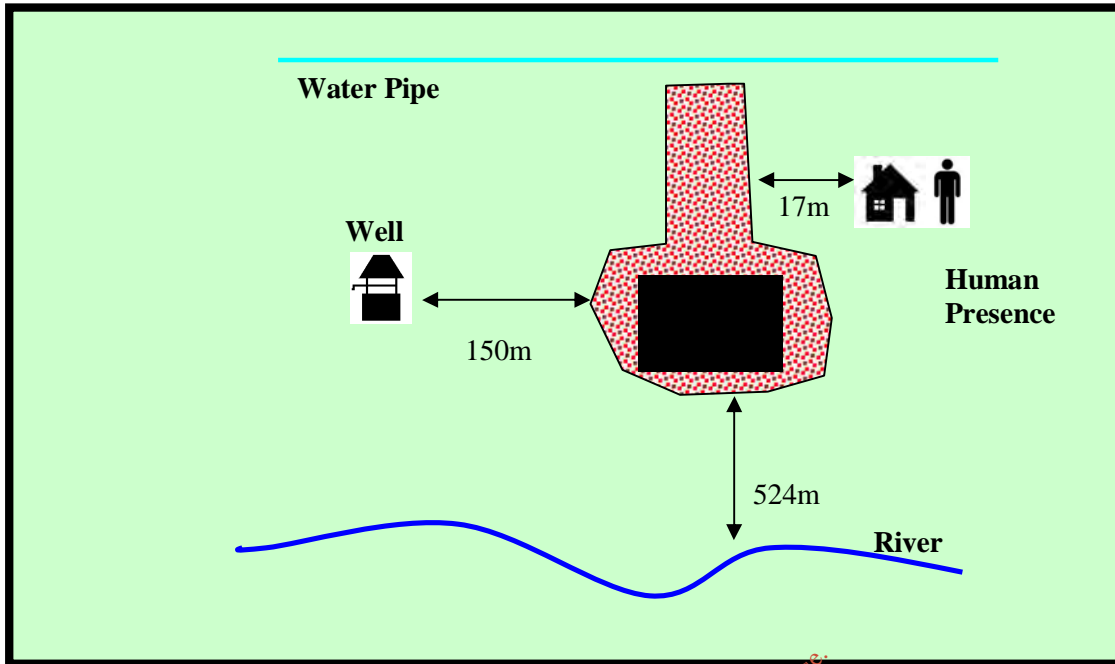
Waterlogged Soil



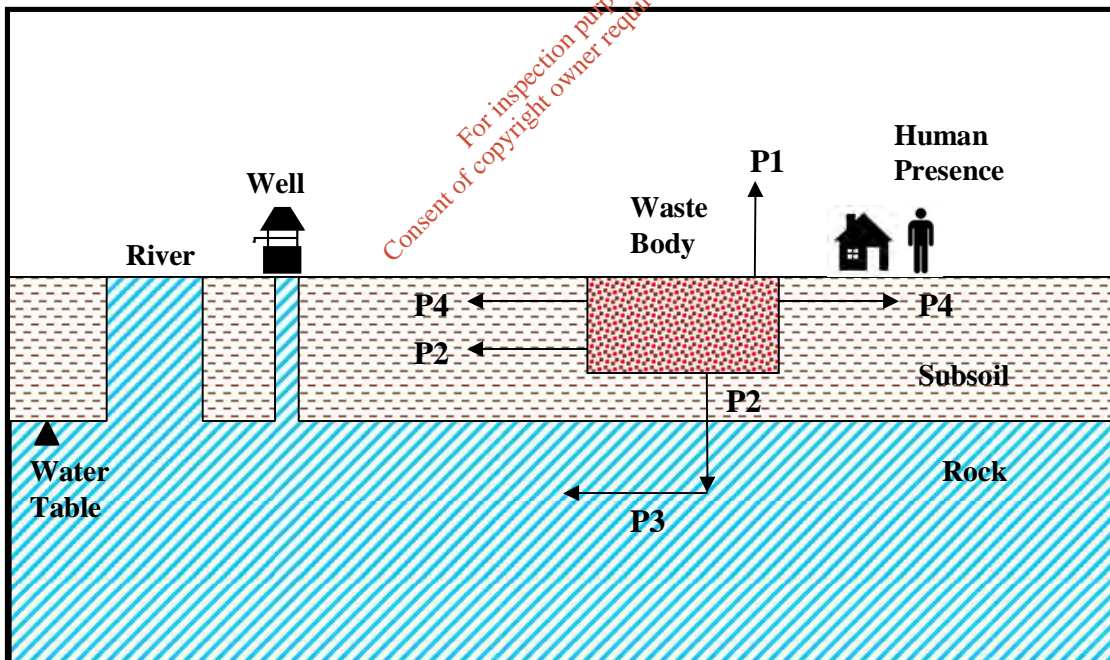
Bare patch

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CONCEPTUAL MODEL



Plan



Cross Section

- P1 – Landfill Gas
- P2 – Leachate Migration – unsaturated zone
- P3 – Leachate Migration – saturated zone
- P4 – Landfill Gas Migration.

WALKOVER SURVEY CHECKLIST

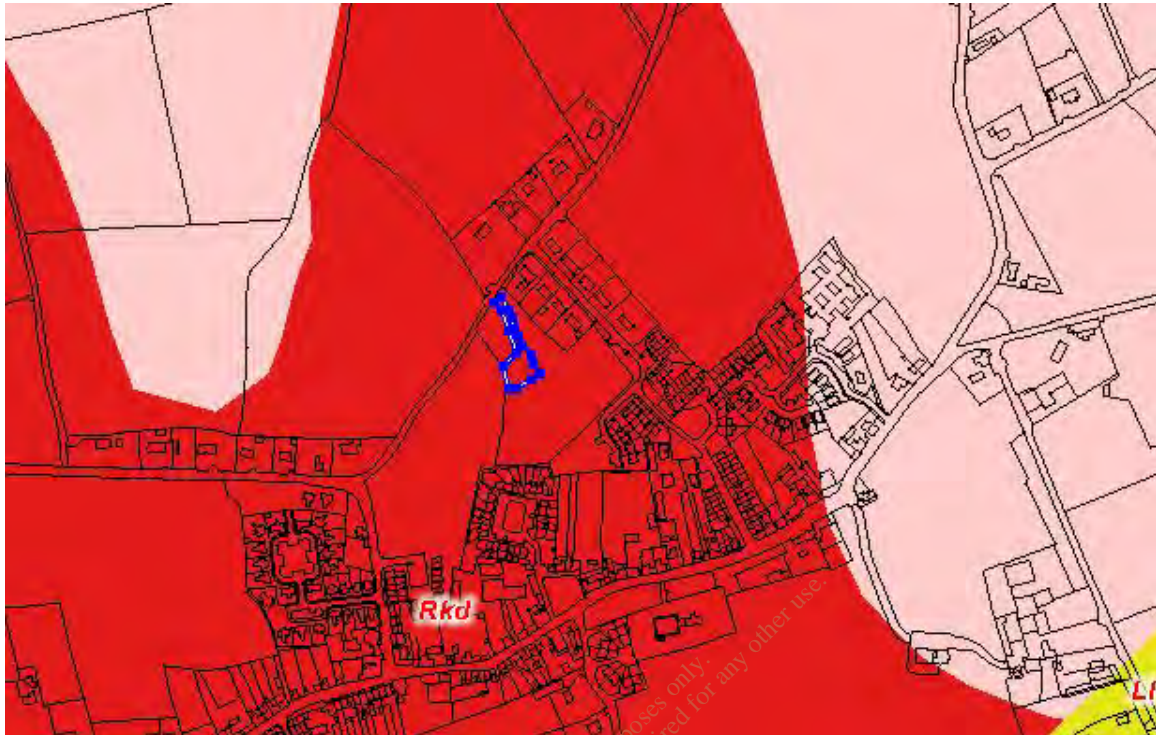
Information	Checked	Comment (include distances from site boundary)
1. What is current Land Use?	✓	Residential/sports/storage yard
2. What are the neighbouring Land Uses?	✓	Residential/agricultural
3. What is the size of the site?	✓	0.087ha
4. What is the topography?	✓	Gentle slope to south west
5. Are there potential receptors (if yes, give details)?	✓	
• Houses	✓	17m east of site
• Surface water features (if yes, distance and direction of flow)	✓	River 524m south of site
• Any wetland or protected areas	✓	None
• Public Water Supplies	✓	2572m north-west of site
• Private Wells	✓	150m
• Services	✓	Water pipe north of site
• Other buildings	✓	Residential
• Other	✓	n/a
6. Are there any potential sources of contamination (if yes, give details)?	✓	
• Surface waste (if yes, what type?)	✓	No (some fly-tipped waste not associated with landfill)
• Surface ponding of leachate	✓	No
• Leachate seepage	✓	No
• Landfill gas odours	✓	No
7. Are there any outfalls to surface water? (If yes, are there discharges and what is the nature of the discharge?)	✓	No
8. Are there any signs of impact on the environment? (If yes, take photographic evidence)	✓	No
• Vegetation die off, bare ground	✓	Yes – some patches of bare ground. See Photo.
• Leachate seepages	✓	No
• Odours	✓	No
• Litter	✓	Yes – not associated with landfill

Tier 1 Risk Assessment – Historical Landfill, Gowran

Information	Checked	Comment (include distances from site boundary)
<ul style="list-style-type: none"> Gas bubbling through water 	✓	No
<ul style="list-style-type: none"> Signs of settlement, subsidence, water logged areas 	✓	No
<ul style="list-style-type: none"> Drainage or hydraulic issues 	✓	Some waterlogged soil on site – most likely due to capping material. See Photo.
<ul style="list-style-type: none"> Downstream water quality appears poorer than upstream water quality 	✓	Not tested
9. Are there any indications of remedial measures? (Provide details)	✓	
<ul style="list-style-type: none"> Capping 	✓	Capped with soil.
<ul style="list-style-type: none"> Landfill gas collection 	✓	No
<ul style="list-style-type: none"> Leachate collection 	✓	No
10. Describe fences and security features (if any)	✓	Fence present – not adequate.
Any other relevant information?		

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AQUIFER

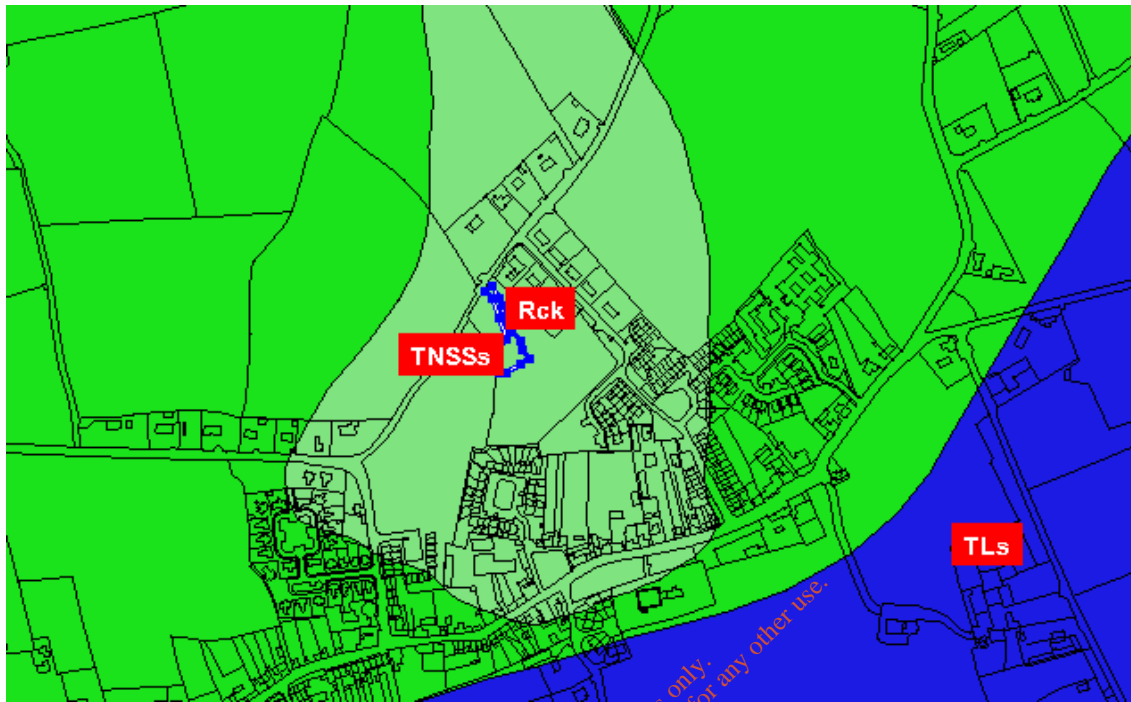


0 197m

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Aquifer type – Rkd – Regionally important karstified aquifer.

SUBSOIL



0 197m

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Rock
TNSSs – Sandstone/shale till

GROUNDWATER VULNERABILITY



0 197m

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Vulnerability – Extreme

- Always extreme with quarry

HEIGHT CONTOURS

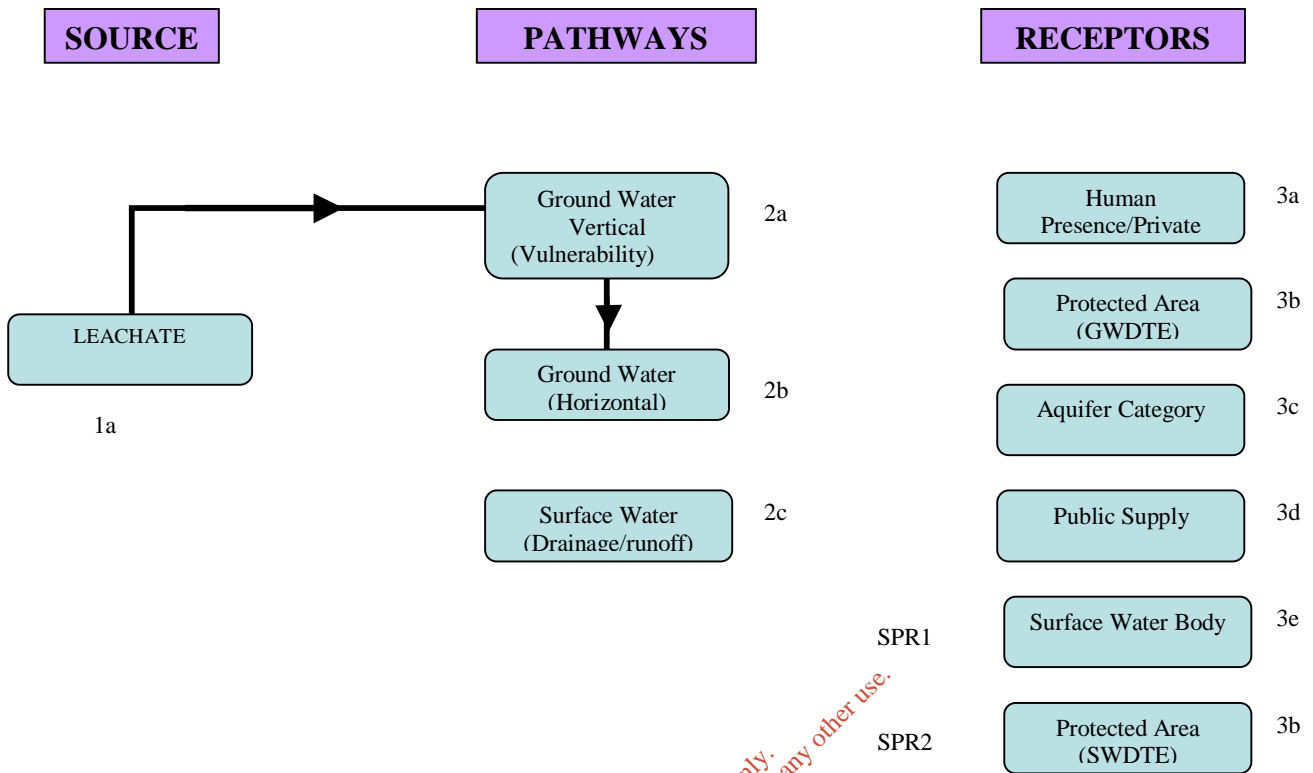


0  252m
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Site slopes in a South Westerly direction.

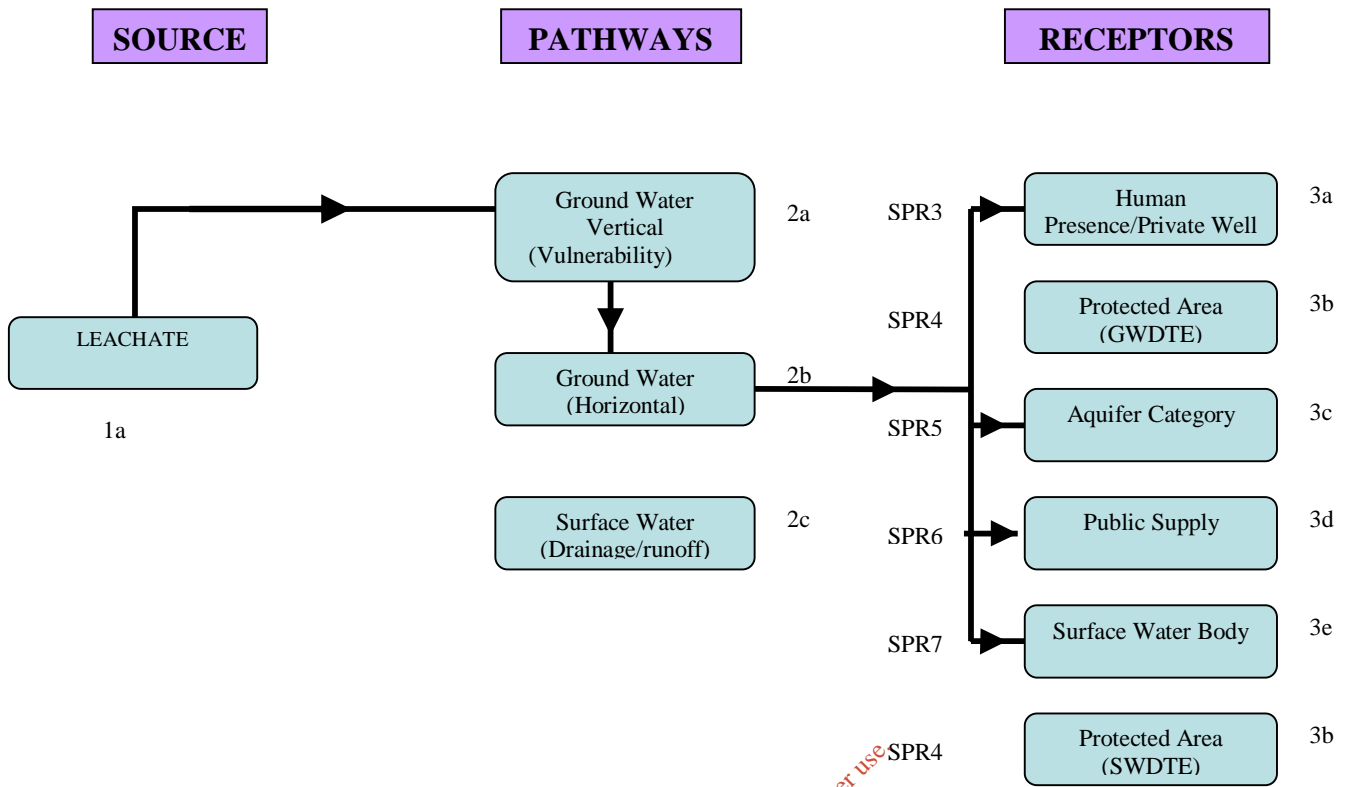
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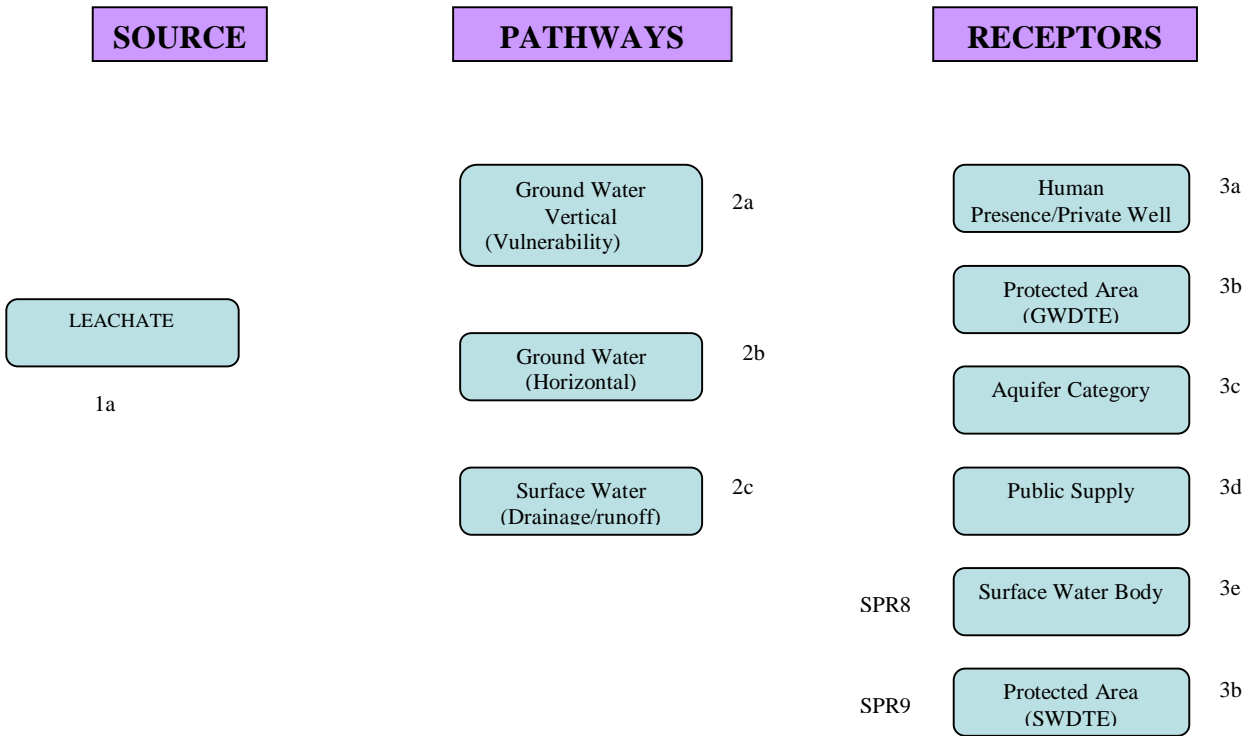


Network Diagram for Leachate Migration through combined groundwater and surface water pathways

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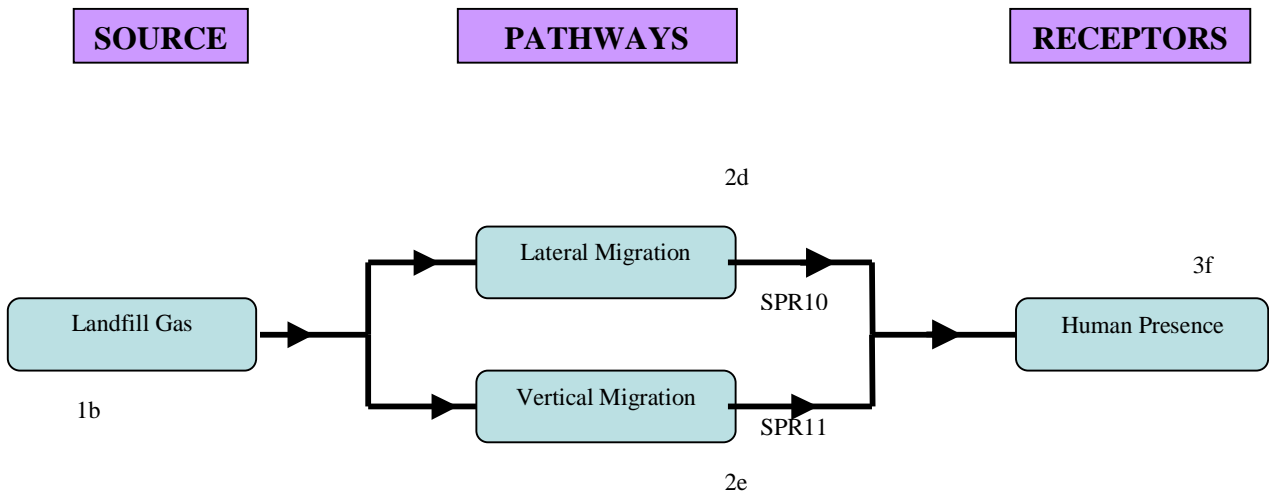


Network Diagram for Leachate Migration through groundwater pathways



Network Diagram for Leachate Migration through surface water pathways

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Network Diagram for Landfill Gas Migration (Lateral and Vertical)

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RISK SCORING MATRICES

Source

Table 1a: LEACHATE: SOURCE/HAZARD SCORING MATRIX

WASTE TYPE	WASTE FOOTPRINT (ha)		
	≤ 1 ha	> 1 ≤ 5 ha	> 5 ha
C&D ²⁰	0.5	1	1.5
Municipal ²¹	5	7	10
Industrial ²²	5	7	10
Pre 1977 sites ²³	1	2	3
		MAX	10

Table 1b: LANDFILL GAS: SOURCE/HAZARD SCORING MATRIX

WASTE TYPE	WASTE FOOTPRINT (ha)		
	≤ 1 ha	> 1 ≤ 5 ha	> 5 ha
C&D ²⁰	0.5	0.75	1
Municipal ²¹	5	7	10
Industrial ²²	3	5	7
Pre 1977 sites ²³	0.5	0.75	1
		MAX	10

Pathways

Table 2a: LEACHATE MIGRATION: PATHWAYS

Parameters	Points available
GROUNDWATER VULNERABILITY (Vertical pathway)	
Extreme Vulnerability	3
High Vulnerability	2
Moderate Vulnerability	1
Low Vulnerability	0.5
High – Low Vulnerability	2

Table 2b: LEACHATE MIGRATION: PATHWAYS

Parameters	Points available
GROUNDWATER FLOW REGIME (Horizontal pathway)	
Karstified Groundwater Bodies (Rk) ²⁵	5
Productive Fissured Bedrock Groundwater Bodies (Rf and Lm) ²⁵	3
Gravel Groundwater Bodies (Rg and Lg) ²⁵	2
Poorly Productive Bedrock Groundwater Bodies (LI, PI, Pu) ²⁵	1

- Rk Regionally Important Karstified Aquifers
- Rf Regionally Important Fissured Bedrock Aquifers
- Rg Regionally Important Extensive Sand/Gravel Aquifers
- LI Locally Important Sand/Gravel Aquifers
- Lm Locally Important Bedrock Aquifers - Generally Moderately Productive
- Lg Locally Important Bedrock Aquifers - Moderately Productive only in Local Zones
- PI Poor Bedrock Aquifers – Generally Unproductive except for Local Zones
- Pu Poor Bedrock Aquifers – Generally Unproductive

Tier 1 Risk Assessment – Historical Landfill, Gowran

Table 2c: LEACHATE MIGRATION: *PATHWAYS*

Parameters	Points available
SURFACE WATER DRAINAGE^{2b} (surface water pathway)	
Is there a direct connection between drainage ditches associated with the waste body and adjacent surface water body? Yes	2
If no direct connection	0

Table 2d: LANDFILL GAS: *PATHWAY* assuming receptor within 250m of source

Parameters	Points available
LANDFILL GAS LATERAL MIGRATION POTENTIAL	
Sand and Gravel, Made ground, urban, karst	3
Bedrock	2
All other Tills (including limestone, sandstone etc – moderate permeability)	1.5
All Namurian or Irish Sea Tills (low permeability)	1
Clay, Alluvium, Peat	1

Table 2e: LANDFILL GAS: *PATHWAY* assuming receptor located above source.

Parameters	Points available
LANDFILL GAS VERTICAL (UPWARDS) MIGRATION POTENTIAL	
Sand and Gravel, Made ground, urban, karst	5
Bedrock	3
All other Tills (including limestone, sandstone etc – moderate permeability)	2
All Namurian or Irish Sea Tills (low permeability)	1
Clay, Alluvium, Peat	1

Receptors

Table 3a: LEACHATE MIGRATION: *RECEPTORS*

Parameters	Points available
HUMAN PRESENCE (presence of a house indicates potential private wells)	
On or within 50m of the waste body	3
Greater than 50m but less than 250m of the waste body	2
Greater than 250m but less than 1km of the waste body	1
Greater than 1 km of the waste body	0

Table 3b: LEACHATE MIGRATION: *RECEPTORS*

Parameters	Points available
PROTECTED AREAS (SWDTE or GWDTE)	
Within 50m of the waste body	3
Greater than 50m but less than 250m of the waste body	2
Greater than 250m but less than 1km of waste body	1

Tier 1 Risk Assessment – Historical Landfill, Gowran

Greater than 1 km of the waste body	0
Undesignated sites ²⁷ within 50m of site of the waste body	1
Undesignated sites ²⁷ greater than 50m but less than 250m of the waste body	0.5
Undesignated sites ²⁷ greater than 250m of the waste body	0

Table 3c: LEACHATE MIGRATION: RECEPTORS

Parameters	Points available
AQUIFER CATEGORY²⁸ (resource potential)	
Regionally Important Aquifers (Rk, Rf, Rg)	5
Locally Important Aquifers (Ll, Lm, Lg)	3
Poor Aquifers (Pl, Pu)	1

- Rk Regionally Important Karstified Aquifers
 Rf Regionally Important Fissured Bedrock Aquifers
 Rg Regionally Important Extensive Sand/Gravel Aquifers
 Ll Locally Important Sand/Gravel Aquifers
 Lm Locally Important Bedrock Aquifers - Generally Moderately Productive
 Lg Locally Important Bedrock Aquifers - Moderately Productive only in Local Zones
 Pl Poor Bedrock Aquifers – Generally Unproductive except for Local Zones
 Pu Poor Bedrock Aquifers – Generally Unproductive

Table 3d: LEACHATE MIGRATION: RECEPTORS

PUBLIC WATER SUPPLIES (other than private wells)	
Within 100m of site boundary	7
Greater than 100m but less than 300m or within Inner SPA (SI) for GW supplies	5
Greater than 300m but less than 1km or within Outer SPA (SO) for GW supplies	3
Greater than 1km (karst aquifer)	3
Greater than 1km (no karst aquifer)	0

Table 3e: LEACHATE MIGRATION: RECEPTORS

Parameters	Points available
SURFACE WATER BODIES	
Within 50m of site boundary	3
Greater than 50m but less than 250m	2
Greater than 250m but less than 1km	1
Greater than 1km	0

Table 3f: LANDFILL GAS: RECEPTOR

Parameters	Points available
HUMAN PRESENCE	
On site or within 50m of site boundary	5
Greater than 50m but less than 150m	3
Greater than 150m but less than 250m	1
Greater than 250m	0.5

RISK SCREENING

SITE: Gowran

RISK: Medium Risk

TABLE		SCORE	RATIONALE
Source			
Leachate Hazard	1a	5	0.09 ha, municipal
Landfill Gas Hazard	1b	5	0.09 ha
Pathways			
Leachate Migration – Ground Water Vulnerability	2a	3	Extreme Vulnerability
Leachate Migration – Ground Water Flow Regime	2b	5	Regionally Important Karstified GW body
Leachate Migration – Surface Water Drainage	2c	0	No direct connection
Landfill Gas – Lateral Migration	2d	3	Karst
Landfill Gas – Vertical Migration	2e	5	Assuming receptor above.
Receptors			
Leachate Migration – Human Presence	3a	2	Well at 150m.
Leachate Migration – Protected Areas	3b	0	None in vicinity of site
Leachate Migration – Aquifer Category	3c	5	Regionally important Aquifer
Leachate Migration – Public Water Supplies	3d	3	Greater than 1km – karst aquifer
Leachate Migration – Surface Water Bodies	3e	1	River 524m from site
Landfill Gas – Human Presence	3f	5	House 17m from site

SPR LINKAGE SCORE			MAX LINKAGE SCORE	NORMALISED SCORE
SPR 1	1a X (2a + 2b + 2c) X 3e 5(3+5+0)1	40	300	13.3%
SPR 2	1a X (2a + 2b + 2c) X 3b (SWDTE) 5(3+5+0)0	0	300	0%
SPR 3	1a X (2a + 2b) X 3a 5(3+5)2	80	240	33.3%
SPR 4	1a X (2a + 2b) X 3b 5(3+5)0	0	240	0%
SPR 5	1a X (2a + 2b) X 3c 5(3+5)5	200	400	50%
SPR 6	1a X (2a + 2b) X 3d 5(3+5)3	120	560	21.4%
SPR 7	1a X (2a + 2b) X 3e 5(3+5)1	40	240	16.67%
SPR 8	1a X 2c X 3e 5(0)1	0	60	0%
SPR 9	1a X 2c X 3b (SWDTE) 5(0)0	0	60	0%
SPR 10	1b X 2d X 3f 5(3)5	70	150	50%
SPR 11	1b X 2e X 3f 5(5)5	125	250	50%

This site scored a maximum linkage score of 50%. This classifies the site as Class B Medium Risk.

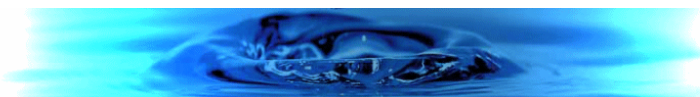
This is due to the size and importance of the underlying aquifer, which is karstified and regionally important.

The presence of the house at 17m poses a medium risk due to lateral migration of landfill gas.

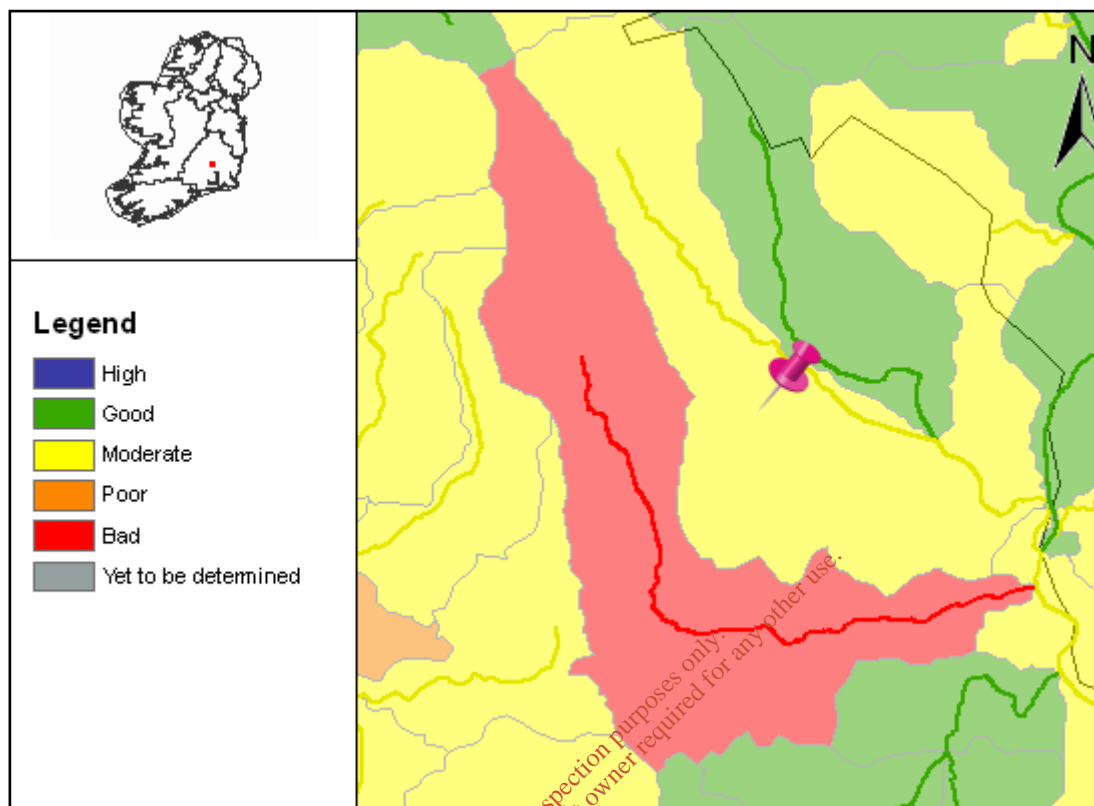
APPENDIX 2

Surface Water Body Report

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Full Report for Waterbody Gowran, Trib of Barrow



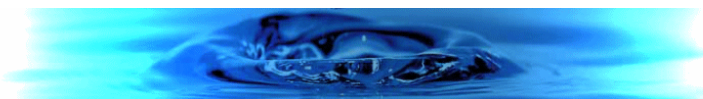
River Basin Management Plans (RBMPs) have been published for all River Basin Districts in Ireland in accordance with the requirements of the Water Framework Directive. The WaterMaps viewer is an integral part of the River Basin Management Plan and provides access to information at individual waterbody level and at Water Management Unit level for all the River Basin Districts in Ireland.

The following report provides summary plan information about the selected waterbody (indicated by the pin in the map above) relating to its status, risks, objectives, and measures proposed to retain status where this is adequate, or improve it where necessary. Waterbodies can relate to surface waters (these include rivers, lakes, estuaries [transitional waters], and coastal waters), or to groundwaters. Other relevant information not included in this report can be viewed using the WaterMaps viewer, including areas listed in the Register of Protected Areas.

You will find brief notes at the bottom of some of the individual report sheets that will help you in interpreting the information presented. More detailed information can be obtained in relation to all aspects of the RBMPs at www.wfdireland.ie.

Date Reported to Europe: July 2010

Date Report Created 08/12/2017



Summary Information:

Water Management Unit: IE_SE_BarrowMain
WaterBody Category: River Waterbody
WaterBody Name: Gowran, Trib of Barrow
WaterBody Code: IE_SE_14_1879
Overall Status: Bad
Overall Objective: Restore_2021
Overall Risk: 1a At Risk
Heavily Modified: No



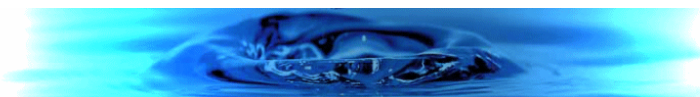
Report data based upon final RBMP, 2009-2015.

The information provided above is a summary of the principal findings related to the selected waterbody. Further details and explanation of individual elements of the report are outlined in the following pages.

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Date Reported to Europe: July 2010

Date Report Created 08/12/2017



Status Report	
Water Management Unit:	IE_SE_BarrowMain
WaterBody Category:	River Waterbody
WaterBody Name:	Gowran, Trib of Barrow
WaterBody Code:	IE_SE_14_1879
Overall Status Result:	Bad
Heavily Modified:	No



Status Element Description		Result
Status information		
Q	Macroinvertebrate status	Bad
PC	General physico-chemical status	Good
FPQ	Freshwater Pearl Mussel / Macroinvertebrate status	N/A
DIA	Diatoms status	N/A
HYM	Hydromorphology status	N/A
FIS	Fish status	N/A
SP	Specific Pollutants status (SP)	N/A
ES	Overall ecological status	Bad
CS	Overall chemical status (PAS)	n/a
EXT	Extrapolated status	N/A
MON	Monitored water body	YES
DON	Donor water bodies	N/A

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n/a - not assessed

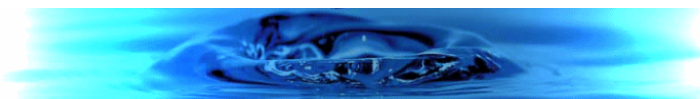
Status

By 'Status' we mean the condition of the water in the waterbody. It is defined by its chemical status and its ecological status, whichever is worse. Waters are ranked in one of 5 status classes: High, Good, Moderate, Poor, Bad. However, not all waterbodies have been monitored, and in such cases the status of a similar nearby waterbody has been used (extrapolated) to assign status. If this has been done the first line of the status report shows the code of the waterbody used to extrapolate.

You can read more about status and how it is measured in our RBMP Document Library at www.wfdireland.ie (Directory 15 Status).

Date Reported to Europe: July 2010

Date Report Created 08/12/2017



Risk Report

Water Management Unit: IE_SE_BarrowMain

WaterBody Category: River Waterbody

WaterBody Name: Gowran, Trib of Barrow

WaterBody Code: IE_SE_14_1879

Overall Risk Result: **1a** At Risk

Heavily Modified: No

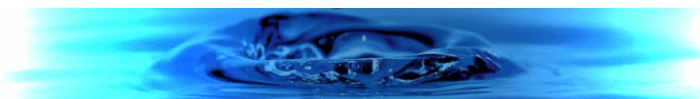


Risk Test Description		Risk	
Diffuse Risk Sources			
RD1	EPA diffuse model (2008)	1a	At Risk
RD2a	Road Wash - Soluble Copper	2b	Not At Risk
RD2b	Road Wash - Total Zinc	2b	Not At Risk
RD2c	Road Wash - Total Hydrocarbons	2b	Not At Risk
RD3	Railways	2b	Not At Risk
RD4a	Forestry - Acidification (2008)	2b	Not At Risk
RD4b	Forestry - Suspended Solids (2008)	2b	Not At Risk
RD4c	Forestry - Eutrophication (2008)	2a	Probably Not At Risk
RD5	Overall Unsewered (2008)	2b	Not At Risk
RD5a	Unsewered Areas - Pathogens (2008)	2a	Probably Not At Risk
RD5b	Unsewered Phosphorus (2008)	2b	Not At Risk
RD6a	Arable	2a	Probably Not At Risk
RD6b	Sheep Dip	2b	Not At Risk
RD6c	Forestry - Dangerous Substances	2b	Not At Risk
RDO	Diffuse Overall -Worst Case (2008)	1a	At Risk
Hydrology			
RHY1	Water balance - Abstraction	2b	Not At Risk
Morphological Risk Sources			
RM1	Channelisation (2008)	2b	Not At Risk
RM2	Embankments (2008)	2b	Not At Risk
RM3	Impoundments	2b	Not At Risk
RM4	Water Regulation	2b	Not At Risk
RM5	Intensive Landuse		N/A
RMO	Morphology Overall - Worst Case (2008)	2b	Not At Risk
Overall Risk			
RA	Rivers Overall - Worst Case (2008)	1a	At Risk

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Date Report Created 08/12/2017



Point Risk Sources		
RP1	WWTPs (2008)	1a At Risk
RP2	CSOs	2b Not At Risk
RP3	IPPCs (2008)	2b Not At Risk
RP4	Section 4s (2008)	2b Not At Risk
RP5	WTPs/Mines/Quarries/Landfills	N/A
RPO	Overall Risk from Point Sources - Worst Case (2008)	1a At Risk
Q Value		
Q	EPA Q rating and Margaritifera Assessment	N/A
Q/RDI or Point/Diffuse		
QPD	Q class/EPA Diffuse Model or worst case of Point and Diffuse (2008)	1a At Risk
Rivers Direct Impacts		
RDI1	Rivers Direct Impacts - Dangerous Substances	N/A

Risk

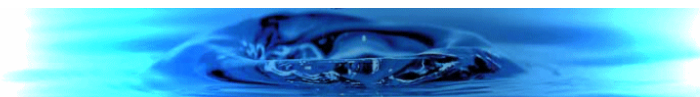
By 'risk' we mean the risk that a waterbody will not achieve good ecological or good chemical status/potential at least by 2015. To examine risk the various pressures acting on the waterbody were identified along with any evidence of impact on water status. Depending on the extent of the pressure and its potential for impact, and the amount of information available, the risk to the water body was placed in one of four categories: 1a at risk; 1b probably at risk; 2a probably not at risk; 2b not at risk. Note that '2008' after the risk category means that the risk assessment was revised in 2008. All other risks were determined as part of an earlier risk assessment in 2005.

You can read more about risk assessment in our 'WFD Risk Assessment Update' document in the RBMP document library, and other documents at www.wfdireland.ie (Directory 31 Risk Assessments).

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Date Reported to Europe: July 2010

Date Report Created 08/12/2017



Objectives Report

Water Management Unit: IE_SE_BarrowMain

WaterBody Category: River Waterbody

WaterBody Name: Gowran, Trib of Barrow

WaterBody Code: IE_SE_14_1879

Overall Objective: Restore_2021

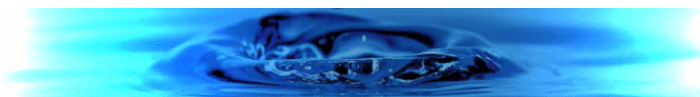
Heavily Modified: No



Objectives Description		Result
Extended timescale information		
E1	Extended timescales due to time requirements to upgrade WWTP discharges	No Status
E2	Extended timescales due to delayed recovery of chemical pollution and chemical status failures	No Status
E3	Extended timescales due to delayed recovery following reduction in agricultural nutrient losses	No Status
E4	Extended timescales due to delayed recovery from physical modifications and physical damage	No Status
E5	Extended timescales due to delayed recovery following implementing forestry acidification measures	No Status
E6	Extended timescales due to physical recovery timescales at mines and contaminated sites	No Status
E7	Extended timescales due to delayed recovery of highly impacted sites	No Status
E8	Extended timescales due to delayed recovery following reduction in agricultural nutrient losses	2021
E9	Extended timescales due to delayed recovery from nitrogen losses to estuaries	2021
E10	Extended timescales due to delayed recovery following reduction in agricultural nutrient losses	2021
E11	Extended timescales due to delayed recovery from physical modifications and physical damage (overgrazing)	No Status
E12	Extended timescales due to delayed recovery from physical modifications and physical damage (channelisation)	No Status
E13	Extended timescales from Northern Ireland Environment Agency	No Status
EOV	Overall extended timescale - combination of all extended timescales fields	2021
E14	Extended timescales due to the presence of Freshwater Pearl Mussel populations	No Status
EX15	Extended timescales due to highly impacted sites	No Status

Date Reported to Europe: July 2010

Date Report Created 08/12/2017



Objectives information		
OB1	Prevent deterioration objective	No Status
OB2	Restore at least good status objective	No Status
OB3	Reduce chemical pollution objective	No Status
OB4	Protected areas objective	Restore_2021
OB5	Northern Ireland Environment Agency objective	No Status
OBO	Overall objectives	Restore_2021

Extended timescales

Extended timescales have been set for certain waters due to technical, economic, environmental or recovery constraints. Extended timescales are usually of one planning cycle (6 years, to 2021) but in some cases are two planning cycles (to 2027).

Objectives

In general, we are required to ensure that our waters achieve at least good status/potential by 2015, and that their status does not deteriorate. Having identified the status of waters (this is given earlier in this report), the next stage is to set objectives for waters. Objectives consider waters that require protection from deterioration as well as waters that require restoration and the timescales needed for recovery. Four default objectives have been set initially:-

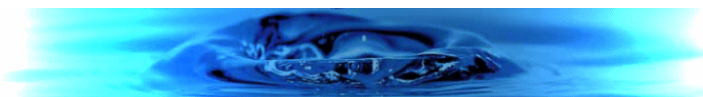
- Prevent Deterioration*
- Restore Good Status*
- Reduce Chemical Pollution*
- Achieve Protected Areas Objectives*

These objectives have been refined based on the measures available to achieve them, the latter's likely effectiveness, and consideration of cost-effective combinations of measures. Where it is considered necessary extended deadlines have been set for achieving objectives in 2021 or 2027.

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Date Reported to Europe: July 2010

Date Report Created 08/12/2017



Measures Report

Water Management Unit: IE_SE_BarrowMain

WaterBody Category: River Waterbody

WaterBody Name: Gowran, Trib of Barrow

WaterBody Code: IE_SE_14_1879

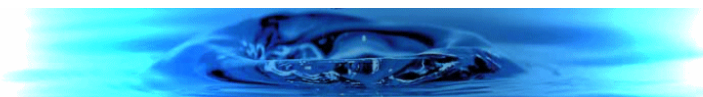
Heavily Modified: No



	Measures Description	Applicable
BC	Total number of basic measures which apply to this waterbody	22
BW	Directive - Bathing Waters Directive	No
BIR	Directive - Birds Directive	No
HAB	Directive - Habitats Directive	No
DW	Directive - Drinking Waters Directive	No
MAE	Directive - Major Accidents and Emergencies Directive	Yes
EIA	Directive - Environmental Impact Assessment Directive	Yes
SS	Directive - Sewage Sludge Directive	Yes
UWT	Directive - Urban Waste Water Treatment Directive	Yes
PPP	Directive - Plant Protection Products Directive	Yes
NIT	Directive - Nitrates Directive	Yes
IPC	Directive - Integrated Pollution Prevention Control Directive	Yes
CR	Other Stipulated Measure - Cost recovery for water use	Yes
SUS	Other Stipulated Measure - Promotion of efficient and sustainable water use	Yes
DWS	Other Stipulated Measure - Protection of drinking water sources	Yes
ABS	Other Stipulated Measure - Control of abstraction and impoundment	Yes
POI	Other Stipulated Measure - Control of point source discharges	Yes
DIF	Other Stipulated Measure - Control of diffuse source discharges	Yes
PS	Other Stipulated Measure - Control of priority substances	Yes
MOD	Other Stipulated Measure - Controls on physical modifications to surface waters	Yes
OA	Other Stipulated Measure - Controls on other activities impacting on water status	Yes
AP	Other Stipulated Measure - Prevention or reduction of the impact of accidental pollution incidents	Yes
TP1	WSIP - Agglomerations with treatment plants requiring capital works	Yes
TP2	WSIP - Agglomerations with treatment plants requiring further investigation prior to capital works	No
TP3	WSIP - Agglomerations requiring the implementation of actions identified in Shellfish PRPs	No
TP4	WSIP - Agglomerations with treatment plants requiring improved operational performance	No
TP5	WSIP - Agglomerations requiring investigation of CSOs	No

Date Reported to Europe: July 2010

Date Report Created 08/12/2017



TP6	WSIP - Agglomerations where existing treatment capacity is currently adequate but predicted loadings would result in overloading	Yes
OTS	On-site waste water treatment systems	Yes
FPM	Freshwater Pearl Mussel sub-basin plan	No
SHE	Shellfish Pollution Reduction Plan	No
IPR	IPPC licences requiring review	No
WPR	Water Pollution Act licences requiring review	Yes
FOR	Forestry guidelines and regulations	Yes
CH1	Chanelisation measures	No
CH2	Chanelisation investigations	No
OG	Overgrazing measures	No
HQW	Protect high quality waters	No

Measures

Measures are necessary to ensure that we meet the objectives set out in the previous page of this report. Many measures are already provided for in national legislation and must be implemented. Other measures have been recently introduced or are under preparation. A range of additional potential measures are also being considered but require further development. Any agreed additional measures can be introduced through the update of Water Management Unit Action Plans during the implementation process.

You can read more about Basic Measures in 'River Basin Planning Guidance' and in other documents in our RBMP Document Library at www.wfdireland.ie.

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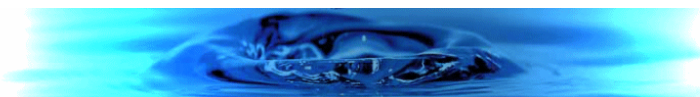
Date Reported to Europe: July 2010

Date Report Created 08/12/2017

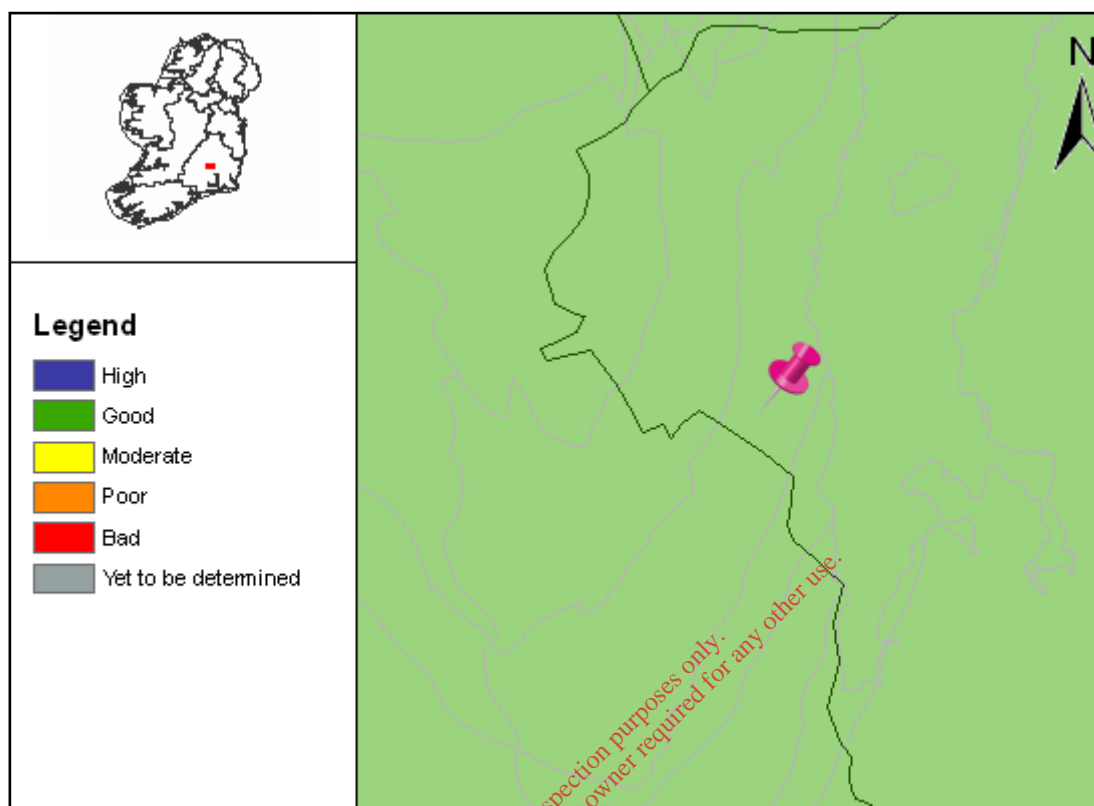
APPENDIX 3

Ground Water Body Report

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Full Report for Waterbody Bagenalstown_3



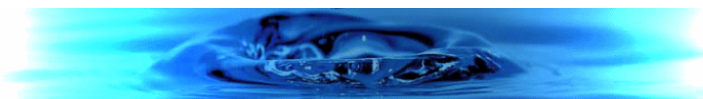
River Basin Management Plans (RBMPs) have been published for all River Basin Districts in Ireland in accordance with the requirements of the Water Framework Directive. The WaterMaps viewer is an integral part of the River Basin Management Plan and provides access to information at individual waterbody level and at Water Management Unit level for all the River Basin Districts in Ireland.

The following report provides summary plan information about the selected waterbody (indicated by the pin in the map above) relating to its status, risks, objectives, and measures proposed to retain status where this is adequate, or improve it where necessary. Waterbodies can relate to surface waters (these include rivers, lakes, estuaries [transitional waters], and coastal waters), or to groundwaters. Other relevant information not included in this report can be viewed using the WaterMaps viewer, including areas listed in the Register of Protected Areas.

You will find brief notes at the bottom of some of the individual report sheets that will help you in interpreting the information presented. More detailed information can be obtained in relation to all aspects of the RBMPs at www.wfdireland.ie.

Date Reported to Europe: July 2010

Date Report Created 08/12/2017



Summary Information:

Water Management Unit: N/A
WaterBody Category: Groundwater Waterbody
WaterBody Name: Bagenalstown_3
WaterBody Code: IE_SE_G_004
Overall Status: Good
Overall Objective: Protect
Overall Risk: 1a At Risk
Heavily Modified: No



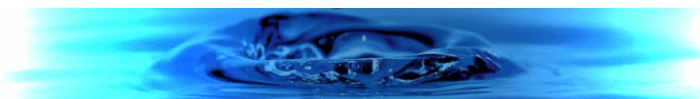
Report data based upon final RBMP, 2009-2015.

The information provided above is a summary of the principal findings related to the selected waterbody. Further details and explanation of individual elements of the report are outlined in the following pages.

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Date Report Created 08/12/2017



Chemical and Quantitative Status Report

Water Management Unit: N/A
WaterBody Category: Groundwater Waterbody
WaterBody Name: Bagenalstown_3
WaterBody Code: IE_SE_G_004
Overall Status Result: Good
Heavily Modified: No



	Status Element Description	Result
Status information		
INS	Status associated with saline intrusion into groundwater	GS-HC
DWS	Status associated with exceedances of water quality above specific standards	GS-LC
DS	Chemical status of groundwater due to pressure from diffuse sources of pollution	GS-LC
CLS	Chemical status of groundwater due to pressure from contaminated soil or land.	GS-HC
MS	Chemical status of groundwater due to pressure from mine sites (active or closed).	GS-HC
UAS	Chemical status of groundwater due to pressures from urban areas	GS-HC
GWS	General groundwater quality status	GS-LC
RPS	Status associated with MRP loading to rivers	GS-LC
TNS	Status associated with nitrate loading to transitional and coastal waters	GS-LC
SWS	Overall status associated with nutrient loadings to rivers and transitional and coastal waters	GS-LC
SQS	Status associated with dependant surface water quantitative status	GS-HC
GDS	Groundwater dependant terrestrial ecosystems status	GS-HC
QSO	Quantitative status overall	GS-HC
CSO	Chemical status overall	GS-LC
OS	Overall status	Good

GS -HC : Good status High Confidence
 GS- LC : Good status Low Confidence
 n/a - not assessed

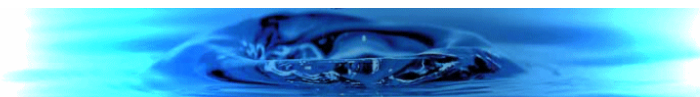
Status

By 'Status' we mean the condition of the water in the waterbody. It is defined by its chemical status and quantitative status, whichever is worse. Groundwaters are ranked in one of 2 status classes: Good or Poor.

You can read more about status and how it is measured in our RBMP Document Library at www.wfdireland.ie (Directory 15 Status).

Date Reported to Europe: July 2010

Date Report Created 08/12/2017



Risk Report

Water Management Unit: N/A
WaterBody Category: Groundwater Waterbody
WaterBody Name: Bagenalstown_3
WaterBody Code: IE_SE_G_004
Overall Risk Result: 1a At Risk
Heavily Modified: No

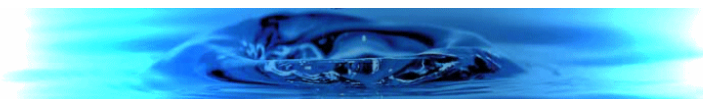


	Risk Test Description	Risk
	Groundwater Dependent Terrestrial Ecosystems	
TE	GWDTE Risk	N/A
	Groundwater Quality	
DIF	Diffuse Elements (General) Risk	N/A
DW	Drinking Waters Risk	N/A
INT	Intrusions Risk	N/A
WB	Water Balance Risk	N/A
	Groundwater Quality (General)	
GQ	General Groundwater Quality Risk	N/A
	Groundwater Quality (Point Risk)	
CL	Contaminated Land Risk	N/A
LF	Landfill Risk	N/A
MI	Mine Risk	N/A
QY	Quarry Risk	N/A
UR	Urban Risk	N/A
UW	UWWT Risk	N/A
	GW Diffuse Risk Sources	
WB3	Mobile Nutrients (NO3)	N/A
WB4	Mobile Chemicals	N/A
WB5	Clustered OSWTSs and leaking urban sewerage systems	N/A
	GW Hydrology	
WB1	Water balance - Abstraction	N/A
WB2	Abstraction - Intrusion	N/A

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GW Point Risk Sources		
WB10	Risk from Point sources of pollution - Contaminated Land	N/A
WB11	Risk from Point sources of pollution - Trade Effluent Discharges	N/A
WB12	Risk from Point sources of pollution - Urban Wastewater Discharges	N/A
WB6	Risk from Point sources of pollution - Mines	N/A
WB7	Risk from Point sources of pollution - Quarries	N/A
WB8	Risk from Point sources of pollution - Landfills	N/A
WB9	Risk from Point sources of pollution - Oil Industry Infrastructure	N/A
Overall Risk		
RA	Groundwater Overall - Worst Case	N/A
Risk information		
CLR	Contaminated land risk	2b Not At Risk
DR	Risk of groundwater due to pressure from diffuse sources of pollution	1a At Risk
DWR	Risk associated with exceedances of water quality above specific standards	1a At Risk
GDR	Groundwater dependant terrestrial ecosystems risk	2b Not At Risk
GWR	General groundwater quality risk	1a At Risk
INR	Risk associated with saline intrusion into groundwater	2b Not At Risk
LR	Risk due to landfills sites/old closed dump sites	2b Not At Risk
MR	Mines risk	2b Not At Risk
NULL	Diffuse nitrates from agriculture risk	N/A
QR	Risk due to quarries	2b Not At Risk
RA	Revised risk assessment	1a At Risk
RPR	Risk associated with MRP loading to rivers	1b Probably At Risk
SQR	Risk associated with dependant surface water quantitative status	2b Not At Risk
SWR	Overall risk associated with nutrient loadings to rivers and transitional and coastal waters	1a At Risk
TNR	Risk associated with nitrate loading to transitional and coastal waters	1a At Risk
UAR	Risk of groundwater due to pressures from urban areas	2b Not At Risk
UWR	Risk due to direct discharges of urban wastewater	2b Not At Risk

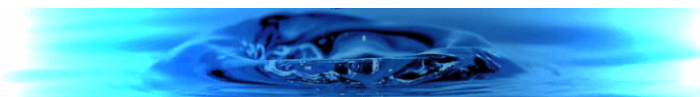
Risk

By 'risk' we mean the risk that a waterbody will not achieve good ecological or good chemical status/potential at least by 2015. To examine risk the various pressures acting on the waterbody were identified along with any evidence of impact on water status. Depending on the extent of the pressure and its potential for impact, and the amount of information available, the risk to the water body was placed in one of four categories: 1a at risk; 1b probably at risk; 2a probably not at risk; 2b not at risk. Note that '2008' after the risk category means that the risk assessment was revised in 2008. All other risks were determined as part of an earlier risk assessment in 2005.

You can read more about risk assessment in our 'WFD Risk Assessment Update' document in the RBMP document library, and other documents at www.wfdireland.ie (Directory 31 Risk Assessments).

Date Reported to Europe: July 2010

Date Report Created 08/12/2017



Objectives Report

Water Management Unit: N/A
WaterBody Category: Groundwater Waterbody
WaterBody Name: Bagenalstown_3
WaterBody Code: IE_SE_G_004
Overall Objective: Protect
Heavily Modified: No



Objectives Description		Result
Extended timescale information		
E1	Extended deadlines due to agricultural P	No Status
E2	Extended deadlines due to agricultural N	No Status
E3	Extended deadlines due to mines	No Status
E4	Extended deadlines due to urban areas	No Status
E5	Extended deadlines due to contaminated lands	No Status
E0	Extended deadlines - overall	No Status
Objectives information		
OB1	Prevent deterioration objective	Protect
OB2	Restore at least good status objective	No Status
OB3	Reduce chemical pollution objective	No Status
OB4	Protected areas objective	No Status
OBO	Overall objectives - objective	Protect

Extended timescales

Extended timescales have been set for certain waters due to technical, economic, environmental or recovery constraints. Extended timescales are usually of one planning cycle (6 years, to 2021) but in some cases are two planning cycles (to 2027).

Objectives

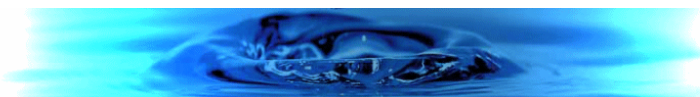
In general, we are required to ensure that our waters achieve at least good status/potential by 2015, and that their status does not deteriorate. Having identified the status of waters (this is given earlier in this report), the next stage is to set objectives for waters. Objectives consider waters that require protection from deterioration as well as waters that require restoration and the timescales needed for recovery. Four default objectives have been set initially:-

- Prevent Deterioration*
- Restore Good Status*
- Reduce Chemical Pollution*
- Achieve Protected Areas Objectives*

These objectives have been refined based on the measures available to achieve them, the latter's likely effectiveness, and consideration of cost-effective combinations of measures. Where it is considered necessary extended deadlines have been set for achieving objectives in 2021 or 2027.

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Date Report Created 08/12/2017



Measures Report

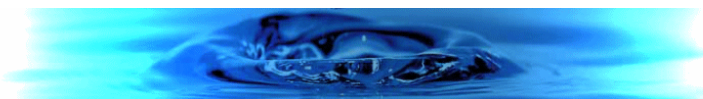
Water Management Unit: N/A
WaterBody Category: Groundwater Waterbody
WaterBody Name: Bagenalstown_3
WaterBody Code: IE_SE_G_004
Heavily Modified: No



	Measures Description	Applicable
BC	Total number of basic measures which apply to this waterbody	24
BW	Directive - Bathing Waters Directive	No
BIR	Directive - Birds Directive	No
HAB	Directive - Habitats Directive	Yes
DW	Directive - Drinking Waters Directive	Yes
MAE	Directive - Major Accidents and Emergencies Directive	Yes
EIA	Directive - Environmental Impact Assessment Directive	Yes
SS	Directive - Sewage Sludge Directive	Yes
UWT	Directive - Urban Waste Water Treatment Directive	Yes
PPP	Directive - Plant Protection Products Directive	Yes
NIT	Directive - Nitrates Directive	Yes
IPC	Directive - Integrated Pollution Prevention Control Directive	Yes
CR	Other Stipulated Measure - Cost recovery for water use	Yes
SUS	Other Stipulated Measure - Promotion of efficient and sustainable water use	Yes
DWS	Other Stipulated Measure - Protection of drinking water sources	Yes
ABS	Other Stipulated Measure - Control of abstraction and impoundment	Yes
POI	Other Stipulated Measure - Control of point source discharges	Yes
DIF	Other Stipulated Measure - Control of diffuse source discharges	Yes
GW	Other Stipulated Measure - Authorisation of discharges to groundwaters	Yes
PS	Other Stipulated Measure - Control of priority substances	Yes
MOD	Other Stipulated Measure - Controls on physical modifications to surface waters	Yes
OA	Other Stipulated Measure - Controls on other activities impacting on water status	Yes
AP	Other Stipulated Measure - Prevention or reduction of the impact of accidental pollution incidents	Yes
OTS	On-site waste water treatment systems	Yes
FPM	Freshwater Pearl Mussel sub-basin plan	No
SHE	Shellfish Pollution Reduction Plan	No
IPR	IPPC licences requiring review	Yes
WPR	Water Pollution Act licences requiring review	No
FOR	Forestry guidelines and regulations	Yes

Date Reported to Europe: July 2010

Date Report Created 08/12/2017



HQW	Protect high quality waters	Yes
-----	-----------------------------	-----

Measures

Measures are necessary to ensure that we meet the objectives set out in the previous page of this report. Many measures are already provided for in national legislation and must be implemented. Other measures have been recently introduced or are under preparation. A range of additional potential measures are also being considered but require further development. Any agreed additional measures can be introduced through the update of Water Management Unit Action Plans during the implementation process.

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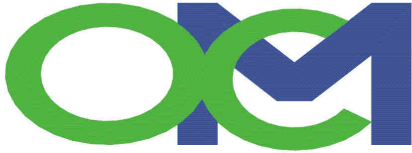
Date Reported to Europe: July 2010

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APPENDIX 4

2017 Borehole Logs

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O'Callaghan Moran & Associates
Phone: 021 4345366

Borehole I.D. BH-1A

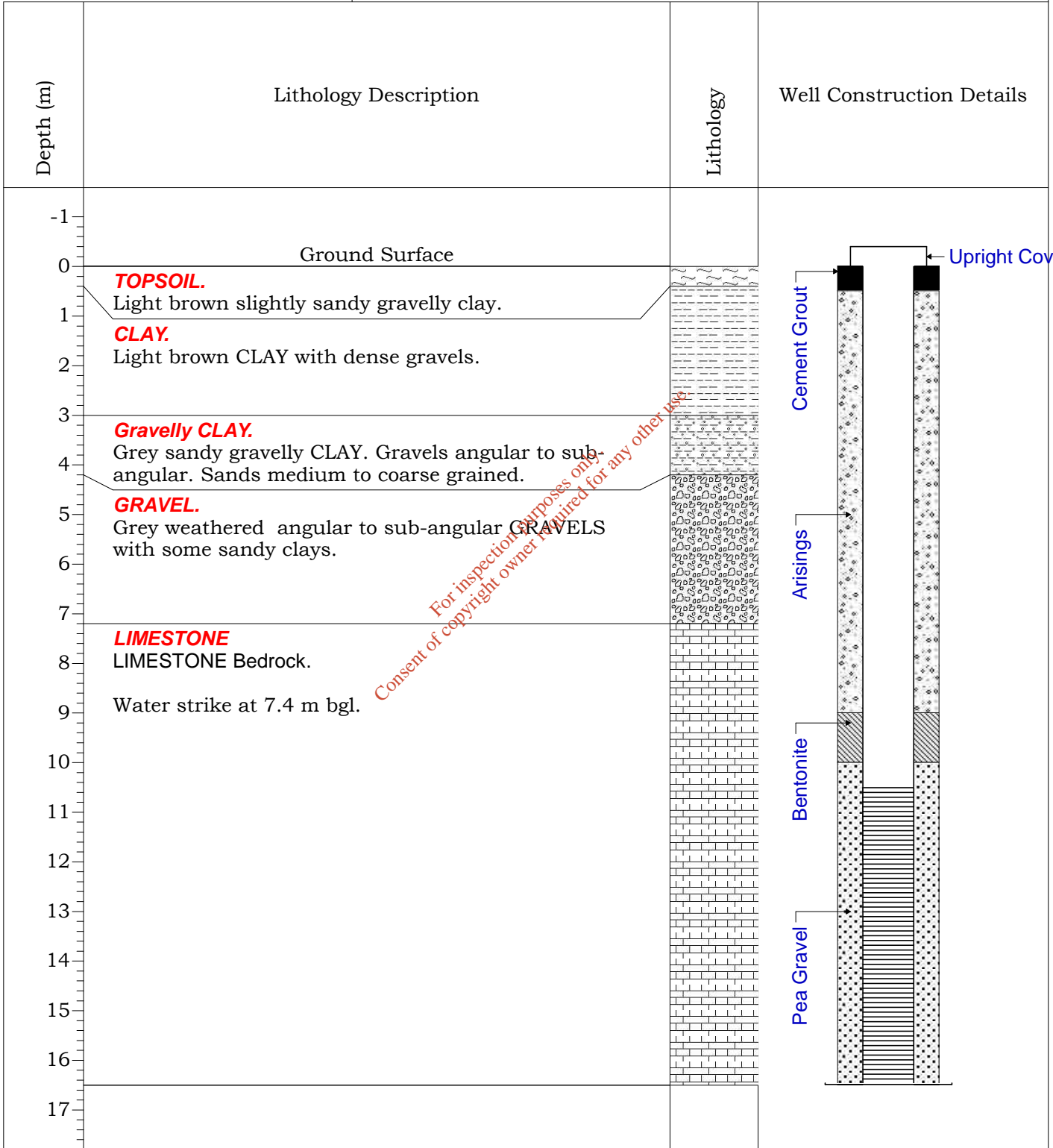
Project: Tier 3 Investigation

Client: Kilkenny County Council

Borehole Depth: 16.5

Location: Gowran

Borehole Type: Monitoring Well



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Drilling Contractor: Ground Investigation Ireland

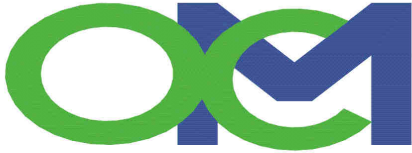
Hole Size: 100mm

Drill Method: Air Rotary

Geologist: Conor McGrath

Drill Date: 15/11/17

Sheet: 1 of 1



O'Callaghan Moran & Associates
Phone: 021 4345366

Borehole I.D. BH-3

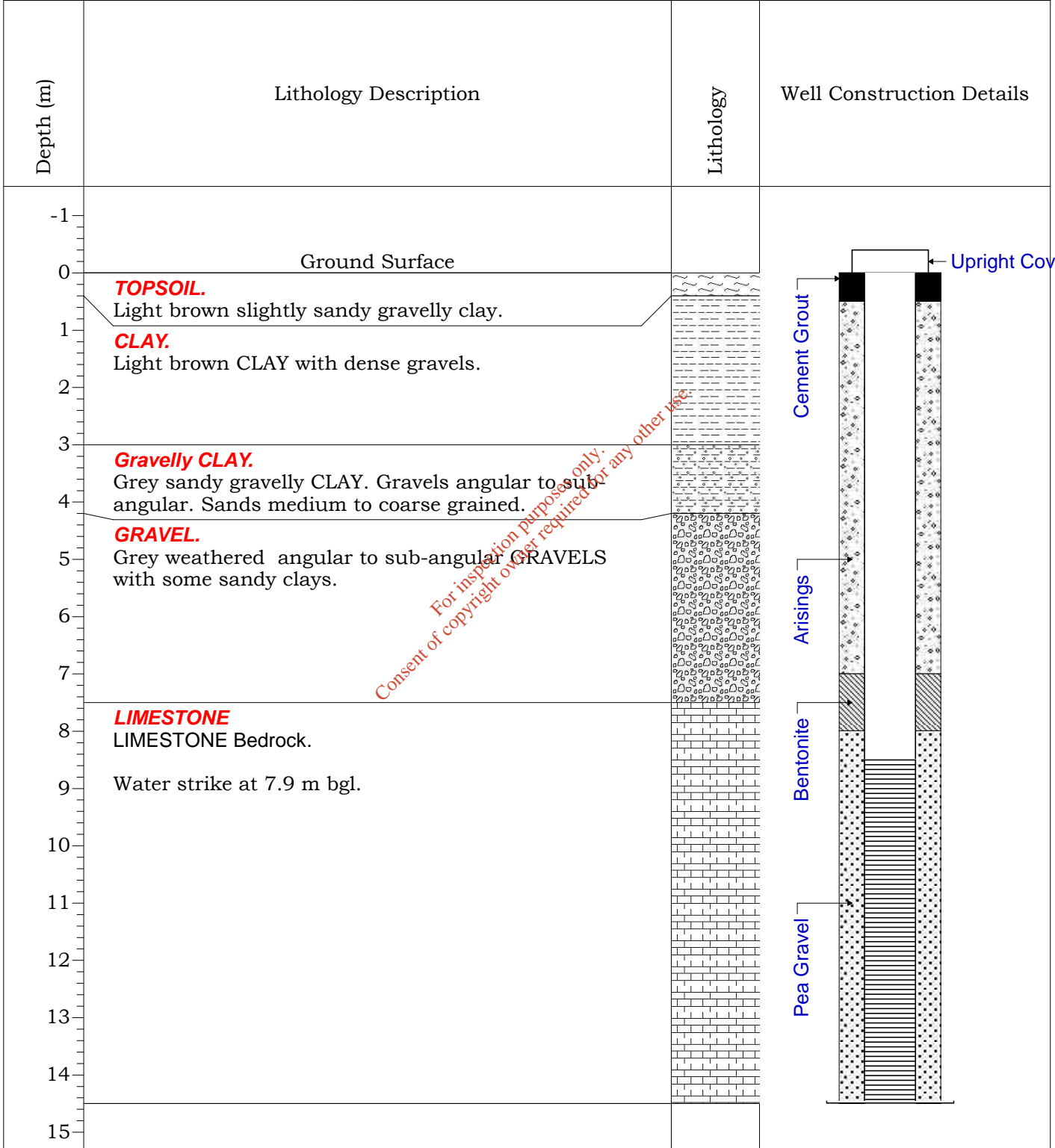
Project: Tier 3 Investigation

Client: Kilkenny County Council

Borehole Depth: 14.5

Location: Gowran

Borehole Type: Monitoring Well



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Drilling Contractor: Ground Investigation Ireland

Hole Size: 100mm

Drill Method: Air Rotary

Geologist: Conor McGrath

Drill Date: 15/11/17

Sheet: 1 of 1

APPENDIX 5

OCM Sampling Protocols

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STANDARD OPERATING PROCEDURE

GROUNDWATER SAMPLING

The primary objective of groundwater sampling is to evaluate whether the potential contaminant sources at a site have impacted the quality of the groundwater in the underlying aquifer. The additional objective is to measure hydraulic gradient, or slope, of the water table in the shallow aquifer in an effort to evaluate the direction of groundwater flow.

The purpose of this procedure is to ensure that representative samples of groundwater are collected and documented using consistent methods to ensure sample integrity.

1.0 SAMPLING PROCEDURES

1.1 Well Operating and Purging Procedures

All groundwater sampling will be conducted after the installed and developed wells have been allowed to equilibrate for at least 2 to 3 days. A Field Data Sheet for Well Sampling will be completed for each well.

Groundwater sampling teams will use the following procedure for approaching, opening, purging and sampling all wells unless directed otherwise by the workplan.

- 1) Prior to placing any equipment into the well, decontaminate the sampling equipment according to standard decontamination protocol.
- 2) Approach the well with a working FID/PID, a well key, and a depth-to-water meter.
- 3) Unlock and open the well cap just enough to insert the probe of the OVA or HNu. Take and record a reading. A decision to upgrade PPE may be necessary based on the FID/PID readings in the breathing zone.
- 4) Where practical, the surface water column will be visually examined for the presence of hydrocarbons, if present or suspected, the thickness of the hydrocarbon layer will be measured using an oil/water interface probe prior to taking the depth-to-water measurement.
- 5) Insert the water level probe into the well and measure and record the static water level to the nearest 0.01 m with respect to the established survey point on top of the well casing.

- 6) Decontaminate the water level probe with DDI water (Do not rinse with any solvents unless product was encountered).
- 7) Calculate and record the minimum volume of water to be purged according to the following conversion factors: -

1 well volume	=	water column in metres x litres/linear metre
2 inch casing	=	2.0 LPM
4 inch casing	=	8.1 LPM
6 inch casing	=	18.2 LPM
8 inch casing	=	32.4 LPM

- 8) Purge the well of at least 3 casing volumes by pumping or bailing with a decontaminated submersible pump or PVC bailer equipped with a bottom filling check valve (if the purge volume is low, generally less than 100 litres, the sampling team might find it more efficient to purge with a bailer than a pump). Use a graduated bucket to track the amount of water removed from the well. Periodically determine the pH, temperature and specific conductance of the purged water. Continue purging until the well has been completely evacuated or until the pH and specific conductance measurements have stabilised for at least one well volume. Wells that become dewatered prior to producing three casing volumes will be sampled as soon as practical once they recover sufficiently.
- 9) Dispose of purge water collected in the graduated bucket by dumping onto the ground at a distance of 50 to 60 metres from the vicinity of the well. If the water is known or suspected to be significantly contaminated, it may be necessary to store the purge water in a secure container, such as a drum, pending proper disposal.
- 10) Be aware and record any unusual occurrence during purging such as cascading (a shallow water entry zone that trickles into the borehole).

1.2 Field Parameter Measurement

Measurements of field parameters of pH, temperature and electrical conductivity are collected and organic vapour screening is conducted while the well is purged. To facilitate the collection of basic field parameters, the field team needs to: -

- Purge three well volumes of water from the well and measure field parameters for each well volume removed.
- Collection of water samples should take place after stabilisation of the following parameters: -
 - Temperature +/- 1°C
 - pH (meter or paper) +/- 0.2 units
 - Specific conductivity +/- 5%

- If the aforementioned parameters do not stabilise within three purge volumes, the well will be purged up to a maximum of six borehole volumes unless two consecutive sets of stabilised parameters are obtained.
- Note any observations in the field logbook.

1.3 Collection of Water Samples

All samples for chemical analysis will be placed in laboratory prepared bottles. The types of sample containers and preservative required for each type of analysis are described in the workplan. If required, preservatives will be placed in the sample containers prior to collecting the samples.

The following procedure will be used to sample a well: -

- 1) After the well has been purged and allowed to recover, sample the well using a properly decontaminated or dedicated disposable bailer. Gently lower the bailer into the water column. Allow the bailer to sink and fill with a minimum of surface disturbance.
- 2) Slowly raise the bailer out of the well. Do not allow the bailer line to contact the ground, either by coiling it on a clean plastic sheet or by looping it from arm to arm as the line is extracted from the well.
- 3) Samples will be collected for VOCs analysis immediately after purging is complete and before other samples are collected. Pour the samples slowly into the laboratory prepared 40 ml glass vial. Overfill each vial slightly to eliminate air bubbles, a convex meniscus should be present at the top of the vial. Ensure that the Teflon liner of the septum cap is facing inward and that no bubbles are entrapped. After capping securely, turn bottle upside-down, tap it against your other hand, and observe sample water for bubbles. If bubbles are observed, remove the cap, overfill the vial and reseal. Repeat this step for each vial until the samples with no bubbles are obtained.
- 4) Place a label on the container and enter the following information: -
 - Client/Site Name
 - Date Collected
 - Time Collected
 - Analysis
 - Preservative
 - Sample Identification Number
- 5) Record pertinent information in the field logbook and on the Field Data Sheet for Well Sampling. Complete chain-of-custody form.
- 6) Place custody seals on the container caps. As soon as possible, place sample containers in a cooler with bagged ice and maintain at 4°C until extraction. Surround the bottles with vermiculite.

- 7) Obtain the semi-volatile compound/pesticides/PCBs sample(s) by transferring the water to a laboratory prepared 1000 ml amber glass bottle with Teflon-lined cap. Fill the bottle to the bottom of the neck and follow steps 4, 5 and 6 above.
- 8) Dissolved metals (if necessary) requires the team to filter the sample water through a .45 micron filter. The water is collected in a 1 litre, unpreserved, plastic or glass bottle with HNO₃ preservative. Filtering must be done within 15 minutes of sample collection.
- 9) Obtain the total metals sample by directly transferring the water from the bailer into a laboratory prepared 1000 ml plastic or glass bottle with HNO₃ preservative.
- 10) Be sure the pH of the metals sampled is less than 2 by pouring off an aliquot in a clean jar and testing for pH using litmus paper. Dispose of this water and rinse the jar.
- 11) Collect and prepare Field QA/QC samples in accordance with separate SOP.
- 12) Be sure to record all data required on the Field Data Sheet or Well Sampling and appropriate entries into the field logbook.
- 13) Secure the well cap and replace the locking cover.
- 14) Decontaminate all sampling equipment according to procedure.
- 15) Decontaminate submersible pumps as follows: -

Scrub pump and cord in a tub of Liquinox and potable water
Pump at least 80 litres of soapy water through pump
Rinse with potable water
Pump at least 80 litres of rinse water through the pump
Rinse with D1 water before lowering pump into the next well.

END.

APPENDIX 6

Laboratory Results

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Exova Jones Environmental

Registered Address : Exova (UK) Ltd, Lochend Industrial Estate, Newbridge, Midlothian, EH28 8PL

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Deeside Industrial Park
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O'Callaghan Moran & Associates
Unit 15
Melbourne Business Park
Model Farm
Cork
Ireland

Tel: +44 (0) 1244 833780

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Attention :	Sean Moran
Date :	4th December, 2017
Your reference :	17.238.02
Our reference :	Test Report 17/19137 Batch 1
Location :	Gowran
Date samples received :	21st November, 2017
Status :	Final report
Issue :	1

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Four samples were received for analysis on 21st November, 2017 of which four were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Compiled By:

Lucas Halliwell
Project Co-ordinator

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 17/19137

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overestimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Please include all sections of this report if it is reproduced

All solid results are expressed on a dry weight basis unless stated otherwise.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range
AA	x2 Dilution
AB	x5 Dilution
AC	x10 Dilution

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JE Job No: 17/19137

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM15	Modified USEPA 8260. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.				
TM15	Modified USEPA 8260. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes			
TM16	Modified USEPA 8270. Quantitative determination of Semi-Volatile Organic compounds (SVOCs) by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM16	Modified USEPA 8270. Quantitative determination of Semi-Volatile Organic compounds (SVOCs) by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM20	Modified BS 1377-3: 1990/USEPA 160.3 Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes			
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.				
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.	Yes			
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM14	Analysis of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for dissolved metals and acidified if required.				

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Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM14	Analysis of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for dissolved metals and acidified if required.	Yes			
TM38	Soluble Ion analysis using the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	PM0	No preparation is required.	Yes			
TM42	Modified US EPA method 8270. Pesticides and herbicides by GC-MS	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM57	Modified US EPA Method 410.4. Chemical Oxygen Demand is determined by hot digestion with Potassium Dichromate and measured spectrophotometrically.	PM0	No preparation is required.	Yes			
TM58	Modified USEPA methods 405.1 and BS 5667-3. Measurement of Biochemical Oxygen Demand. When cBOD (Carbonaceous BOD) is requested a nitrification inhibitor is added which prevents the oxidation of reduced forms of nitrogen, such as ammonia, nitrite and organic nitrogen which exert a nitrogenous demand.	PM0	No preparation is required.	Yes			
TM60	Modified USEPA 9060. Determination of TOC by calculation from Total Carbon and Inorganic Carbon using a TOC analyser, the carbon in the sample is converted to CO2 and then passed through a non-dispersive infrared gas analyser (NDIR).	PM0	No preparation is required.	Yes			
TM89	Modified USEPA method OIA-1667. Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM0	No preparation is required.	Yes			
TM149	Determination of Pesticides by Large Volume Injection on GC Triple Quad MS, based upon USEPA method 8270	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				

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APPENDIX 7

Steeples Housing Development Water Quality

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APPENDIX 8

Tier 3 Risk Scores

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Risk Screening/ Prioritisation

Table 1a LEACHATE: SOURC/HAZARD SCORING MATRIX			
WASTE TYPE	Waste FOOTPRINT (ha)		
	≤ 1ha	> 1 ≤ 5 ha	> 5ha
C&D	0.5	1	1.5
Municipal	5	7	10
Industrial	5	7	10
Pre 1977 sites	1	2	3

1a =	5
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Table 1b LANDFILL GAS: SOURC/HAZARD SCORING MATRIX			
WASTE TYPE	Waste FOOTPRINT (ha)		
	≤ 1ha	> 1 ≤ 5 ha	> 5ha
C&D	0.5	0.75	1
Municipal	5	7	10
Industrial	3	5	7
Pre 1977 sites	0.5	0.75	1

1b =	5
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Table 2a : LEACHATE MIGRATION: PATHWAYS	
GROUNDWATER VULNERABILITY (Vertical Pathway)	Points
Extreme Vulnerability	3
High Vulnerability	2
Moderate Vulnerability	1
Low Vulnerability	0.5
High - Low Vulnerability (use where vulnerability not on GIS)	2

2a =	3
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Table 2b : LEACHATE MIGRATION: PATHWAYS	
GROUNDWATER FLOW REGIME (Horizontal Pathway)	Points
Karstified Groundwater Bodies (Rk)	5
Productive Fissured Bedrock Groundwater Bodies (Rf & Lm)	3
Gravel Groundwater Bodies (Rg and Lg)	2
Poorly Productive Bedrock Groundwater Bodies (LI, PI, Pu)	1

2b =	5
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Table 2c : LEACHATE MIGRATION: PATHWAYS	
SURFACE WATER DRAINAGE (Surface water pathway)	Points
Is there a direct connection between drainage ditches associated with the waste body and adjacent surface water body? Yes	2
If no direct connection	0

2c =	0
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Risk Screening/ Prioritisation

Table 2d : LANDFILL GAS: PATHWAY	
LANDFILL GAS LATERAL MIGRATION POTENTIAL	Points
Sand and Gravel, Made ground, urban, karst	3
Bedrock	2
All other Tills (including limestone, sandstone etc - moderate permab)	1.5
All Namurian or Irish Sea Tills (low permability)	1
Clay, Alluvium, Peat	1
2d =	3

Table 2e : LANDFILL GAS: PATHWAY (assuming receptor located above source)	
LANDFILL GAS LATERAL MIGRATION POTENTIAL	Points
Sand and Gravel, Made ground, urban, karst	5
Bedrock	3
All other Tills (including limestone, standstone etc - moderate permab)	2
All Namurian or Irish Sea Tills (low permability)	1
Clay, Alluvium, Peat	1
2e =	0

Table 3a : LEACHAGE MIGRATION: RECEPTORS	
HUMAN PRESENCE (presence of a house indicaates potential private wells)	Points
On or within 50m of the waste body	3
Greater than 50m but less than 250m	2
Greater than 250m but less than 1km from waste body	1
Greater than 1km of the waste body	0
3a =	3

Table 3b : LEACHAGE MIGRATION: RECEPTORS PROTECTED AREAS (SWDTE or GWDTE)	
	Points
Within 50m of waste body	3
Greater than 50m but less than 250m of the waste body	2
Greater than 250m but less than 1km from waste body	1
Greater than 1km of the waste body	0
Undesignated sites within 50m of waste body	1
Undesignated sites greater than 50m but less than 250m	0.5
Undesignated sites greater than 250m of the waste body	0
3b =	0

Table 3c : LEACHAGE MIGRATION: RECEPTORS	
AQUIFER CATEGORY (resource potential)	Points
Regionally Important Aquifers (Rk, Rf, Rg)	5
Locally Important Aquifers (Ll, Ll, Ll)	3
Poor Aquifers (Pl, Pu)	1
3c =	5

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Risk Screening/ Prioritisation

Table 3d : LEACHAGE MIGRATION: RECEPTORS	
PUBLIC WATER SUPPLIES (Other than private wells)	Points
Within 100m of site boundary	7
Greater than 100m but less than 300m or with in Inner SPA for GW supplies	5
Greater than 300m but less than 1km or within Outer SPA (SO) for GW supplies	3
Greater than 1km (karst aquifer)	3
Greater than 1km (no karst aquifer)	0
3d =	5

Table 3e : LEACHAGE MIGRATION: RECEPTORS	
SURFACE WATER BODIES	Points
Within 50m of site boundary	3
Greater than 50m but less than 250m	2
Greater than 250m but less than 1km	1
Greater than 1km	0

3e =	1
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Table 3f : LEACHAGE MIGRATION: RECEPTORS	
HUMAN PRESENCE	Points
On site or within 50m of site boundary	5
Greater than 50m but less than 150m	3
Greater than 150m but less than 250m	1
Greater than 250m	0.5

3f =	5
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Risk Screening/ Prioritisation

Note: The table below represents the Tier 1 risk rating for this site. SPR 1 to 9 represent the leachate risk scores. SPR 10 & 11 represent Landfill Gas risks. The migration pathways are colour coded as follows:

Groundwater & Surface Water	Groundwater only	Surface water only	Lateral & Vertical
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Calculator	SPR Values	Maximum Score	Linkages	Normalised Score
SPR 1 =	40	300	Leachate => surface water	13%
SPR 2 =	0	300	Leachate => SWDTE	0%
SPR 3 =	120	240	Leachate => human presence	50%
SPR 4 =	0	240	Leachate => GWDTE	0%
SPR 5 =	200	400	Leachate => Aquifer	50%
SPR 6 =	200	560	Leachate => Surface Water	36%
SPR 7 =	40	240	Leachate => SWDTE	17%
SPR 8 =	0	60	Leachate => Surface Water	0%
SPR 9 =	0	60	Leachate => SWDTE	0%
SPR 10 =	75	150	Landfill Gas => Human Presence	50%
SPR 11 =	0	250	Landfill Gas => Human Presence	0%

Risk Classification	Range of Risk Scores
Highest Risk (Class A)	Greater than or equal to 70% for any individual SPR linkage
Moderate Risk (Class B)	Between 40-70% for any individual SPR linkage
Lowest Risk (Class C)	Less than or equal to 40% for any individual SPR linkage

TIER 3 RATING	MODERATE RISK (Class B)
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