

Appendix A7.7 SKM Enviros 2013 Odour Control Plan

Kerdiffstown Landfill

TASK 7: KERDIFFSTOWN ODOUR CONTROL PLAN

- Final
- August 2013



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Regus House
Harcourt Centre
Harcourt Road
Dublin 2
Republic of Ireland.

Web: www.skmenviros.com

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Drawings

Drawing 1: Odour Profile

Drawing 2: Odour Monitoring Locations

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1. Introduction

The former landfill and waste processing facility at Kerdiffstown has now closed and is in the early stages of remediation. The Environmental Protection Agency (EPA) are using powers under Section 56 of the Waste Management Act 1996 (as amended) to restore the site and put in place appropriate aftercare measures to prevent and limit pollution from the materials which are present at the site.

In February 2013 SKM Enviro (SKME) were appointed as a framework contractor by the EPA to provide technical environmental support services in relation to the remediation of Kerdiffstown Landfill. Phase 1 of the contract involves the completion of a number of discrete technical tasks in order to progress towards identification of potential remedial options for the site.

Task 7 of Phase 1 involves the development an overall strategy for the control of odours from the site. This strategy has been formed following the undertaking of a number of subtasks which included

- Review of current sources of odour; and,
- Review of odour characteristics.

This report outlines the findings of the above tasks and details the Odour Management Plan (Chapter 4) to be established as part of the remediation project.

1.1. Background to Odours at Kerdiffstown Landfill

Odour emissions at Kerdiffstown landfill are primarily linked with diffuse landfill gas emissions, while other potential secondary odour sources include the leachate lagoon and gas flare emissions. Landfill gas is made up of a mixture of components, including methane, carbon dioxide, nitrogen and many trace gases. It can be explosive and hazardous to humans at high concentrations, but disperses to non-hazardous concentrations once diluted in the atmosphere. However, it is the sensory odour impact of landfill gas that can cause the most immediate deterioration of quality of life to nearby sensitive receptors.

While the site was operational, the odour emissions from Kerdiffstown landfill gave rise to sustained complaints from people living in and visiting the area. This culminated in serious concerns regarding odour and air pollution when an underground landfill fire ignited in January 2011.

1.2. Measures Implemented by the EPA

The site was under the control of the Kildare Fire Service until late February 2011, when it was handed over to the care of the EPA, who took emergency measures (under powers of the Waste Management Act) to contain and limit the environmental impact of the site. Since the fire was brought under control and extinguished in 2011 the site remains under “emergency measures” and the EPA have implemented a series of follow up works to deal with the most immediate risks presented at the site.

A landfill gas management system was implemented as a priority to reduce the risk of further fires which consisted of the installation of an active landfill gas collection system. There are two flares on site, one with capacity 250m³/hr, the second with capacity 500m³/hr. Currently, all gas extracted from wellfields in the northwest and the lined cell is being burnt at the 250m³/hr flare.



Currently gas is extracted at a rate of c. 150m³/hr. The overall quality of gas entering the flare has declined gradually over time with current (April 2013) levels noted at 23% methane, 23% carbon dioxide and 0.3% oxygen.

The management of the landfill gas in this way has also assisted with controlling odour issues in the north western boundary area and in the south-eastern lined cell area. Both of these areas are in close proximity to a number of sensitive receptors and as such represent locations where active gas management was most necessary.

The active gas management system has the dual function of controlling diffuse emissions to atmosphere (and hence control of odours) as well as preventing lateral migration along the north-western boundary of the site). The system has been operational for approximately 18 months, and has been successful in meeting both of these objectives.

Odour issues and/or complaints are now rare occurrences on site, with only six complaints logged by the EPA between February 2011 and March 2013. Some complaints related directly to intrusive site investigations that were taking place in 2012 when boreholes were drilled through the waste body to prove depth to natural ground and provide information of waste. The odour experienced on site during these investigations was logged, and provides an insight into the type of odour emissions that have to be anticipated during remediation works, when waste material will again be disturbed. This information has been transposed onto a plan of the site as provided as Drawing 1 at the end of this report.

1.3. Requirement for future Odour Management Plan

The scoping for the Odour Management Plan (OMP) for Kerdiffstown landfill site has been drawn up in recognition of past odour concerns arising from the operational landfill. In view of the required remediation of the site, and development of end-use options, it is recognised that odour management must be implemented at every stage of the remediation works.

The final OMP will be designed to be implemented in conjunction with the overall Landfill Gas Management Plan (LGMP). The LGMP provides an estimate of the duration and quantity of gas production in the site. Based on the assessments carried out the site waste is currently at peak gas production. The gas quantities will diminish, but will continue to require gas management over the next 30 years.

At the present time it should be noted that a detailed remedial design for the site including detailed engineering designs, phasing of works and timescales for implementation has not yet been finalised. Therefore, the objectives of this Odour Management Plan at the present time are to:

- Identify current and future potential odour emission sources on the site (Chapter 2)
- Review the Odour Characteristics identified at Kerdiffstown and qualitatively assess the risk of odours impacting on sensitive receptors (Chapter 3);
- Scope an initial Odour Management Plan (OMP), including mitigation measures to inform current and future site conditions. The final OMP will be worked up and implemented as part of the preferred remediation and after-use design. (Chapter 4)

Once detailed designs become available, then it is anticipated that information contained within this report can be used as a basis against which a detailed OMP can be development for implementation during site remedial works.



2. Sources of Odour

The main sources of odour from Kerdiffstown are due to diffuse gases arising from the decomposition of waste in the landfill. These emissions have been monitored as part of various baseline studies, and are described in the **Environmental Baseline Report**.

A summary of surveys, and resultant identification of predominate areas from which odours are known to arise is provided below. While these assessments have set out to identify and characterise the odour arisings, it is accepted in guidance literature on landfill odour (*EA Horizontal Odour Guidance*¹ ; *EPA: AG5 -Odour Assessment Guidance*²) that odour incidents which give rise to complaints can often be episodic and short-lived, and therefore difficult to witness and record. In addition, emissions are greatly diluted from their point of release, and are often below detection limits of instruments, but as odour thresholds of some compounds are very low, they may still be detected by people. Furthermore, the taking of chemical odour samples on a sorption device can only provide average chemical concentrations. These may bear little relevance to the peak events that can cause annoyance, or offence to nearby sensitive receptors.

It must therefore be appreciated that odour emissions can by their very nature be difficult to quantify. However, this does not diminish the importance of implementing rigorous odour mitigation measures.

A total of six odour complaints have been received regarding odour issues at the site since the EPA took control in February 2011 up to March 2013. This low number of complaints indicates that odours are not currently a significant source of nuisance.

2.1. Odour Emissions Assessment (Sniff Test)

The current odour emissions at Kerdiffstown have been qualitatively assessed. Regular odour checks are carried out by site personnel during daily and weekly site surveys. Any odours noted are logged in the daily site assessment records, together with metrological conditions and details of works taking place on site.

An Odour Assessment (Sniff Test) in line with the *EPA: AG 5 (Ref 2)* was carried out on the 10th April 2013 (onsite) and on the 13th May 2013 (offsite) by SKME staff. The onsite assessment was carried out by two qualified personnel. The entire site was assessed, with particular emphasis in the areas in which previous odour logs had identified prevalence of strong odours.

As part of the onsite odour assessment, ten locations were assessed on the northern half of the site. In line with the EPA assessment method, an odour Intensity of 0 to 4 (most intense) was logged, and an odour persistence between 0 and 2 (most persistent). The most persistent and intense odours were noted on the top of the northern site, around Borehole 36B, with a strong rotten cabbage/ rotten egg smell being evident. This area, and the northern end of the NW gas field, is generally the location of strongest diffuse odours on site.

1 EA Additional Guidance to H4 Odour Management: How to comply with your Environmental Permit; 2011
2 EPA Air Guidance Note 5 (AG5) Odour Impact Assessment Guidance for EPA Licensed Sites



On the survey carried out on 10th April the wind was blowing from a south / south-easterly direction, and was occasionally gusty, leading to concentrated pockets of odour being blown in a north-westerly direction. The southern half of the site was included in the odour survey; however, no odours were apparent in the southern site.

As part of the offsite odour assessment, eight locations surrounding the perimeter of the site were assessed. During the survey there was a light to gentle breeze blowing from the NW. No odour was detectable at any of the upwind locations (OMP1-4 as shown in Drawing 2). Intermittent faint to moderate odours were detected at OMP 6 and OMP 7 during the assessment. At both locations the odour was noted as “sweet rotten eggs”. These locations are adjacent to the EPA air quality monitoring shelters located along the driveway connecting Kerdiffstown House to the L2005 road.

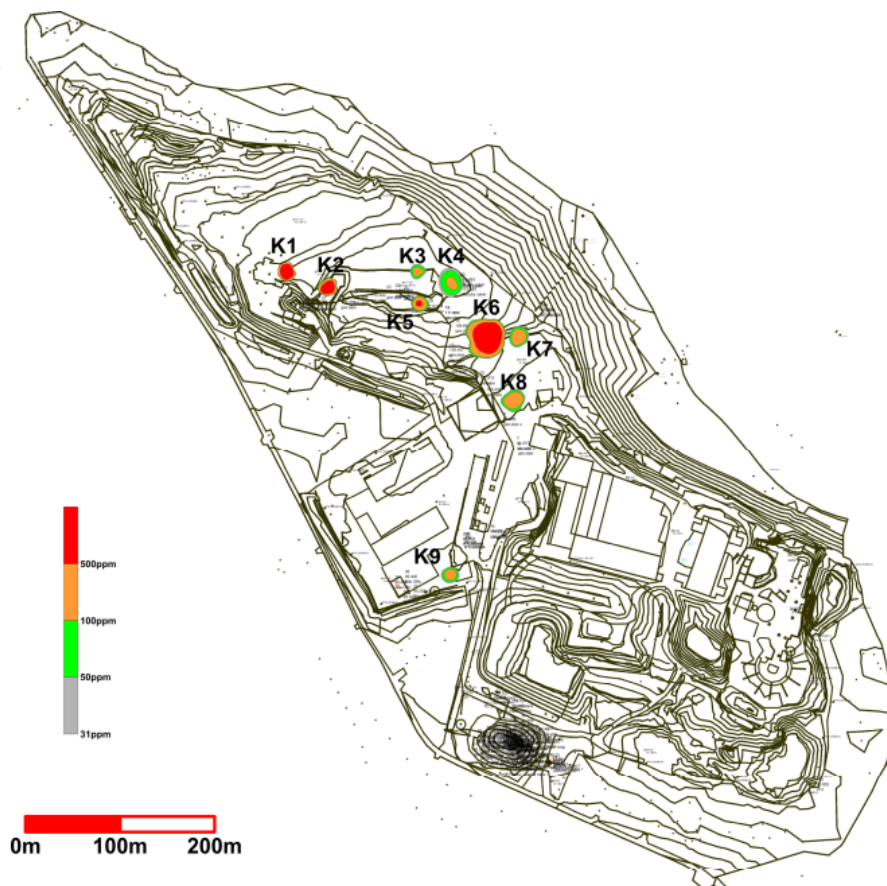
2.2. Surface VOC monitoring

Surface emission monitoring of volatile organics diffusing from the site has been carried out annually between 2008 and 2012 by Odour Monitoring Ireland, in accordance with the *EPAs AG 6 Air Guidance*³. Surface VOC monitoring was carried out with a hand-held flame ionisation detector (FID). It provides an instantaneous indication of areas in which landfill gas is diffusing out of the waste body. While the FID measures total VOCs, as a component of landfill gas, it does not quantify the other constituent landfill gas components.

The most recent Surface VOC monitoring was carried out in October 2012, see Figure 2.1 below. During this survey nine individual surface emission zones of landfill gas were identified, all in the centre and north-west of the site. These locations corresponds to the results of the Odour ‘Sniff’ surveys discussed above, and soil core odour logs detailed in Section 2.1.

3 EPA Air Guidance Note 6 (AG6) Surface VOC Emissions Monitoring on Landfill Facilities

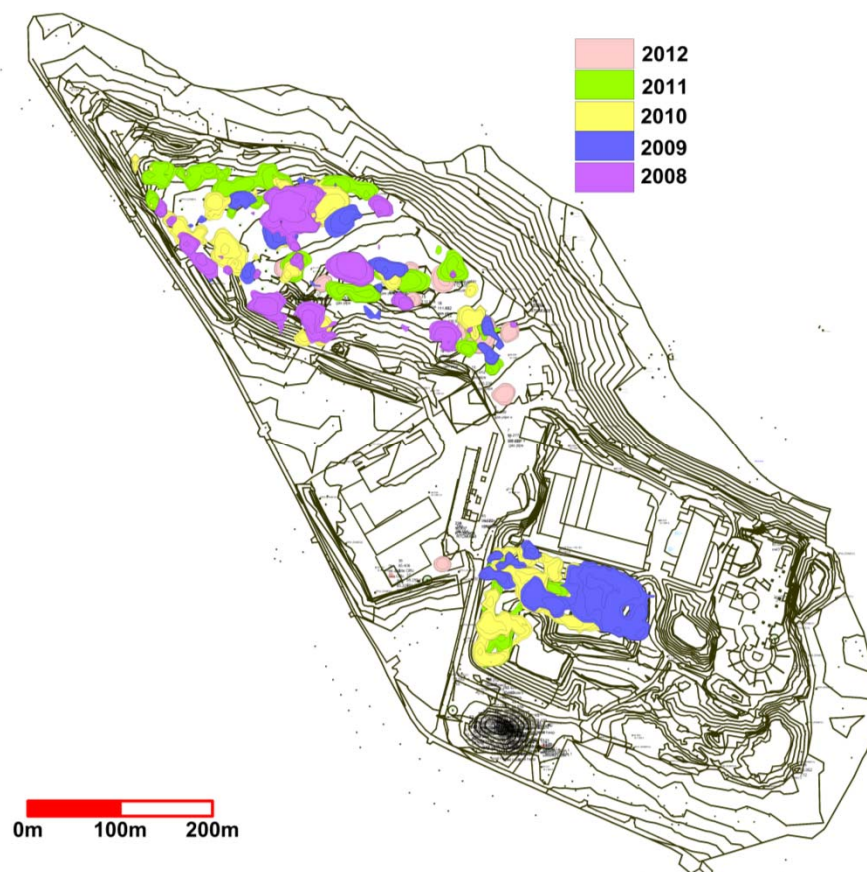
Figure 2.1.: VOC Surface Emission mapping 2012 at Kerdiffstown Site (Source: Odour Monitoring Ireland)



No diffuse VOC emissions were indicated in the south-east lined cell area, which currently has a temporary cap placed on it. This change in emissions, compared to previous years (see Figure 2.2) is evidence of the effectiveness of capping for emission and odour management procedures.

Figure 2.2 provided below shows the change in surface emission locations recorded over the past five years. This figure does not indicate VOC **concentrations**, just changes in **locations** of diffuse emissions arising. Overall VOC surface emission locations have decreased at the site, most significantly in the south-east. The elimination of surface emissions in the south-east of Kerdiffstown has been due to the lining of this site area, thereby preventing diffuse emission releases.

Figure 2.2.: VOC Surface Emission location mapping 2008-2012 at Kerdiffstown (Source: Odour Monitoring Ireland)



2.3. Summary Odour Source Locations

Current Odour Source Location

By combining the results of the Odour Assessments with the results of the Surface VOC emission survey, a clear picture emerges regarding the area of the main diffuse odour emissions in the northern part of the site. Figure 2.1 delineates the current odour emission locations.

Odour Source locations expected during Remediation works

These emissions are mainly released from the uncapped NW waste area, north of the 2011 fire zone. The temporarily capped south east area is currently not considered a source of odours, however, this will change once during remediation works, when the temporary cap potentially may be removed and waste material disturbed as part of the landfill re-profiling.

For the purpose of odour management during site remediation works, the entire waste body, and certainly the areas marked in Figure 2.2, must be considered as potential odour sources, as any lifting of temporary caps, and disturbance of waste material can lead to mobilisation of odorous gases.

3. Review of Odour Characteristics

3.1. Subjective Odour Characteristic Identification

During the site walk over surveys, such as described above, odour characteristics are routinely recorded on the field sheets, in addition to odour strength and metrological data. The subjective odour characteristics most frequently used to describe the perceived impact from Kerdiffstown are 'rotten eggs'; rotten cabbage' and 'oily petroleum'.

Odour characteristics during Site Investigation Activities

Odour characteristics were also assessed on a qualitative basis during site investigation works, whereby soil cores were removed from the site during two intrusive site investigations carried out in 2012. Soil core samples were removed from over 50 boreholes, in some cases from depths up to 25 meters into the waste body. Odour ranging from faint to very strong smells was logged. The characteristics of smells were described as burnt (from the previous fire area), oily, indicating hydrocarbons, rotten eggs, indicating hydrogen sulphide and rotten cabbage/ vegetable, indicating mercaptan smells.

The strongest odours were recorded from soil cores taken from the northern centre of the site and the north-western gas field. Boreholes 14, 16, 30B, 35A, 36B and 43B indicated particularly strong smells.

Records of these odours and the depths at which they occur have been transposed onto a plan to further assist the remediation works when they are undertaken. This is presented in Drawing 1 as part of this report.

3.2. Trace-gas Analysis

In order to better characterise the odours arising from Kerdiffstown landfill, trace-gas monitoring of speciated VOC's, was carried out from four in-waste gas wells and boreholes on 24th April 2013. The monitoring involved sampling on tenax/ multimedia tubes and subsequent GCMS analysis of a typical landfill trace-gas suite. The assessment was undertaken in accordance with the *EA Guidance on Tracegas Analysis*.⁴ Total VOC emissions were not sampled on this occasion, rather the sampling was undertaken to provide chemical characterisation of the VOC compounds generated within the site.

The predominant VOC compounds identified at the four in-waste gas sampling locations are shown in the table below against their associated odour thresholds and characteristics. As stated previously, gases such as hydrogen sulphide and mercaptans have very low odour detection thresholds. In addition, it is known from published studies that trace-gas concentrations in a landfill can vary significantly due to fluctuation of temperature, atmospheric pressure and humidity. Therefore, the analysis carried out took cognisance of compounds detected, even where the concentrations indicated were at or below the analytical margin of error. The very low odour threshold of the compounds characterised in the landfill emissions highlight the importance of managing activities that may release potentially odorous emissions, as even very low levels of these gases can cause significant impacts.

4 EA Guidance on monitoring trace components in landfill gas, LFTGN04 v 3.0 2010



The table below lists the compounds identified their odour thresholds and typical smell characteristics. The indicated odour characteristics tally closely with the description of odours previously noted from complaints, during site walk-over surveys and as part of sniff tests.

Table 3.1. VOC Trace-Gas Analysis Component identification at Kerdiffstown Landfill 24-04-2013

Parameter	Odour Detection Limit mg/m ³ Ref ^{5 6}	Odour Character	Location 1 LG-18 (SE Site)	Location 2 LG34 (N site)	Location 3 LG10 (N site)	Location 4 BH36B- (N central)
Hydrogen Sulphide	0.0001	rotten eggs	x	x	x	x
Dimethyl sulphide	0.0037	rotten vegetables		x		
Dimethyl disulphide	0.004				x	
Methylmercaptan	0.08	sewer/ rotten cabbage	x	x	x	x
Styrene	0.07	rubbery plastic	x	x	x	
Butyl mercaptan	0.04	skunk	x	x		
Ethyl mercaptan	0.18	garlic/ sewer/ rotten cabbage		x		x
1, Pentene	0.16	pungent petrol	x	x		
Carbon Disulphide	0.7	rotten vegetables	x	x	x	x
Toluene	0.7	floral, pungent	x	x		x
1,3 Butanidiene	1.1	petrol				x
Trichloroethylene	3	Solvent		x		
Benzene	9.0	Solvent	x	x		
Chloroethane	39	Etheral	x	x		x
Furan	Not known	Etheral	x			

Information on odour generated by different waste components is provided in the *EA Guidance Quantification of Trace components in Landfill Gas, 2004*⁷ which points to mixture of domestic and commercial waste types, for the type of odours characterised above.

5 SEPA Odour Guidance 2010

6 EA Guidance on Landfill Gas Flaring version 2.1, 2002

7 EA Quantification of Trace Components in Landfill Gas, 2004



3.3. Qualitative Odour Risk Assessment

Based on the findings above, comprising odour sources, locations, and odour characteristics, a *qualitative* Odour Risk Assessment has been carried out. This assessment considered the following factors:

- Current Complaint History and Daily Walk-over Records;
- Community responses to past Odour Sources;
- Sensitive Receptors and locations of likely Odour Impacts;
- Routine and non-routine causes of Odour Sources;
- Observed dispersion of odour under all different weather conditions; and,
- Risks to effectiveness of emission controls and mitigation measures in place.

A summary of the considerations identified for this risk assessment are given below, whereas mitigation measures are included in the scoped Odour Management Plan (presented below).

3.4. Current Complaint History and Daily Walk-over Records

Complaints have significantly reduced since 2011m with a total of 6 complaints logged by the site management and notified to the EPA between July 2011 and March 2013. Two of these complaints came from the Naas Golf Course, located to the North-West of the site, and three from one resident located about one kilometre South-West of the site. In accordance with site management protocol, an odour investigation was carried out by the site supervisor following each complaint. Some, but not all, incidences could be accounted for due to prevailing wind conditions or site works. There is no apparent pattern to the recent complaint history.

Daily walk-over records are logged by the site supervisor, which include observations on all site conditions, including any evident odour at any locations. These daily records are maintained by the site management, and provide a record of odour prevalence and weather conditions. The daily records confirm that the primary odour sources from the site are diffuse emissions from the northern waste body.

3.5. Community Responses to past Odour Sources

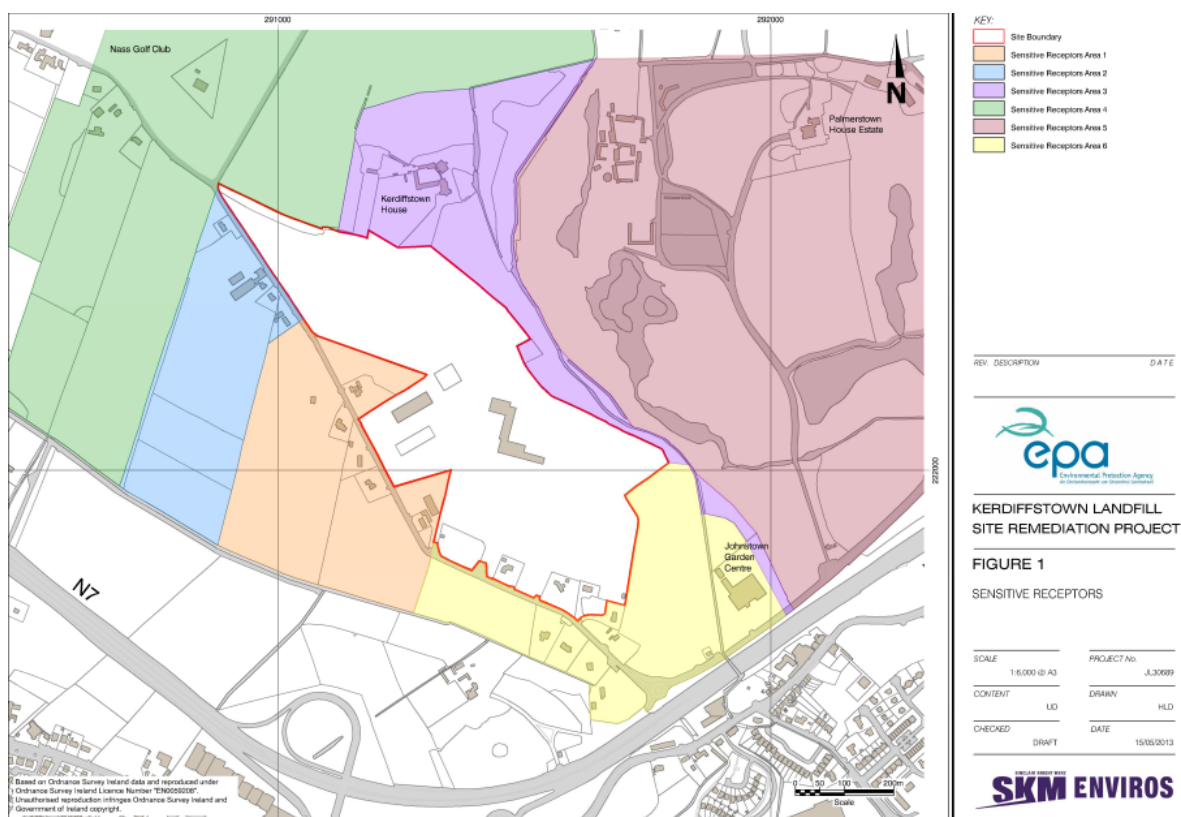
The community in the vicinity of Kerdiffstown site are sensitised to the odours arising from the landfill, due to the past history of complaints relating to the site. For many years, up to 2011, the area including a few kilometres radius around the site was subjected to very strong odours. While these odours have reduced significantly with the current site management and provision of landfill gas control systems, it is inevitable that stronger odours could potentially be released during site remediation works.

The EPA has fostered a good relationship with local community representatives and residents groups, who will be kept informed of all planned remediation works. The involvement of the residents groups throughout the remediation works will assist in enabling an understanding and tolerance for the short term necessary impacts that will arise during site remediation.

3.6. Sensitive Receptors and locations of likely Odour Impacts

The closest locations of sensitive receptors around the site have been grouped into 6 areas, as shown on the Figure below. It is evident that the closest receptors, the residential houses along the local road, and identified as SR-1 and SR-2 are located upwind of the prevailing wind direction, whereas SR-3, Kerdiffstown House, SR-4, Naas Golf Club, and SR-5, Palmerstown House Golf Club, are located to the north and north-east, more directly in the prevailing wind direction. These receptors are also closest to the main waste deposition area in the north-of the site, and are therefore most at risk of odour impacts.

Figure 3.1: Sensitive Receptors



Currently, the main location of diffuse odours arising at the site is from the northern waste deposit area. The intensity of odours is of a fluctuating nature, even when the waste body is undisturbed. The odour emissions can vary depending on prevailing meteorological conditions, such as wind direction, wind speed, barometric pressure and air temperature.

The prevailing wind at the site is south-westerly. The sensitive receptors to the north and north-east of the site are therefore at higher risk of receiving odour impacts. However, no complaints from these locations have been received over the past 2 years.

During remediation works the risk of odour impacts will increase significantly, when waste containing materials potentially will become exposed. Odour mitigation measures are discussed in the Odour Management Plan.



3.7. Routine and Non-Routine Causes of Odour

The current condition of the Kerdiffstown landfill is an inactive, yet only provisionally controlled, landfill site. While no fresh waste deposition is being carried out, the site does not have comprehensive landfill gas management infrastructure or permanent capping in place. Although an active gas collection and flaring system has been installed, the infrastructure currently only accounts for the removal of gas from approximately one fifth of the site area. Diffuse landfill gas emissions can therefore still emit from the uncapped surface of the landfill in the northern waste area, as evidenced above. These emissions are the current 'routine emissions'.

Non-routine causes of odour will arise when site remediation works will cause disturbance of the waste body in the northern waste body, as well as in the south of the site, where temporarily capped waste may be re-opened and require re-emplacement. These non-routine odours will arise during the remediation works, but the duration and extent of the works that will cause odour releases will be minimised as far as practicable. As such, the entire north and south waste-body has to be considered as a potential, non-routine odour source.

Other non-routine sources of odour may arise if the leachate lagoon is disturbed. The management and impact minimisation from leachate is discussed separately.

In addition, odours may be emitted if any stagnant bodies of water are pumped out, such as accumulated water in tanks to the east of the site, in the prior waste processing area. Mitigation measures will be taken during these activities, and local sensitive receptors will be notified in advance of any non-routine works being carried out.

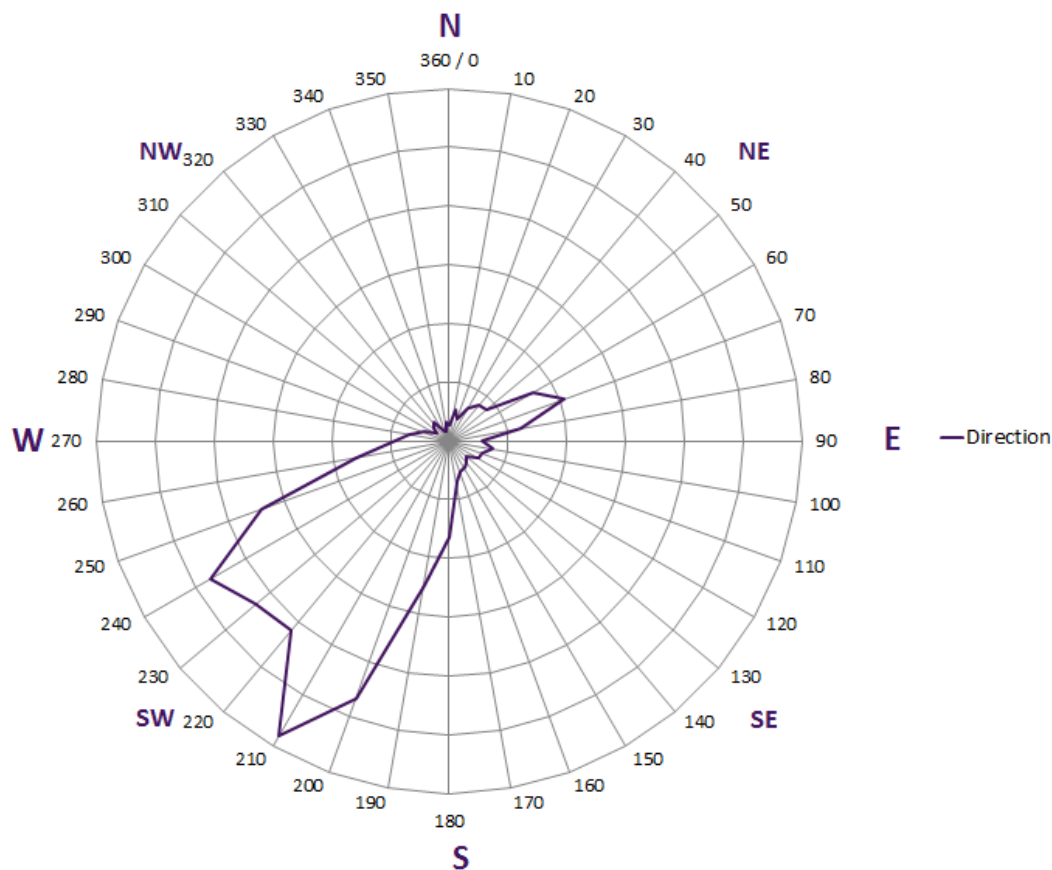
3.8. Dispersion of Odour under different weather Conditions

Daily site logs and the detailed odour assessments carried out at the site consistently indicate that the odours at Kerdiffstown landfill are most prevalent along the northern edge of the north-eastern waste body.

The main prevailing wind direction applicable to the Kerdiffstown site is from the south-west, as indicated on the Casement Wind Rose, depicted below. The main receptors located in the prevailing wind direction are therefore Kerdiffstown House Retreat Centre (SR 3) and Palmerstown House Golf Course (SR-5).

The prevalence of odours can change with weather conditions, in that the strongest odours are experienced on site during low wind conditions, when there is little dilution of air. In addition, at landfills a sudden drop in barometric pressure tends to result in an increase in gas diffusing from the waste body, until the pressure differential between the soil and air has balanced out again. High atmospheric temperatures also stimulate gas particle movement, and lead to increased gas diffusion, resulting in more odours being released in warm weather.

Figure 3.2. Windrose from Casement Metrological Station Casement (2006-2013) (Source EPA)



3.9. Risks to Effectiveness of Emission Control and Mitigation Measures

The main mitigation measures are discussed in the OMP scoping section below. The mitigation measures primarily rely on good management, planning of remediation phases, provision of temporary cover to contain odour arisings, and good communication with affected receptors.

A daily odour protocol is already in place at Kerdiffstown site, and the finalising of the remediation works phasing plan will enable the details of the OMP to be planned, re-assessed, developed and implemented on a day to day basis. The effectiveness of the OMP, regarding emission control and implementation of mitigation measures, will be assessed as a Continuous Improvement Loop, whereby daily effectiveness of odour control during remediation works will be checked and documented by on-site staff/management.



3.10. Summary Risk Assessment

Diffuse Odours

This qualitative risk assessment considers that the risk of diffuse odours impacting on sensitive receptors is currently **low to medium** during the absence of works, while the site is in its current situation. While there is some diffusion of gas from the uncapped landfill surface in the northern waste-body, this is maintained at a low level due to active gas extraction/flaring, and prevention of waste disturbance. The southern waste body is temporarily capped, and does not indicate any diffuse emissions.

When remediation works commence, involving waste material movement, the potential risk of odours being emitted from any working face at the site will be **high**. Comprehensive odour mitigation measures will be required to be implemented as a daily priority. The risk of high odour emissions will be a temporary occurrence, for the duration of remediation works.

Once remediation works are completed, the site will be fully capped, and comprehensive landfill gas extraction and flaring infrastructure will be in place. In the End-Use phase the risk of diffuse odour emissions will be **very low**.

Odours from Landfill Flare

A quantitative air dispersion model (AERMOD) of potential impacts from the landfill flare emissions was carried out in 2012 by the EPA. No likely impact from flare gas emissions was predicted in the model. Therefore, odour emissions from landfill gas flaring operations are not anticipated from the site.

Table 3.1. Risk Assessment of Odour Emissions during foreseeable Site Phases

Qualitative Risk Assessment Site Phase	Current Dormant Site	Remediation orks Phase	After-use Phase
Diffuse Odour Emissions	Medium- Low	High	Very Low
Odours from Flare Emissions	Low	Low	Low
Odours from other sources (leachate/ stagnant water/ diesel fuel spillage)	Low	Medium	Low

Odour Risk from other Sources

The risk of odours arising from other sources, including from the disturbance of leachate or stagnant water or other materials such as diesel fuel spillage, has been considered. The risk from these sources is considered low during the current dormant site conditions.

The risk of other odour sources is considered medium during site remediation works, as the leachate lagoon will be disturbed as part of engineering works. Similarly any stagnant water in defunct storage tanks will be pumped out, leading to disturbance of potentially anaerobic and odorous liquids. Mitigation measures set out in 4.4. will apply to any such works.

During the after-use phase it is considered that the risk of odours arising from other sources will be low.

4. Odour Management Plan

This section sets out the scoping for a comprehensive odour management plan (OMP), which will be worked up as part of the overall Remediation Works Management Plan. The overarching objectives of this OMP scoping are to:

- identify appropriate odour mitigation methods, including monitoring and contingencies, to control and minimise odour pollution;
- identify appropriate methods to prevent unacceptable odour nuisance at all times;
- reduce the risk of odour releasing incidents or accidents by anticipating them and planning accordingly.

This OMP scoping has considered the above requirements, as set out in the *UK EA Horizontal Guidance on Odour Management, Ref 2*, which is considered Best Available Technique (BAT). The requirements are applicable for current 'dormant' site conditions, as well as for the future remediation works and end-use phase. In doing so the OMP will address the following points and will contain various associated documents and protocols, which are already in place as part of the current EPA controlled site management.

- Summary of the site and surrounding area;
- Odour sources and location of sensitive receptors;
- Odour management procedures;
- Site procedures for dealing with odour complaints;
- Response to odour issues and mitigation measures;
- Operative training;
- Record keeping;
- Housekeeping;
- Maintenance and inspection of odour controlling plant and material;
- Spillage/contaminated material management procedures;
- Emergency/incident response planning; and,
- Community relations.

4.1. Summary of Site and Surrounding Areas

The details of the site and surrounding area are discussed in the Environmental Baseline Report, Chapters 1-3.



4.2. Odour sources and location of sensitive receptors

Details of Odour Sources and the location of sensitive receptors are provided in Section 2.1 and 3.6, above.

4.3. Odour Management Procedures

For the Kerdiffstown Landfill, the remediation works will give rise to the highest risk of odour releases. While activities which may disturb waste, such as excavation and reprofiling of slopes, or replacement of materials, will be unavoidable, this OMP provides outline mitigation measures to minimise odour impacts as can be anticipated.

It must be noted, however, that a detailed phasing and daily/ weekly specification of most appropriate mitigation measures cannot be provided, until the full remediation plan has been finalised.

Odour Management during Current Site Conditions

At the present time it is considered that odour occurrences are being minimised at the site through best practice and regular monitoring. This is in line with guidance provided in the *EPA Landfill Manuals, Landfill Monitoring*⁸.

Current Odour Minimisation and Prevention measures which are currently implemented includes:

- Carrying out sniff tests and logging details of odorous emissions during daily and weekly site assessments;
- Noting wind direction, temperature and barometric pressure on a daily basis;
- Ensuring that landfill gas flaring is balanced and optimised to maximise gas collection from installed gas wells and flaring according to operational recommendations;
- Investigating any odour that appears stronger than the normal emission;
- Logging any odour complaints, and investigating circumstances on the day the complaint was made. This includes correlating wind direction and speed, barometric pressure, and whether any site works were being carried out; and,
- Notifying nearby sensitive receptors prior to any works being carried out, that may disturb the waste body and cause odours to be released (such as intrusive site investigations).

Odour Management during Remediation Works

During the remediation works ground disturbance will be unavoidable. Such ground disturbance is likely to occur when waste movement for the reprofiling of the NW area will be required, as well as re-emplacement of waste into the lined cell in the SE area. As the specifics of the remediation works are not finalised, the phasing and duration of such emissions cannot currently be fully assessed.

⁸ EPA Landfill Manuals, Landfill Monitoring, 2nd Edition, 2003



In addition, currently none of the facility areas are permanently capped. Capping will alter the location and rate of any landfill gas emissions from the site, as it will prevent diffuse emissions through the top of the facility. A potential impact of capping the site could be to direct the gas emissions sideways towards any pathways of least resistance. This could result in landfill gas migrating offsite, if not adequately managed with the landfill gas infrastructure.

Nevertheless, a comprehensive OMP will be drawn up to cover the anticipated remediation works, and specify most suitable odour minimisation methods, based on the details provided below. A daily odour protocol is already in place at Kerdiffstown site, and the finalising of the remediation works phasing plan will enable the details of the OMP to be planned, reassessed and improved on a day to day basis. The effectiveness of the OMP, regarding emission control and implementation of mitigation measures, will be assessed as a Continuous Improvement Loop, whereby daily effectiveness of odour control during remediation works will be checked and documented by the site supervisor.

4.4. Odour Mitigation Measures

Minimise Evaporation of Odours Compounds

The first step to mitigating diffuse odour emissions from a landfill is by minimising the potential evaporation of odorous compounds. This will be enacted during remedial works through adoption of measures such as the following:

- Provision of an adequate supply of temporary cover material prior to any works commencing (e.g. clean topsoil, clay or liner membrane,);
- Any exposure of odorous waste will be kept to the minimum practical duration;
- The surface area of exposed waste will be kept to a minimum size at all times;
- Temporary cover will be applied to all works areas as quickly as practicable;
- The carrying out of major waste movements during hot weather when odours volatilise most readily will be avoided;
- Leaving open waste exposed in direct sunlight, which increases evaporation, will be avoided;
- Water spray to lower the temperature of exposed waste, and inhibit evaporation will be used;
- Screening of materials containing waste, unless adequately contained, will be avoided;
- Any waste containing material that has to be transported from one side of the site to another will be covered and contained during transport;
- If unacceptable odours are generated from a particular activity it may be necessary to cover the exposed waste, and cease the activity until additional odour control measures can be put in place. This may include the provision of additional water bowsers, cooler weather conditions, or the use of odour suppressants/ masking substances; and,
- During normal circumstances the use of odour masking agents will not be promoted, as these substances can become a source of odour nuisances in their own right.



Informing nearby Sensitive Receptors

The Naas Community Liaison Group is well established, and will be kept informed of the progress and plans regarding the remediation and end-use of the site. They will be made aware of the nature of the site works, which will include the necessary reprofiling and movement of some waste materials, in order to achieve the final approved landforms.

The site management will request their patience; on the understanding that once remediation works have been completed, they will no longer experience nuisances, deterioration of their quality of life, or reduction of property value.

Nearby sensitive receptors will be informed prior to any remediation works being carried out. They will be informed of the works phasing plan, and the locations of works planned for the duration of remediation works will be regularly updated and communicated. Where adverse metrological conditions coincide with works phasing that cannot be averted, residents will be informed of the heightened risk of short-term odour nuisances.

Monitoring of Odorous Emissions

During remediation works the odour emissions from the site will be a requirement for monitoring which is likely to include the following:

- Frequent sniff sampling and logging of odour characteristics at the working face, in accordance with EPA AG5 (Ref 2);
- Frequent sniff tests at the site perimeter downwind from the working face;
- Frequent sampling of specified compounds with colour indicator tubes specified at appropriately low detection ranges. These should include indicative sampling for benzene, chloroethane, 1,4 epoxy 1.3-butanediene (furan), and hydrogen sulphide. Such sampling will assure that health related emission concentrations do not arise;
- Frequent sampling of Total VOC concentrations using a FID handheld field detector; and,
- Regular sniff tests off-site near sensitive receptor locations.

If monitoring indicates higher than expected odour emissions, or impacts at sensitive receptors, additional mitigation measures will need to be implemented. If necessary, and in adverse conditions, the works may have to be stopped and the workface contained with a temporary cover, until adequate mitigation can be assured.

4.5. Odour Impacts during After-use Phase

It is not anticipated that any diffuse odour impacts will occur during the after-use phase, as the remediation, capping, and on-going landfill gas management of the site will control any diffuse odours from arising.



Post Remediation Landfill Gas Management

It is recognised that when the site is fully restored, a comprehensive gas management system needs to be in place across the whole site to meet the following objectives:

- Prevent off-site horizontal migration;
- Control vertical emissions of gas through the cap to ensure restoration planting is not impacted by gas build up in the root zone; and,
- Prevent gas accumulating in any on-site buildings and other confined areas.

A detailed gas management plan will be worked up as part of the preferred restoration and after-use design. Active extraction and flaring of gas will be required.

It is envisaged that within the main body of the site, gas extraction wells will be installed on a nominal 40m grid spacing, with closer spacing of wells close to the perimeter to prevent migration, typically at 20 to 25 m centres along most sensitive boundaries such as adjacent to the north-west corner where housing is closest to the site boundary. The system needs to be flexible to allow it to adapt to falling gas levels and generation rate, as wastes progressively degrade.

4.6. Site procedures for dealing with Odour Complaints

The site procedures for dealing with odour complaints will remain as current in place. This will include a procedure to log a complaint, and notify the EPA on the Incident Form. The complaint will then be investigated by the site supervisor or other suitably trained site staff. The odour investigation will consist of a site walk-over assessment and sniff test, during which metrological conditions will be logged, as well as any odours characterised, odour strength determined and locations of strongest odour impact identified. The sniff test will follow the EPA Guidance AG 5 (Ref 2). The investigation will consider the following

- Are any unplanned activity occurring on site;
- Have the specified control measures been implemented correctly;
- Can control procedures be increased for the current activity;
- What are the metrological conditions on the day;
- Did the complaints arise from a downwind location from the days activities;
- Investigate results from the daily health indicator testing and VOC sampling, to ascertain that no health impacts are associated with the odours complained about

The complaint investigation will be made available for public viewing.

4.7. Operative Training

All site operatives tasked to carry out odour assessments must be environmental professionals who can demonstrate suitably familiarity with the EPA Odour Assessment Guidance AG-5. A list of operatives who carry out odour assessments and their relevant qualifications will be kept on site.



4.8. Record keeping

The record keeping procedure for odour management will be in line with the overall site record keeping protocol. This will be provided in an Appendix of the OMP.

4.9. Housekeeping

Odour minimisation on a landfill is intrinsically linked with good site management and housekeeping. The pertinent considerations that must be carried out for the minimisation of odours are set out above.

4.10. Maintenance and inspection of odour controlling plant and material

The landfill gas control infrastructure is the main odour controlling plant, consisting of the in-waste pipelines, valves, gas well, pumps, and flaring units. The regular balancing of the gas fields, and proper maintenance of the flares is a primary aspect of the site supervisors duties. The landfill gas procedures are set out, and will be provided in an Appendix of the OMP.

4.11. Spillage/contaminated material management procedures

Spillages that could give rise to odours include spillages of leachate or stagnant water, or spillages of diesel fuels. No other odorous liquids are likely to be transported or used at the site. Any spillages of such liquids will be dealt with as per the site incident and emergency procedures. A copy of these will be provided in an Appendix of the OMP.

Material spillages could occur if odorous waste containing materials are transported across the site for planned re-emplacement. If this occurs this will be covered by the Odour Minimisation procedures.

4.12. Emergency/incident response planning

The overall site management has detailed emergency and incident response procedures in place, and these will be revised and amended to address all possible occurrences during the remediation period. Unexpected odour is a consequence of an unplanned incident or mismanagement of an unforeseen event. As such, the management of odour arising from an incident will be intrinsic to the management of the source of emergency. Such emergency measures will be drawn up in detail once the remediation plan has been finalised.

4.13. Community relations

Community relations have been well established by the EPA. The channels of communication will be maintained, and community groups as well as residents will be informed of works phasing through the duration of works occurring at Kerdiffstown site.



Drawings

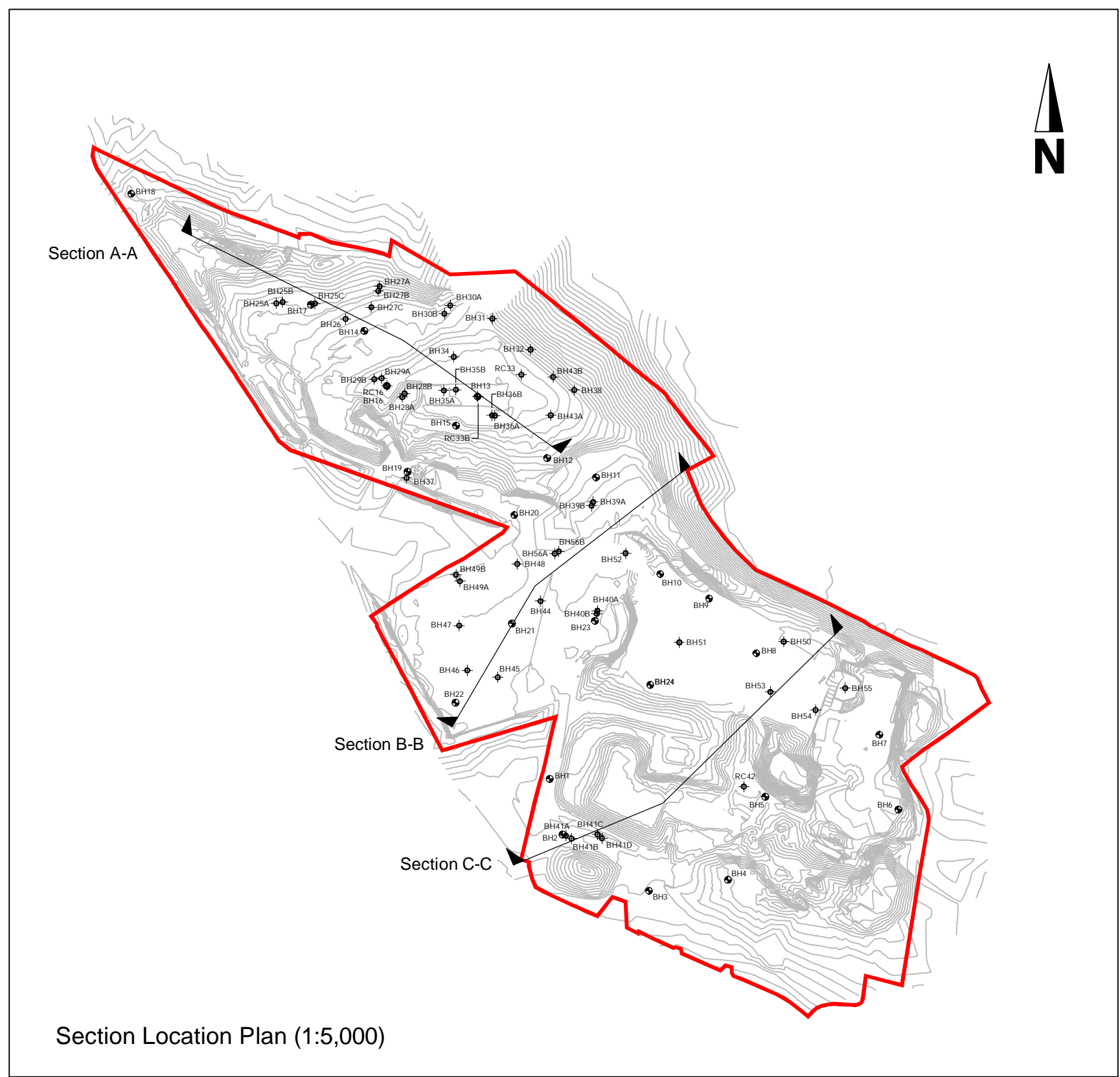
Drawing 1:Odour Profile






Drawing 2:Odour Monitoring Locations

[illegible]

00	No odour	No gas odour	Slight gas odour	Slight gas odour	No odour	No gas odour	No gas odour	Not recorded	Not recorded	Medium musk gas odour	Medium musky smell	No odours noted on all logs (very shallow BT)	Slight odour of rotten eggs	Medium smoke gas odour	Medium smoke gas odour	No odour	No odour
00	No odour	No gas odour	Slight gas odour	Slight gas odour	Slight odour	No gas odour	No gas odour	Not recorded		Medium musk gas odour			Medium odour of rotten eggs	Medium smoke gas odour	Medium smoke gas odour	Not recorded	Odour of burned material noted
00	Not recorded	Slight gas odour	Slight gas odour	Slight gas odour	Slight odour	No gas odour	No gas odour	Not recorded		Medium musk gas odour			Medium odour of rotten eggs	Medium smoke gas odour		Not recorded	Odour of burned material noted
00	Not recorded	Slight gas odour	Slight gas odour	Slight gas odour	No odour	No gas odour	No gas odour	Not recorded		Medium musk gas odour			Medium odour of rotten eggs	Medium smoke gas odour		Not recorded	Odour of burned material noted
00		Slight gas odour	Slight gas odour	Medium oil gas odour	No odour			Not recorded		Medium musk gas odour			Medium odour of rotten eggs	Medium smoke gas odour		Not recorded	Odour of burned material noted
00		Slight gas odour	Slight gas odour	Medium oil gas odour	No odour			Not recorded		No odour			Medium odour of rotten eggs	Medium smoke gas odour		Not recorded	Odour of burned material noted
00		Slight gas odour	Slight gas odour	Medium oil gas odour				No odour		No odour			Medium odour of rotten eggs	Medium smoke gas odour		Not recorded	Odour of burned material noted
00		Slight gas odour	Slight gas odour	Medium oil gas odour				No odour		No odour			Medium odour of rotten eggs	Medium smoke gas odour		Not recorded	Odour of burned material noted
00		Slight gas odour	Slight gas odour	Medium oil gas odour				No odour		No odour			Medium odour of rotten eggs	Medium smoke gas odour		Not recorded	Pungent odour of burned material noted
00		Slight gas odour	Slight gas odour	Medium oil gas odour				No odour		No odour			Medium odour of rotten eggs	No gas odour			Pungent odour of burned material noted
00		Slight gas odour	Medium oil gas odour	Medium oil gas odour	No gas odour			No odour		No odour			Medium odour of rotten eggs	No gas odour			Pungent odour of burned material noted
00		No gas odour	Medium oil gas odour	Medium oil gas odour	No gas odour			No odour		No odour			Medium odour of rotten eggs	No gas odour			Pungent odour of burned material noted
00		No gas odour	Medium oil gas odour	Slight gas odour	No gas odour			No odour		No odour			No odour	No gas odour			Not recorded
00		No gas odour	Medium oil gas odour	No gas odour				No odour		No odour			No odour	No gas odour			Not recorded
00		No gas odour	No gas odour	No gas odour				No odour		No odour			No gas odour	No gas odour			Not recorded

1.00	No odour	No odour	No waste present, no odours recorded	No waste present, no odours recorded	No waste present, no odours recorded	No waste present, no odours recorded	Slight Odour	Rotary Bonehole only Not recorded	Not recorded	Odour of H ₂ S	Very slight gas odour	Slight gas odour	Not recorded but gravelly so unlikely	No odour	No gas odour	Odour of H ₂ S	Slight gas odour	Not recorded but gravelly so unlikely	Slight organic odour
2.00	No odour	No odour					No odour		Not recorded	Odour of H ₂ S	Very slight gas odour	Slight gas odour	Not recorded but gravelly so unlikely	Clay with boulders - no odour	No gas odour	Not recorded	Slight gas odour	Not recorded but gravelly so unlikely	Slight organic odour
3.00	No odour	No odour					Not recorded but gravelly so unlikely		Not recorded	No odour		Slight gas odour	Not recorded but gravelly so unlikely	No gas odour	No gas odour	Not recorded	Slight gas odour	Not recorded but gravelly so unlikely	Slight organic odour
4.00	No odour						Not recorded but gravelly so unlikely		No odour		Very slight gas odour	Slight to medium gas odour	Not recorded but gravelly so unlikely	No gas odour	No gas odour	Not recorded	Slight gas odour	Not recorded but gravelly so unlikely	Slight organic odour
5.00	No odour						Not recorded but gravelly so unlikely		No odour		Very slight gas odour	Slight to medium gas odour	Not recorded but gravelly so unlikely	No gas odour	No gas odour	Not recorded	Slight gas odour	Not recorded but gravelly so unlikely	Slight organic odour
6.00	No odour						Not recorded but gravelly so unlikely		No odour		Very slight gas odour	Slight to medium gas odour	Not recorded but gravelly so unlikely	No gas odour	No gas odour	Not recorded	Medium gas odour	Not recorded but gravelly so unlikely	Slight organic odour
7.00	No odour						Not recorded but gravelly so unlikely		No odour		Very slight gas odour	Slight gas odour	Not recorded but gravelly so unlikely	No gas odour	No gas odour	Not recorded	Medium gas odour	Not recorded but gravelly so unlikely	Slight organic odour
8.00	No odour								No odour							Not recorded but gravelly so unlikely			
9.00	No odour															Not recorded but gravelly so unlikely			
10.00	No odour															Not recorded but gravelly so unlikely			



	Former W0047-02 Waste Licence Boundary
	No Odour Detected
	Slight Odour Detected
	Moderate/Medium Odour Detected
	Strong Odour Detected
	Very Strong Odour Detected



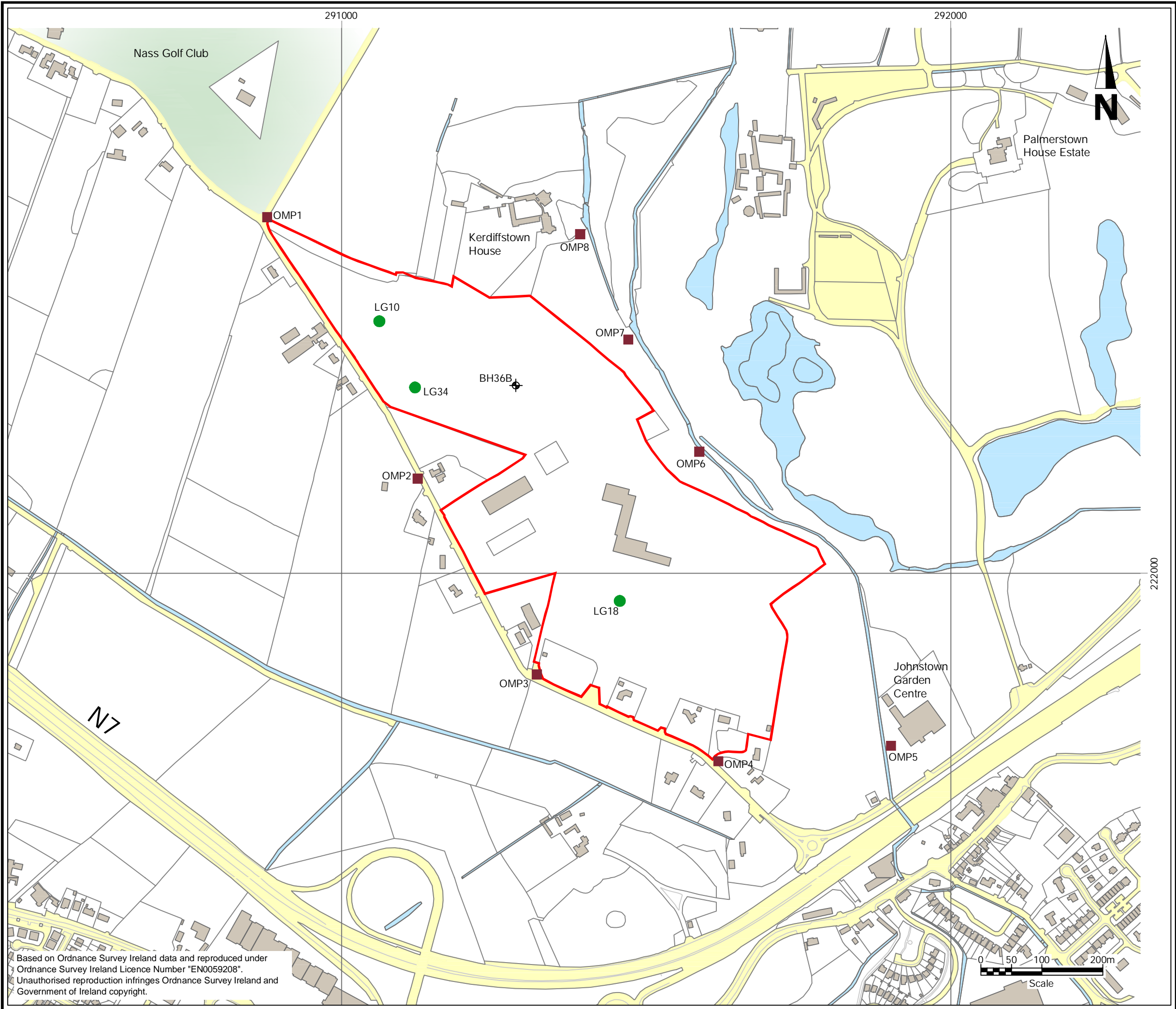
KERDIFFSTOWN LANDFILL
SITE REMEDIATION PROJECT

DRAWING 1
ODOUR PROFILE



SKM ENVIROS

Ref: I:\Enviros\Design\PROJECTS\JLW\JL30689\Figures\Task 71
Plot date: May 23, 2013 - 5:18pm
File name: HLD3833.dwg
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KEY:

- Former WA0047-02 Waste Licence Boundary
- LG24 On-site Trace Gas Analysis Location
- OMP3 Off-site Odour Monitoring Point

REV.	DESCRIPTION	DATE
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KERDIFFSTOWN LANDFILL
SITE REMEDIATION PROJECT

DRAWING 2
ODOUR MONITORING LOCATIONS

SCALE	PROJECT No.
1:6,000 @ A3	JL30689
CONTENT	DRAWN
UD	HLD
CHECKED	DATE
DRAFT	17/05/2013

