



# **Landfill Gas Risk Assessment**

**52 Golf Road, Oakleigh South,  
Victoria**

**Golf Road Project Development  
February 2021**

**Client No: G0092**

**Job No: 37947**

# Statement of Limitations

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## **Sampling Risks**

Prensa acknowledges that any scientifically designed sampling program cannot guarantee all sub-surface contamination will be detected. Sampling programs are designed based on known or suspected site conditions and the extent and nature of the sampling and analytical programs will be designed to achieve a level of confidence in the detection of known or suspected subsurface contamination. The sampling and analytical programs adopted will be those that maximises the probability of identifying contaminants. Golf Road Project Development must therefore accept a level of risk associated with the possible failure to detect certain sub-surface contamination where the sampling and analytical program misses such contamination. Prensa will detail the nature and extent of the sampling and analytical program used in the investigation in the investigation report provided.

Environmental site assessments identify actual subsurface conditions only at those points where samples are taken and when they are taken. Soil contamination can be expected to be non-homogeneous across the stratified soils where present on site, and the concentrations of contaminants may vary significantly within areas where contamination has occurred. In addition, the migration of contaminants through groundwater and soils may follow preferential pathways, such as areas of higher permeability, which may not be intersected by sampling events. Subsurface conditions including contaminant concentrations can also change over time. For this reason, the results should be regarded as representative only.

Golf Road Project Development recognises that sampling of subsurface conditions may result in some cross contamination. All care will be taken and the industry standards used to minimise the risk of such cross contamination occurring, however, Golf Road Project Development recognises this risk and waives any claims against Prensa and agrees to defend, indemnify and hold Prensa harmless from any claims or liability for injury or loss which may arise as a result of alleged cross contamination caused by sampling.

## **Reliance on Information Provided by Others**

Prensa notes that where information has been provided by other parties in order for the works to be undertaken, Prensa cannot guarantee the accuracy or completeness of this information. Golf Road Project Development therefore waives any claim against the company and agrees to indemnify Prensa for any loss, claim or liability arising from inaccuracies or omissions in information provided to Prensa by third parties. No indications were found during our investigations that information contained in this report, as provided to Prensa, is false.

## **Recommendations for Further Study**

The industry recognised methods used in undertaking the works may dictate a staged approach to specific investigations. The findings therefore of this report may represent preliminary findings in accordance with these industry recognised methodologies. In accordance with these methodologies, recommendations contained in this report may include a need for further investigation or analytical analysis. The decision to accept these recommendations and incur additional costs in doing so will be at the sole discretion of Golf Road Project Development and Prensa recognises that Golf Road Project Development will consider their specific needs and the business risks involved. Prensa does not accept any liability for losses incurred as a result of Golf Road Project Development not accepting the recommendations made within this report.

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## 1 Introduction

Prensa Pty Ltd (Prensa) was engaged by Golf Road Project Development to conduct a Landfill Gas Risk Assessment (LGRA) of the property located at 52 Golf Road, Oakleigh South, Victoria (the Site). The location of the Site has been illustrated in the **Conceptual Site Model (CSM)**, attached to this report.

## 2 Background

It is understood that Golf Road Project Development has lodged a development plan application for the Site with the City of Monash, the application is for a residential development. Schedule 5 of the development plan overlay (DP05) for the Site requires a risk assessment detailing the risk of landfill gas migration from nearby landfills.

Prensa was previously engaged to complete a Landfill Gas Investigation at the Site in March 2014 (reference: Prensa, *Desktop Landfill Gas Investigation, 1 Beryl Avenue, Oakleigh South, Victoria*, dated March 2014). It is noted that 1-17 Beryl Avenue was the former address and the Site is now identified as 52 Golf Road. The investigation was undertaken on behalf of the Department of Treasury and Finance (DTF), the former property owner, and was undertaken to provide an indication of the potential for landfill gas to be present at the site. The findings of the investigation indicated that landfill gas was unlikely to be present at the Site at levels posing a risk to human health to the proposed future residential users.

Subsequently, Golf Road Project Development acquired the property and engaged Prensa in December 2018 to undertake a review (reference: Prensa, *Review of Desktop Landfill Gas Investigation for 52 Golf Road, Oakleigh South, Victoria* (revised), dated December 2018) of Prensa's previously completed landfill gas investigation to assess whether the landfill gas investigation was still relevant for assessing landfill gas migration.

Golf Road Project Development issued the review to Monash City Council (Council) to support the development application. Council forwarded the review to the Environmental Protection Authority Victoria (EPA) in January 2021 for technical review. EPA's review (reference: EPA Ref: 5011425, *Development Plan 2020 – Development of the land with 86 Townhouses*, 29 January 2021) outlined additional data and methodology requirements necessary for the risk assessment to allow for the development plan application to be considered by Council.

As a result, Prensa was engaged by Golf Road Project Development, in February 2021 to undertake additional landfill gas monitoring at subsurface services at and surrounding the Site to address data gaps identified by EPA and to update Prensa's previously issued LGRA (2018).

## 3 Objective

The objective of this LGRA is to assess the risk of landfill gas migration from the nearby former quarry to satisfy the requirements under Schedule 5 of the development plan overlay for the Site.

## 4 Scope of Works

### 4.1 Key Undertakings

To complete the LGRA, Prensa undertook the following works:

- Conducted a desktop review, including:
  - Previous landfill gas investigations undertaken at the Site;
  - Publicly available EPA information;
  - Dial Before You Dig (DBYD) plans; and
  - Aerial photographs.
- Undertook landfill gas monitoring of the subsurface services using an Inspectra Laser device with an extendable probe capable of detecting methane concentrations at a sensitivity of 1 ppm at fourteen (14) locations, including a background location; and
- Prepared this summary report.

### 4.2 Assessment Boundaries

The Assessment is limited to the accessible subsurface services at and adjacent the Site, along Golf Road and Beryl Avenue.

### 4.3 Regulatory Framework

The LGRA was conducted in general accordance with the following:

- Victorian Government, *Environment Protection Act 1970*;
- Victorian Government, *State Environment Protection Policy (Prevention and Management of Contamination of Land)*, 2002;
- EPA Victoria, Publication 788.3, *Siting, Design, Operation and Rehabilitation of Landfills*, 2015 (Landfill BPEM);
- EPA Victoria, Publication 1323.3, *Landfill Licensing Guidelines*, April 2016;
- EPA Victoria, Publication, *Closed Landfill Guidelines*, January 2018;
- EPA Victoria, Publication 1684, *Landfill Gas Fugitive Emissions Monitoring Guidelines*, 2018; and
- UK CIRIA C665, *Assessing Risks Posed by Hazardous Ground Gases to Buildings*, 2007.

## 5 Methodology

### 5.1 Landfill Gas Risk Assessment

It is noted that DPO5 requires a landfill gas risk assessment in accordance with the EPA Publication 788.1, *Siting, design, operation and rehabilitation of landfills*, August 2010 (EPA788.1). The EPA788.1 identified in DPO5 has been revised twice with the latest version being EPA Publication 788.3 dated August 2015 (Landfill BPEM). The updates to the document have not significantly altered the manner in which landfill gas assessment is undertaken compared to that set out in EPA788.1. However, the more recent version has been used as the basis for this assessment.

The Landfill BPEM provides guidance relating to the technical requirements for siting, design, operation, management and monitoring of landfills in Victoria. Landfill operators and owners are expected to meet the objectives and required outcomes by implementing the relevant best practice measures described by the Landfill BPEM as ‘suggested measures’. Further, EPA may require additional measures to be undertaken to protect the environment.

The following elements are considered to be relevant to the assessment of landfill gas risk at the Site:

- The Landfill BPEM specifies buffer distances to buildings and structures for Type 3 (solid inert waste) and Type 2 (putrescible waste) landfills as 200 m and 500 m, respectively;
- The Landfill BPEM identifies the following landfill gas action levels (hereafter referred to as Landfill BPEM trigger levels):
  - 1% v/v methane and 1.5% v/v carbon dioxide above background concentration within the subsurface geology at the landfill boundary;
  - 10,000 ppm of methane within the subsurface services on the landfill and within adjacent areas; and
  - 5,000 ppm of methane within buildings and structures on the landfill and in adjacent areas and 1% v/v methane within buildings.
- The recommended method to evaluate the level of risk posed by landfill gas from an individual site is to conduct a site-specific landfill gas risk assessment (LGRA). Guidance on how to complete a LGRA is provided in the *Landfill Licensing Guidelines* (EPA Publication 1323.3, April 2016); and
- Appendix 2 of the *Landfill Licensing Guidelines*, as well as Appendix 2 of the *Closed Landfill Guidelines*, sets out the basic landfill gas risk assessment process as follows:
  - Development of a conceptual model of the landfill and its surroundings;
  - Hazard identification and risk screening; and
  - Basic quantitative or qualitative risk assessment.

The process recommended in Appendix 2 of the *Landfill Licensing Guidelines* and the *Closed Landfill Guidelines* is based on the procedure described in the UK Environment Agency, *Guidance on the management of landfill gas* (LFTGN 03), September 2004.

Prensa has developed a CSM based on available data collected for the site. Prensa has also collected monitoring data to support the CSM.

## 5.2 Landfill Gas Subsurface Service Monitoring

A Gazomat Spectra Laser CH<sub>4</sub> analyser (serial no. 8609) (inspectra laser) was used to detect the concentrations of methane in identifiable pits and drains at and surrounding the Site. The inspectra laser unit employed was a low-concentration methane detector with an extendable probe that detects methane in parts per million in accordance with Table 2 of EPA Publication 1684. The calibration certificate for the inspectra laser is attached to this report.

Prensa conducted one (1) round of subsurface service monitoring at fourteen (14) locations at and surrounding the Site on the 18<sup>th</sup> February 2021. Prior to monitoring of subsurface services, a background reading in ambient air was recorded. The work began at 7:30 am and finished at 11:00 am. The monitoring was completed on a day of reducing barometric pressure (refer to **Section 7.2**). Efforts were made to monitor the pits through penetrations in the lids as opposed to lifting the lid.

The monitoring locations are illustrated in the **CSM** attached to this report.

## 6 Desktop Review

### 6.1 Previous Assessments

A number of previous assessment reports were reviewed, including:

- Beveridge Williams, *Contamination Assessment Oakleigh South Primary School Beryl Avenue, Oakleigh South*, February 2000.
- Beveridge Williams, *Validation Sampling and Testing, Oakleigh South Primary School Beryl Avenue, Oakleigh South*, June 2002.
- Beveridge Williams, *Contamination Assessment Oakleigh South Primary School Beryl Avenue, Oakleigh South*, May 2003.
- Golder Associates Pty Ltd, *Preliminary Contamination Assessment & Cost Estimate – DET Site, Oakleigh South*, 11 November 2005.
- HLA Envirosciences Pty Ltd (HLA), *Environmental Site Assessment Former Oakleigh South Primary School, Beryl Avenue, Oakleigh South*, 1 December 2006.
- HLA, *Groundwater Assessment Former Oakleigh Primary School, Beryl Avenue, Oakleigh South*, 19 January 2007.
- HLA, *Additional Environmental Site Assessment Former Oakleigh South Primary School, Beryl Street, Oakleigh, Victoria*, 9 January 2008.
- Prensa, *Phase 1 Preliminary Environmental Site Assessment – Former Oakleigh South Primary School, Oakleigh South VIC 3167*, August 2010.
- Senversa, *Review of Various Environmental Site Assessment Reports Former Oakleigh South Primary School, 1 Beryl Avenue, Oakleigh South VIC 3167*, 22 February 2012.
- Prensa, *Environmental Site Assessment, 1 Beryl Avenue, Oakleigh South, Victoria, Revision 1*, August 2013.
- Prensa, *Site Development Management Plan, 1 Beryl Avenue, Oakleigh South, Victoria*, August 2013.

No reference was made within the aforementioned documents regarding the potential for landfill gas to be present at the Site.

The previous landfill gas investigation completed by Prensa (2014) is summarised below.

#### 6.1.1 Summary of Previous Desktop Landfill Gas Investigation

The objective of the Desktop Landfill Gas Investigation previously completed by Prensa was to, ‘provide an indication of the potential for landfill gas to be present at the Site, which may represent a potential risk to the proposed future residential use of the Site.’

As part of the *Desktop Landfill Gas Investigation*, Prensa undertook the following:

- Desktop review, including:
  - Review of environmental assessment reports relating to the Site;
  - Liaising with EPA Victoria and the City of Monash;
- Site inspection and monitoring using a portable landfill gas monitor; and
- Preparation of a report outlining the findings.

The desktop review identified a former sand quarry, alternatively identified as ‘the Cavanagh Sands Quarry’ or the ‘Centre Road Quarry’, which was located on the corner of Centre and Warrigal Roads, approximately 200 m southwest of the Site.

In summary, the *Desktop Landfill Gas Investigation* identified that the Cavanagh Sands Quarry was:

- Used as a sand quarry;
- The sand quarry was located at the Cavanagh Sands property, potentially since 1931.
- Backfilled with “*clean fill*” according to City of Monash and “*solid fill*” – “*inert*” according to EPA Victoria, following its closure. Based on aerial photographs, filling appeared to have begun in the 1980s and was completely backfilled by 1991;
- Rezoned from an Industrial 1 Zone (IN1Z) to a Business 3 Zone (B3Z), in accordance with the City of Monash planning scheme;
- Redeveloped into a “*Large Format Home Improvement Store and Supermarket*” circa 2012, in accordance with the rezoning information provided by City of Monash.

Preliminary landfill gas monitoring was undertaken by Prensa at the Site in January 2014 at nine (9) locations, which predominantly comprised stormwater drains, service pits and a groundwater monitoring well. The monitoring reported methane at 0.0% v/v, and carbon dioxide at 0.0-14.7% v/v, consistent with ambient air readings.

The results were below BPEM Action Levels and confirmed that significant subsurface landfill gas migration was not occurring within the onsite underground services.

It was noted that although the portable landfill gas monitor used (GFM410) had a sensitivity that would detect concentrations of methane at 10,000 ppm (BPEM Action Level) it was not suitable for detecting concentrations marginally below the BPEM Action Level. As concentrations below the BPEM Action Level could represent a potential risk, monitoring of landfill gases with a more sensitive instrument is appropriate.

Based on the site history review and landfill gas monitoring undertaken, Prensa considered it unlikely that the Cavanagh Sands Quarry had been filled with putrescible wastes and considered the potential was low for landfill gas to be present at the Site that would pose a potential health risk to future low-density residential users of the Site.

## 6.2 EPA Victoria Information

Due to the time since the Prensa investigation in 2014, a review and update of desktop resources was completed. This included a review of publicly available information from EPA Victoria:

- A search of EPA Victoria audit reports indicated that an environmental audit had not been undertaken at the former Cavanagh Sands Quarry nor within the vicinity of the former Cavanagh Sands Quarry since the 2014 review.
- Prensa reviewed the interactive Victorian Landfills Register Map (<https://nationalmap.gov.au>) on 24 February 2021. The map identified one (1) solid inert landfill located at 19 - 71 Carroll Road, Oakleigh South, approximately 800 m south-southeast of the Site. A search of the EPA interaction portal indicated that a Post Closure Pollution Abatement Notice (PC PAN) had been issued to this site on 6 September 2016.
- Prensa reviewed the Priority Sites Register on 24 February 2021. The landfill located at Carroll Road was noted to be on the Priority Sites Register as a former landfill requiring ongoing management. No other sites were listed in the vicinity of the Site.

### 6.3 Dial Before You Dig

Prensa requested and reviewed Dial Before You Dig (DBYD) Plans available for the Site and the surrounding area, including the former quarry. The review was undertaken to gain an understanding of the underground services present, which could potentially be serving as a preferential pathway for the migration of landfill gas from the former quarry.

A review of the plans indicated that the South Eastern Trunk Sewer is present running in a north-western to south-eastern direction in between the Site and the former quarry.

Review of the Locality Plan and Longitudinal Section provided by Melbourne Water indicated that the sewer pipeline located between the Site and the former landfill was approximately 3.5 m diameter, with the invert located approximately 3 m below surface.

Copies of the Melbourne Water plans are provided in **Appendix A**.

## 7 Landfill Gas Monitoring - February 2021

### 7.1 Field Results

Prensa visited the Site on 19<sup>th</sup> February 2021 to address the data and methodology gaps identified by the EPA, as well as provide additional data to support the CSM for the Site. The assessment comprised monitoring at sub-surface services at and surrounding the Site using a portable landfill gas analyser (Inspectra Laser Gas Leak Detector) with an extendable probe capable of measuring low-concentration methane in parts per million (ppm).

Gas measurements were taken to assess for the presence of landfill related gases on and surrounding the Site. Prior to monitoring of subsurface services, a background reading in ambient air was recorded. A total of fourteen (14) measurements were collected. Specific locations have been illustrated within the **CSM** attached to this report.

In summary, concentrations of methane were not reported above the actions levels at the monitoring locations (refer to **Table 1**).

Location	Description	Methane (%)	
		Peak	Stabilised
LG01	Stormwater drain	2.2	2.0
LG02	Stormwater drain	2.4	2.2
LG03	Stormwater drain	2.0	1.9
LG04	Stormwater drain	1.9	1.8
LG05	Stormwater drain	1.7	1.6
LG06	Stormwater drain	0.9	0.8
LG07	Telstra Pit	1.3	1.2
LG08	Service pit	1.5	1.4
LG09	Telstra pit	1.8	1.6
LG10	Telstra pit	2.1	2.0
LG11	Stormwater	2.3	2.1

**Table 1: Gas Measurement Results**

<b>LG12</b>	Telstra Pit	0.9	0.7
<b>LG13</b>	Stormwater	0.7	0.5
<b>LG14</b>	Stormwater	1.6	1.4
<b>Background</b>	Golf Road - north west of site	2.2	0.5

At the time of the assessment it was noted that high vehicle traffic was observed nearby sampling locations LG01 and LG02.

The background measurements correlated with that stated in EPA Publication 1684, *Landfill Gas Fugitive Monitoring Guideline's*, that global background methane concentrations is ~ 1.8ppm and is likely to be influenced by emissions from vehicles and industrial/commercial emissions.

## 7.2 Weather Conditions

Weather conditions were obtained from the Bureau of Meteorology (BoM) website. It is acknowledged that changes in weather conditions, particularly atmospheric pressure can impact the concentrations of soil vapour during sampling and should be considered in evaluating the dataset.

Prensa undertook the monitoring on 19<sup>th</sup> February, a day of reducing barometric pressure, with weather data summarised in **Table 2** and detailed data provided in **Appendix D**.

**Table 2: Weather Conditions**

Date	Daily Rainfall (mm)	7:30 am		9:30am	
		Temp (°C)	Pressure (hPa)	Temp (°C)	Pressure (hPa)
<b>17<sup>th</sup> February 2021</b>	0.0	18.1	1021.3	22.1	1021.9
<b>18<sup>th</sup> February 2021</b>	0.0	21.4	1022.2	23.8	1022.7
<b>19<sup>th</sup> February 2021</b>	0.0	20.6	1017.5	25.2	1016.9



## 8 Risk Assessment

As described in **Section 5.1**, Appendix 2 of the *Landfill Licensing Guidelines*, as well as Appendix 2 of the *Closed Landfill Guidelines*, sets out the basic landfill gas risk assessment process as follows:

- Development of a conceptual model of the landfill and its surroundings;
- Hazard identification and risk screening; and
- Basic quantitative or qualitative risk assessment.

The following sections outline this process.

### 8.1 Conceptual Site Model

Based on the findings of the desktop review, a CSM was developed for the Site (refer to the attached **CSM**).

A summary of data reviewed in developing the CSM is provided in the table below.

Table 3: Data Reviewed		
CSM Factors	Assessment Results/Comments	
Nature of Source	<b>Age of Filling</b>	Aerial photographs (refer to <b>Appendix B</b> ) indicated the quarry was potentially present from as early as 1931.
	<b>Nature of Waste Received</b>	<ul style="list-style-type: none"> <li>• Backfilled with “<i>clean fill</i>” according to City of Monash (written information obtained from Waste Service Project Officer of the City of Monash) (refer to <b>Appendix C</b>); and</li> <li>• Backfilled with “<i>solid fill</i>” – “<i>inert</i>” according to EPA Victoria, following its closure</li> </ul>
	<b>Quarry Design</b>	It is presumed that the former quarry is unlined and does not have an engineered cap.
	<b>Scale of Quarry Operations</b>	Conservatively estimated at 2.5 hectares based on the review of aerial photographs (refer to <b>Appendix B</b> )
Landfill Gas Migration Pathways	<b>Geology and Hydrology</b>	<ul style="list-style-type: none"> <li>• Quaternary aged high level alluvium surrounded by quaternary-aged sand ridges and sand hills – Sourced from Geological Map Series Melbourne Map Sheet 1:63,360, No. 849, Zone 7, Ringwood (<b>Appendix D</b>).</li> <li>• Groundwater monitoring previously completed at the Site (reference: Prensa, <i>Environmental Site Assessment</i>, August 2013) indicated that groundwater was shallow, with gauging data identifying groundwater between approximately 2.2 to 3.3 m below ground level.</li> </ul>
	<b>Preferential Pathways</b>	Based on DBYD plans obtained for the Site (refer to <b>Appendix A</b> ), a trunk sewer is present between the former quarry and the Site. The sewer is approximately 3.5 m diameter and located approximately 3 m below surface (refer to attached <b>CSM</b> ). The trunk sewer does not connect the landfill and the Site, but may present a preferential pathway for lateral migration of landfill gas from the landfill.
	<b>Buffer distance</b>	<p>The distance to the Site from the Cavanagh Sands Quarry is approximately 200 m, which is the buffer distance recommended for solid inert landfills.</p> <p>The distance to the Site from the Carrol Road Landfill is approximately 800 m, which is greater than the recommended buffer distance.</p>



**Table 3: Data Reviewed**

<b>Receptors</b>	<b>Nature of Development</b>	The proposed future development comprises residential townhouses with no proposed basement levels.
	<b>Previous Landfill Gas Data</b>	Prensa, <i>Desktop Landfill Gas Investigation, 1 Beryl Avenue, Oakleigh South, Victoria, March 2014</i>

## 8.2 Hazard Identification and Risk Screening

The CSM describes the properties of the source, pathways and receptor, including whether any source-pathway-receptor linkages actually exist. In the context of assessing risks posed by landfill gas migration, if it can be shown that there is no plausible connection or pathway between a potential landfill gas source and the receptor of concern, then the situation cannot be considered to pose a risk. Where complete or potentially complete source-pathway-receptor linkages are identified, the risk posed by the linkages is further assessed.

The hazard identification and risk screening stage should have the following overall objectives:

- Development of an understanding of the proposed or existing landfill in its environmental setting (the conceptual model described above), including identification of all possible sources of risk, the pathways and the potential receptors;
- Consideration of the sensitivity of receptors and initial selection of the appropriate trigger levels for each receptor or groups of receptors; and
- Consideration of the potential impacts on each receptor. This may be achieved by using a simple quantitative or qualitative process that systematically examines each source–pathway–receptor linkage and determines the potential impact. For each receptor, this analysis should prioritise the risks and the requirements to be evaluated for further risk assessment.

In reviewing the source, pathway and receptor risk factors of the CSM, the following aspects have been considered:

### 8.2.1 Source

- The potential source of the landfill gas is approximately 30 years old. As waste degrades over time, its ability to produce methane diminishes. Whilst the time will vary based on many factors, the key period of landfill gas production is generally within 30 years of waste placement. As such the likelihood of sites producing significant quantities of landfill gas that may migrate to the development site is diminished and likely to be low; and
- Information suggests the quarry was backfilled with either clean fill or solid inert fill, both of which have a low potential for methane gas generation.

### 8.2.2 Pathways

- The distance to the Site from the Cavanagh Sands Quarry is approximately 200 m, which is the buffer distance recommended for solid inert landfills;
- The geology at the Site has been identified as Quaternary aged high level alluvium, which is conducive to gas migration through the silty sand. The porous nature of the geology provides opportunity for vertical migration of the landfill gas rather than lateral migration (towards the Site);

- Underground services have the potential to create a preferential pathway. A sewer main identified to run through the area in between the former quarry and the Site would likely intercept vapour movement moving from the former quarry to the Site and provide a preferential pathway for landfill gas migration (away from the Site);
- Groundwater monitoring previously completed at the Site (reference: Prensa, *Environmental Site Assessment*, August 2013) indicated that groundwater was shallow, with gauging data identifying groundwater between approximately 2.2 to 3.3 m below ground level. This limits the ability for landfill gas to migrate laterally in the subsurface soils;
- Landfill gas monitoring undertaken by Prensa in 2014 from subsurface services and a groundwater monitoring well did not indicate the presence of landfill gas; and
- Landfill gas monitoring undertaken by Prensa in 2021 from subsurface services (refer to **Section 8**) did not indicate the presence of landfill gas.

### 8.2.3 Receptor

- The proposed future development comprises residential townhouses with no proposed basement levels.

## 8.3 Basic qualitative risk assessment

A qualitative assessment has been developed for risk screening purposes. The assessment has been based on the LFTGN03 (EA, 2004) and is consistent with the landfill gas risk assessment recommended approach in Appendix 2 of EPA Publication 1490.1. The consequence categories, likelihood categories, severity likelihood matrix and risk evaluation scores are provided in **Table 4** to **Table 6** below.

Risk is defined as a function of the likelihood of a hazard occurring and the consequences of that hazard, as represented by the following equation:

$$\text{Risk} = \text{Consequence} \times \text{Likelihood}$$

Using a qualitative method, consequence and likelihood are defined based on qualitative criteria consistent with EPA, CIRIA and UK Environment Agency guidelines. Qualitative levels of consequence associated with fire, explosion and asphyxiation hazard used in the risk assessment are presented in **Table 8**.

Table 4: Consequence Categories	
Category	Indicative Definitions
1 Minor	No health impacts. Nuisance on site only (no off-site effects). No outside complaint.
2 Moderate	Noticeable nuisance off-site, e.g. discernible odours. Minor breach of permitted emission limits, but no environmental harm. Landfill gas odours noted in outdoor spaces. One or two complaints from the public.
3 Significant	Severe and sustained nuisance, e.g. strong offensive odours. First aid required. Major breach of permitted emissions limits with possibility of prosecution. Landfill gas odours noted in indoor spaces. Numerous public complaints.

**Table 4: Consequence Categories**

<b>4</b>	<b>Major</b>	<p>Large environmental release or incident which directly affects off-site receptors.</p> <p>Persistent landfill gas odours.</p> <p>Hospital treatment required.</p> <p>Public warning and off-site emergency plan invoked.</p>
<b>5</b>	<b>Severe</b>	<p>Evacuation of local populace.</p> <p>Temporary disabling and hospitalisation.</p> <p>Serious toxic effect on beneficial or protected species.</p> <p>Widespread but not persistent damage to land.</p>
<b>6</b>	<b>Extreme</b>	<p>Substantial impacts to broader environment, long term environmental damage.</p> <p>Major release with serious off-site effects.</p> <p>Death or injury requiring hospitalisation or medical attention.</p> <p>Catastrophic damage to buildings and structures.</p> <p>Incidents involving fire or explosion.</p> <p>Extensive remediation required.</p> <p>Site shutdown.</p>

**Table 5: Consequence Categories**

Category	Indicative Definitions	Indicative Frequency	
<b>1</b>	<b>Highly Unlikely</b>	<p>Theoretically possible but not expected to occur unless circumstances affecting the hazard change.</p> <p>A credible linkage exists but circumstances are such that it is improbable that a trigger hazardous event would occur within the timeframe of concern.</p>	Once in 50 years
<b>2</b>	<b>Unlikely</b>	<p>Event has not occurred and is unlikely to occur at the site.</p> <p>A credible linkage exists and circumstances under which a trigger hazardous event could occur are possible. However, it is by no means certain that the event will occur within the timeframe of concern and is less likely in the short term.</p>	Once in 30 years
<b>3</b>	<b>Possible</b>	<p>Event has not occurred but may occur within the next few years</p>	Once in 10 years
<b>4</b>	<b>Likely</b>	<p>Event has occurred and is likely to occur again.</p> <p>A credible linkage exists, and all necessary elements required for a trigger hazardous event to occur are present. Occurrence is not inevitable, but it is possible in the short term, and probable over the full timeframe of concern.</p>	Once in three years
<b>5</b>	<b>Almost Certain</b>	<p>Event has occurred and is likely to occur on a regular basis.</p> <p>A credible linkage exists, and a trigger hazardous event is very likely to occur in the short term, and almost inevitable over the full timeframe of concern. The likelihood of state consequence is also high.</p>	Once a year or more frequently

Table 6: Risk Matrix							
Likelihood		Severity of Consequences					
		Minor	Moderate	Significant	Major	Severe	Extreme
1	Highly likely	1	2	3	4	5	6
2	Unlikely	2	4	6	8	10	12
3	Possible	3	6	9	12	15	18
4	Likely	4	8	12	16	20	24
5	Almost certain	5	10	15	20	25	30

Table 7: Risk Ratings Associated with Fire, Explosion and Asphyxiation Hazards	
Magnitude of Qualitative Risk	Score
Low	1 to 4
Medium	5 to 10
High	11 to 15
Very High	16 to 20
Extreme	21 to 30

### 8.3.1 Landfill Linkages and Qualitative Risk Analysis

Potential source-pathway-receptor linkages are summarised in **Table 8**.

**Table 8: Landfill Gas Linkages and Qualitative Risk Analysis**

Source and Pollutants	Migration Pathway	Receptor	Consequence	Likelihood	Comments	Risk
<b>Offsite quarry Methane and carbon dioxide</b>	Lateral migration via subsurface silty sand towards Site	Future site users (residential) Future intrusive construction and maintenance workers	Minor	Unlikely	<p>The consequence and likelihood of lateral migration via subsurface silty sand towards the Site was selected based on the following:</p> <ul style="list-style-type: none"> <li>• Waste placed in the landfill is more than 30 years ago;</li> <li>• The landfill is presumed unlined and uncapped;</li> <li>• Fill comprises solid inert or clean fill;</li> <li>• Groundwater is shallow reducing potential for lateral vapour migration;</li> <li>• Underground trunk sewer presents a potential preferential pathway that would likely divert vapour away from the Site; and</li> <li>• The Site is located on the perimeter of the buffer zone.</li> </ul>	Low
	Underground services from landfill to Site		Minor	Unlikely	No services linking former quarry to Site	

## 9 Summary

Based on the conceptual model and the review of the key risk factors and data presented above, Prensa considers that the risk of landfill gas migration occurring and causing an unacceptable human health or environmental impact on the proposed residential development at 52 Golf Road, Oakleigh South, is low. As such, further landfill gas investigation or assessment is not considered warranted. This conclusion is supported by:

- The type (clean fill or solid inert) and significant age (approximately 30 years) of the placed waste;
- The distance to the receptor (approximately 200 m);
- No known issues from the current development overlying the former quarry;
- The presence of a trunk sewer between the former quarry and the Site creating a potential preferential pathway diverting landfill gas away from the Site;
- The shallow depth to groundwater limiting lateral gas migration; and
- The direct monitoring of subsurface services at and surrounding the site providing no evidence of landfill gas migration to the site.

These lines of evidence suggest that there is unlikely to be a pathway for landfill gas migration towards the Site.

## 10 Closing

Should you have any questions or queries regarding the report, please do not hesitate to contact me on (03) 9508 0100.

Yours sincerely,



**Brodie Aumont**  
**HSE Consultant**  
**Prensa Pty Ltd**

# Conceptual Site Model



# 52 Golf Road, Oakleigh South Conceptual Site Model and Sampling Plan



Not to scale - All locations are approximate



Ground Floor,  
5 Burwood Rd,  
Hawthorn VIC 3122

prensa.com.au  
P: (03) 9508 0100  
F: (03) 9509 6125

Client No: G0092      Job No: 37947

Client: Golf Road Project Development

Project: LGRA 52 Golf Road

Address: 52 Golf Road, Oakleigh South

Legend:

- The Site
- Former Quarry
- Sewer main
- ~ Potential Soil Vapour Migration
- LG Sample location

Index Location Map:

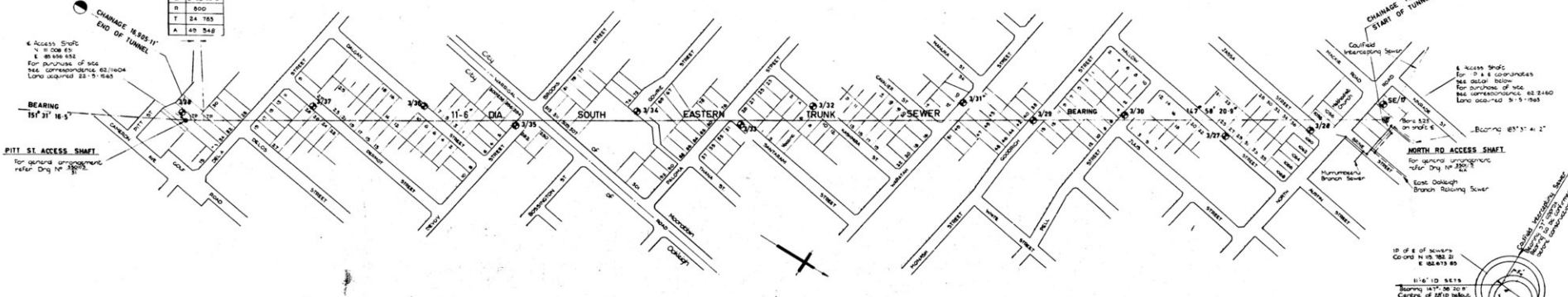
Image Source: Google Maps      Viewed: 23/02/2021

File Name: 37497 LGRA Figure 1		Version: 1	
Drawn By: NTA	Checked By: GXM	Date: 23/02/2021	Figure number: 1



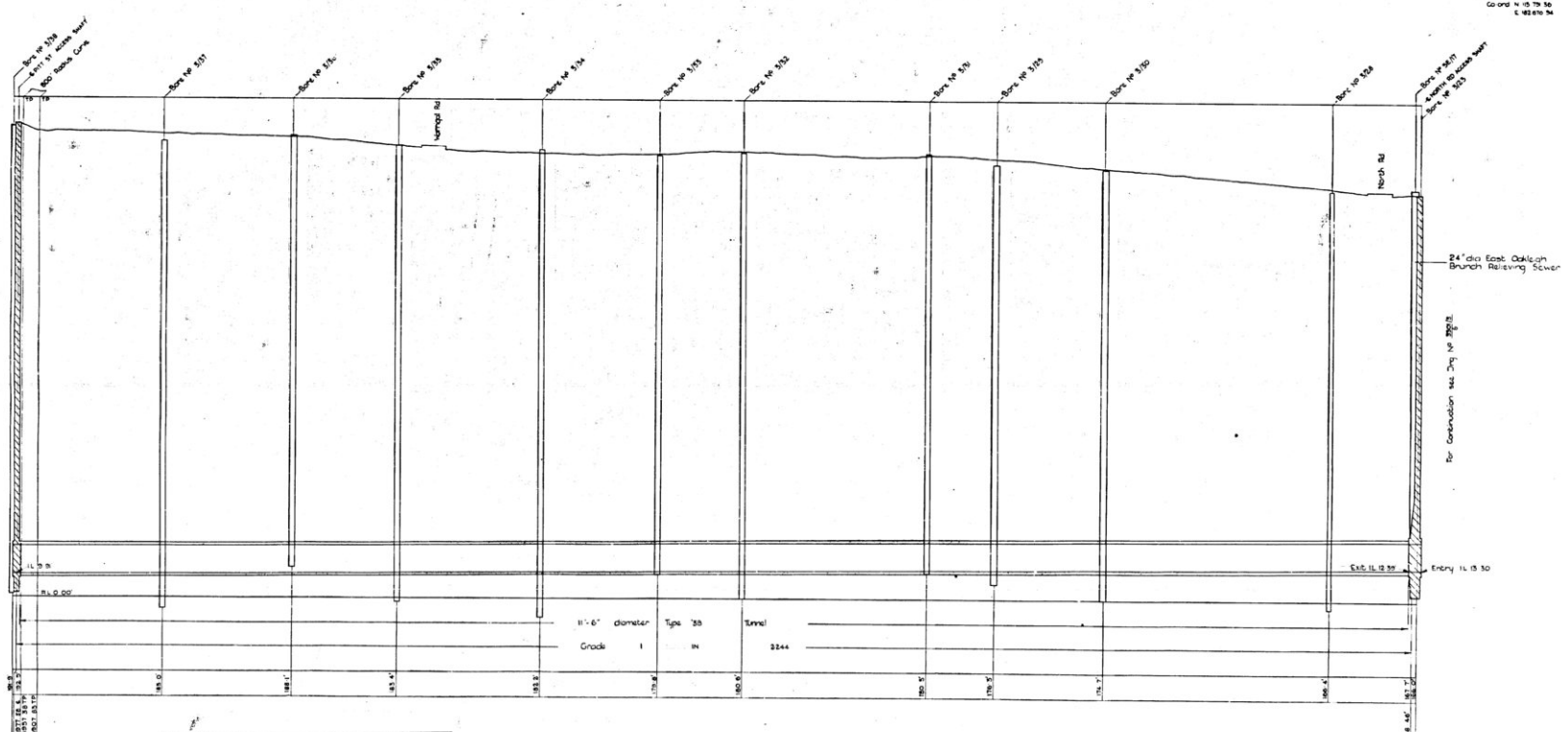
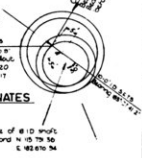
# Appendix A: DBYD Plans

Curve	
1	5° 32' 55.6"
2	800'
3	24' 763'
4	40' 348'



**LOCALITY PLAN**  
Scale: 200 feet to 1 inch

**NORTH RD SHAFT CO-ORDINATES**  
Scale: 20 ft to 1 inch



**LONGITUDINAL SECTION**  
Scale: Vertical 20 feet to 1 inch  
Horizontal 200 feet to 1 inch

FOR AS CONSTRUCTED SURVEY INFORMATION (INVERT LEVEL S TO A.H.D. AND BEARINGS AND CO-ORDINATES TO A.M.G.) REFER TO DRG'S C 3 301 00, 80 & 81.

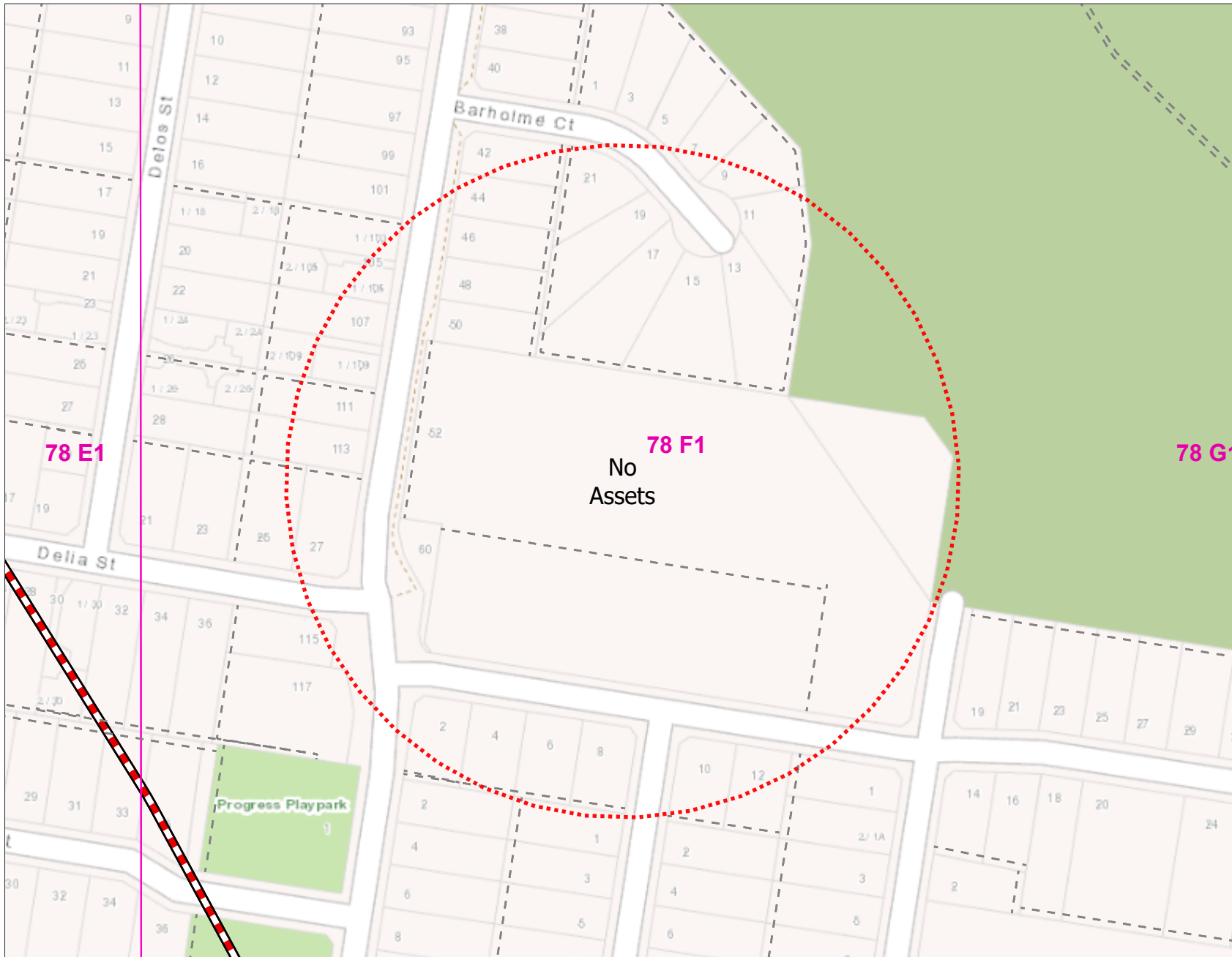
1. For Locality Plan & Longitudinal Section of Section 3 see Drg. No. 3301/3.  
2. For Tunnel Design Sections see Drg. No. 3301/3.  
3. For Details of Boreholes see Plans 5575/3 Boreholes shown thus 3/32.

PASSED <i>John H. Miller</i> ENGINEER IN CHARGE		DESIGNED GEORGE E. J. TRACER R.E.	
		CHECKED J. H. S.	
SUBMITTED <i>John H. Miller</i> ENGINEER IN CHARGE		RECOMMENDED <i>John H. Miller</i> ENGINEER IN CHARGE	
		APPROVED <i>John H. Miller</i> ENGINEER IN CHARGE	

MELBOURNE AND METROPOLITAN BOARD OF WORKS — MAJOR SEWERAGE DESIGN  
 SOUTH EASTERN TRUNK SEWER - SECTION 3  
 PITT ST. ACCESS SHAFT TO NORTH RD. ACCESS SHAFT  
 LOCALITY PLAN AND LONGITUDINAL SECTION

SCALE: AS SHOWN  
 DRAWING NO.  
**3301/3**  
**7A**

REV	DATE	DESCRIPTION



### Legend

- DBYD Enquiry
- Water**
  - Water supply scour
  - Water supply main
  - Abandoned water supply main
  - Water Service Reservoir
  - Cathodic protection zone
- Sewer**
  - Sewer main
  - Abandoned sewer main
- Drainage**
  - Drainage pipeline
  - Drainage Abandoned Main
- Recycled**
  - Recycled (Non Drinking) Water Main
  - Recycled Water Abandoned Main
- Other Infrastructure**
  - Electricity Main

Please refer to map sheet(s) for details

Scale 1:2,500

Assets may contain asbestos material and therefore works on these assets must be undertaken in accordance with OHS (asbestos) Regulations.  
**DISCLAIMER:** While reasonable measures have been taken to ensure the accuracy of the information contained in this plan response, neither Melbourne Water or SmarterWX shall have any liability whatsoever in relation to any loss, damage, cost or expense arising from the use of this plan response or the information contained in it or the completeness or accuracy of such information. Use of such information is subject to and constitutes acceptance of these terms.  
 Vicmap Basemap Services © State of Victoria (Department of Environment, Land, Water and Planning)

## Appendix B: Aerial Photographs



Aerial Photograph 1931



Aerial Photograph 1950





Aerial Photograph 1960



Aerial Photograph 1968





Aerial Photograph 1975



Aerial Photograph 1984





Aerial Photograph 1991



Aerial Photograph 2010





## Appendix C: Email Correspondence

**Holly Butler**

---

**To:** Sarah Fitzpatrick  
**Subject:** RE: Information regarding landfill gas sites

**From:** Sarah Fitzpatrick [mailto:sarah.fitzpatrick@prensa.com.au]  
**Sent:** Wednesday, 29 January 2014 10:49 AM  
**To:** Butler  
**Subject:** FW: Information regarding landfill gas sites

**Sarah Fitzpatrick | HSE Consultant | Prensa Pty Ltd**  
**Office:** 261-271 Wattletree Rd, Malvern VIC 3144  
**Postal Address:** PO Box 2203, Wattletree Rd LPO, East Malvern VIC 3145  
**Phone:** (03) 9508 0100 **Mobile:** 0401 637 344  
**Email:** [sarah.fitzpatrick@prensa.com.au](mailto:sarah.fitzpatrick@prensa.com.au) | **Web:** [www.prensa.com.au](http://www.prensa.com.au)



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---

**From:** April Williams [mailto:AprilW@monash.vic.gov.au]  
**Sent:** Thursday, 23 January 2014 11:58 AM  
**To:** 'Sarah Fitzpatrick'  
**Subject:** RE: Information regarding landfill gas sites

Hi Sarah,

I have forwarded your questions to the relevant manager and this is his response:

I refer to your request regarding information on Talbot Road and 1041-1049 Centre Road. The Council operated landfill at Talbot Road was filled between 1977 -78 with putrescible waste. This was a small landfill with monitoring undertaken which showed no migration of gas at the boundaries. This was undertaken some 5 years ago. The Centre Road/Warrigal site was operational from 1940 and was filled using clean fill.

In regards to your request for the development proposal for the sites, I have requested this information from our Town Planning department. Some of these files are stored off-site, but when these are retrieved, I will be able to provide you with information from the files.

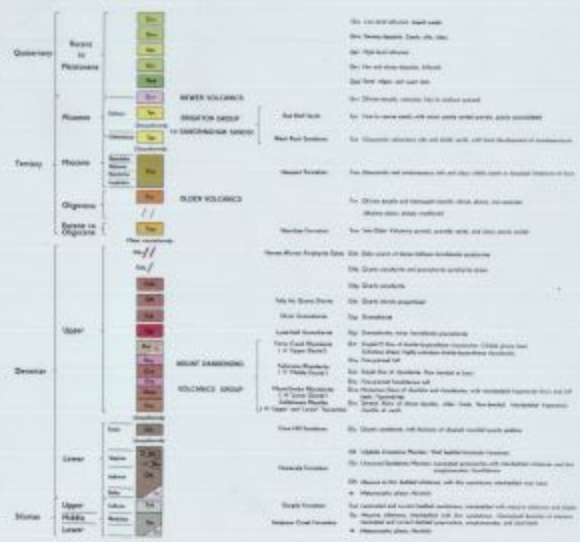
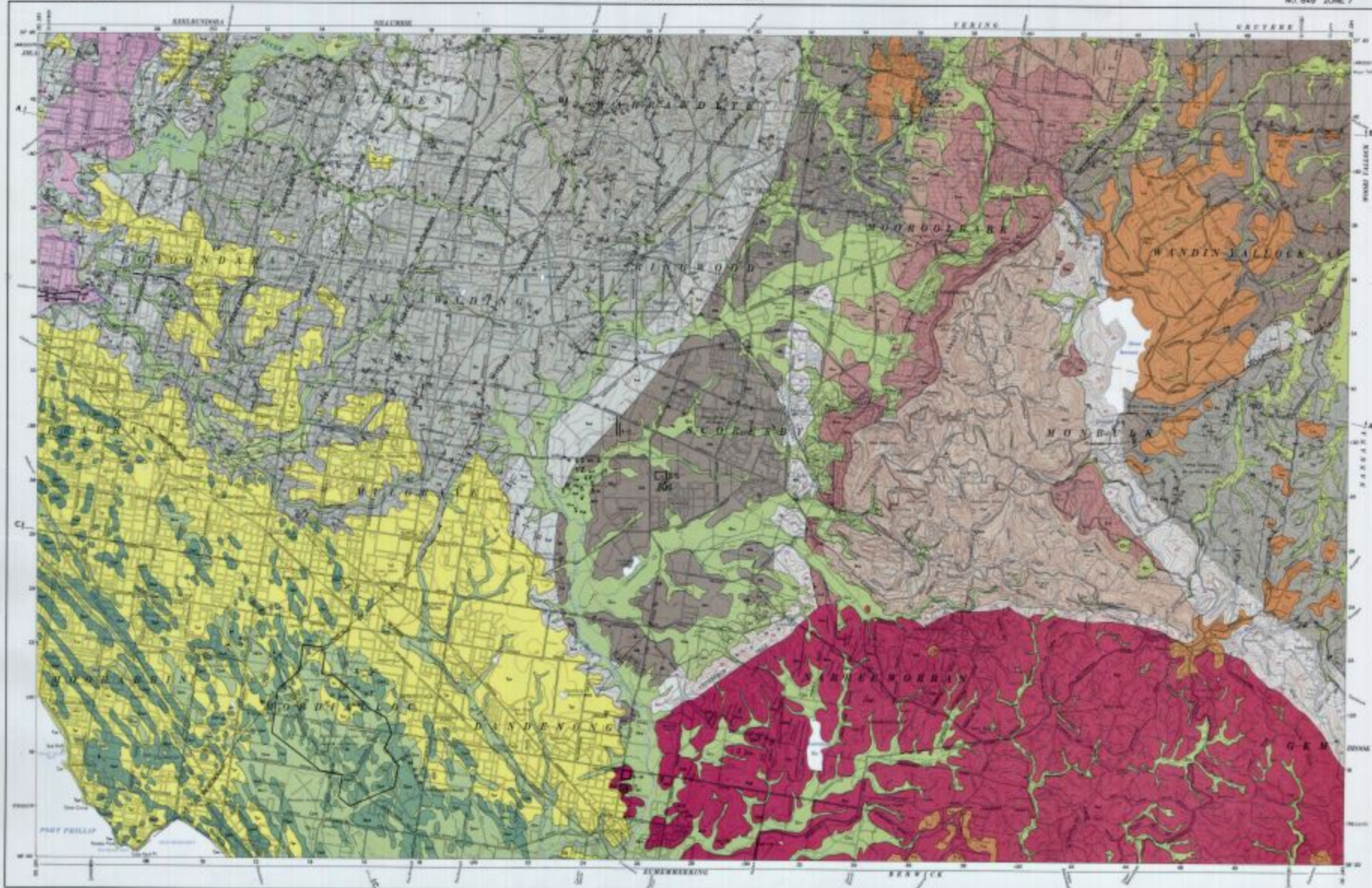
Thanks,



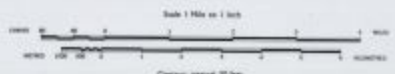
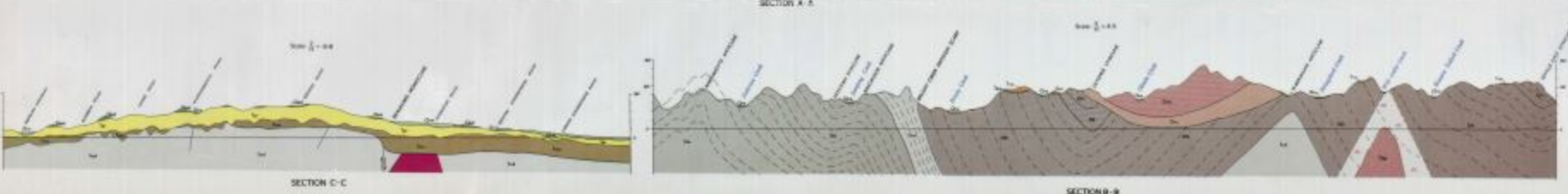
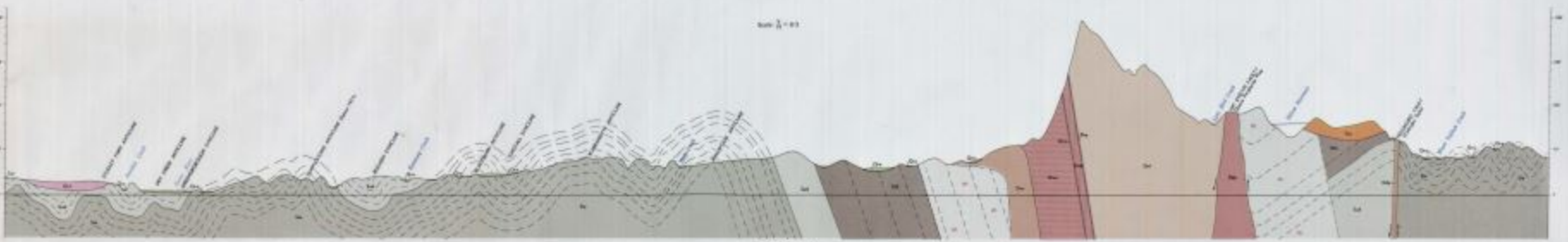
**April Williams**  
**Waste Services Project Officer**

## Appendix D: Geological Map





INDEX TO GEOLOGICAL SHEETS		
8400	8401	8402
8403	8404	8405
8406	8407	8408



Geological Survey of Victoria, Melbourne  
 1911  
 Printed and Published by the Government Printer, Melbourne  
 1911



# Appendix E: Calibration Certificate

Date: 9.10.20

Attn: MeeLan Liew  
Air-Met Scientific Pty. Ltd.  
7-11 Ceylon Street  
Nunawading  
Vic. 3131

O/N 725745

## Calibration Verification Certificate # 5127

Manufacture/Model	: Gazomat Inspectra Laser CH4 analyser	
S/N	: 860916	
Gases Monitored	: CH4, 0-100%	
		Specification +/-10%
N2 BOC High Purity reads	: 0.0ppm	
10ppm +/-10% CH4 in Air reads CAC W0256901-1	: 10.ppm	(9-11ppm) Conforms
500ppm +/- 2% CH4 in Air reads CAC W0228926-4	: 537ppm	(450-550ppm) Conforms
2500ppm +/- 2% CH4 in Air reads CAC W0256895-1	: 2620ppm	(2250-2750ppm) Conforms
1.0% +/- 2% CH4 in Air reads CAC W0246480-7	: 10157ppm (1.0%)	(0.9-1.1%) Conforms
2.5% CH4 in Air reads CAC W0246482-14	: 2.5%	(2.25-2.75%) Conforms
99.9% CH4 reads Coregas	: 102.5%	(90-110%) Conforms
Comments	: Calibration OK	
Next Service/calibration Due	: 9.10.21	
Stephen Hurst ANRI Instruments & Controls Pty Ltd		