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Project 71459.10
28 February 2019
71459.10.R.004.Rev2
NW

Attention: Adam Perrott

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Landfill Gas Monitoring, November 2018
Proposed Rezoning (Area 1) and Georges Cove Marina (Area 2)
146 Newbridge Road, Moorebank

1. Introduction

This letter prepared by Douglas Partners Pty Ltd (DP) outlines results of a landfill gas monitoring event completed in November 2018 at the southern portion of 146 Newbridge Road, Moorebank (the site) adjacent to a dredge pond. Landfill gas concentration readings were taken from three monitoring wells (MW101, MW102 and MW103) at the locations shown on the attached Drawing 1.

Two previous landfill gas monitoring events were reported by DP (2018) *Preliminary Site Investigation for the Proposed Rezoning (Area 1) and Georges Cove Marina (Area 2)*, 146 Newbridge Road, Moorebank, (ref: 71459.10.R.001.Rev1). The results of the previous monitoring events are also summarised in this report.

2. Fieldwork Methods

Monitoring of gas flow rates and concentrations was undertaken using a calibrated GA5000 landfill gas meter. The monitoring was conducted according to the following general procedure:

- Record atmospheric pressure prior to monitoring;
- Connect the inlet hose of a GA5000 to the well gas cap using a 'quick connect' fitting with the pump switched on;
- Record readings of carbon dioxide, methane, hydrogen sulphide, carbon monoxide and oxygen at 30 second intervals for a period of up to five minutes including the peak and stabilised concentrations;
- Allow the well to stabilise for at least 30 minutes; and
- Connect the inlet hose of a GA5000 to the well gas cap using a 'quick connect' fitting and measure the gas flow rate.

3. Fieldwork Results

The landfill gas monitoring was undertaken on 23 November 2018. Atmospheric pressure readings were between 999 mb and 1000 mb during the monitoring event.

Table 1 provides a summary of the results and calculated gas screening value (GSV) and associated characteristic gas situation (CGS) for the monitoring event and previous gas monitoring events in March and April 2018.

Table 1: Landfill Gas Monitoring Results

MW	Date	Flow Rate Peak (L/h) [1]	Methane Peak %	CO_2 Peak %	GSV = flow x highest Methane or CO_2	CGS [2]
MW101	20/3/2018	<0.1	0.1	11.1	0.011	2
	9/4/2018	-0.1	0.0	10.9	0.011	2
	23/11/2018	-0.4	0.0	9.5	0.038	2
MW102	20/3/2018	<0.1	2.1	4.2	0.004	2
	9/4/2018	<0.1	0.0	4.6	0.005	1
	23/11/2018	-0.7	0.0	11.5	0.081	2
MW103	20/3/2018	<0.1	0.1	4.8	0.005	1
	9/4/2018	0.1	0.0	4.5	0.005	1
	23/11/2018	0.1	0.0	11.5	0.012	2

Notes to table:

1. The flow rate used to calculate the GSV was the detection limit of the instrument for <0.1 L/h readings and negative readings were assumed as the equivalent positive reading as recommended in NSW EPA (2012)
2. Where methane >1% or CO_2 >5% CGS was increased to Situation 2 as per Table 6 of NSW EPA (2012)

As shown in Table 1, methane was below the detection limit of the GA5000 landfill gas meter in each monitoring well, while the maximum concentration of CO_2 was 11.5% in both MW102 and MW103. The highest flow rate recorded was -0.7 L/h in MW102. The landfill gas results indicate generally low landfill gas concentrations and flow rates with a calculated CGS of 2 for each well. According to Table 6 in NSW EPA (2012), a CGS of 2 is typical of 'natural soils with high organic content' and 'typical fill'.

The landfill gas monitoring field sheets are attached.

4. Conclusion

Whilst there has been some general variability in concentrations and flow rates between monitoring events, overall the results are generally consistent. As discussed in Section 3, the concentrations of landfill gas encountered are considered to be typical of the existing ground conditions (i.e. 'natural soils with high organic content' and/or 'typical fill'). Recorded gas concentrations are considered unlikely to be landfill gas that has migrated from the landfill located to the north, possibly with the exception of MW101, which is located in close proximity to the boundary of the two areas within the overall Lot.

Substantially higher concentrations of methane have been recorded in some monitoring wells and some probes that were located on the landfill to the north, suggesting different landfill gas / ground conditions between the two areas within the same overall Lot.

In summary, the current results indicate that the conclusions and recommendations in DP (2018) remain valid, including the recommendation that:

- "Further gas monitoring is undertaken and demonstrates that mitigation systems can be suitably installed and operated within the proposed building designs. Preliminary landfill gas monitoring indicates that the residential use envelope may require landfill gas mitigations. If continued monitoring indicates that mitigations are required, an addendum to the EMM (2016b) RAP must be prepared to address this specific issue. Further to this, it is understood that buildings currently being proposed involves suspended slabs under which mitigation systems could be readily incorporated into the design, if necessary."

Accordingly, additional monitoring events should be undertaken to confirm any trends (e.g. stable, increasing or decreasing concentrations or flow rates) and to assist in future landfill gas mitigation designs for structures proposed to be built at the site.

5. Limitations

Douglas Partners Pty Ltd has prepared this report for this project at 146 Newbridge Road, Moorebank in accordance with DP's proposal SYD180001 (Rev1) dated 17 January 2018 and acceptance received from Mirvac Homes NSW Pty Ltd. The work was carried out under the agreed contract. This report is provided for the exclusive use of Mirvac Homes NSW Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the environmental components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Please contact the undersigned if you have any questions on this matter.

Yours faithfully

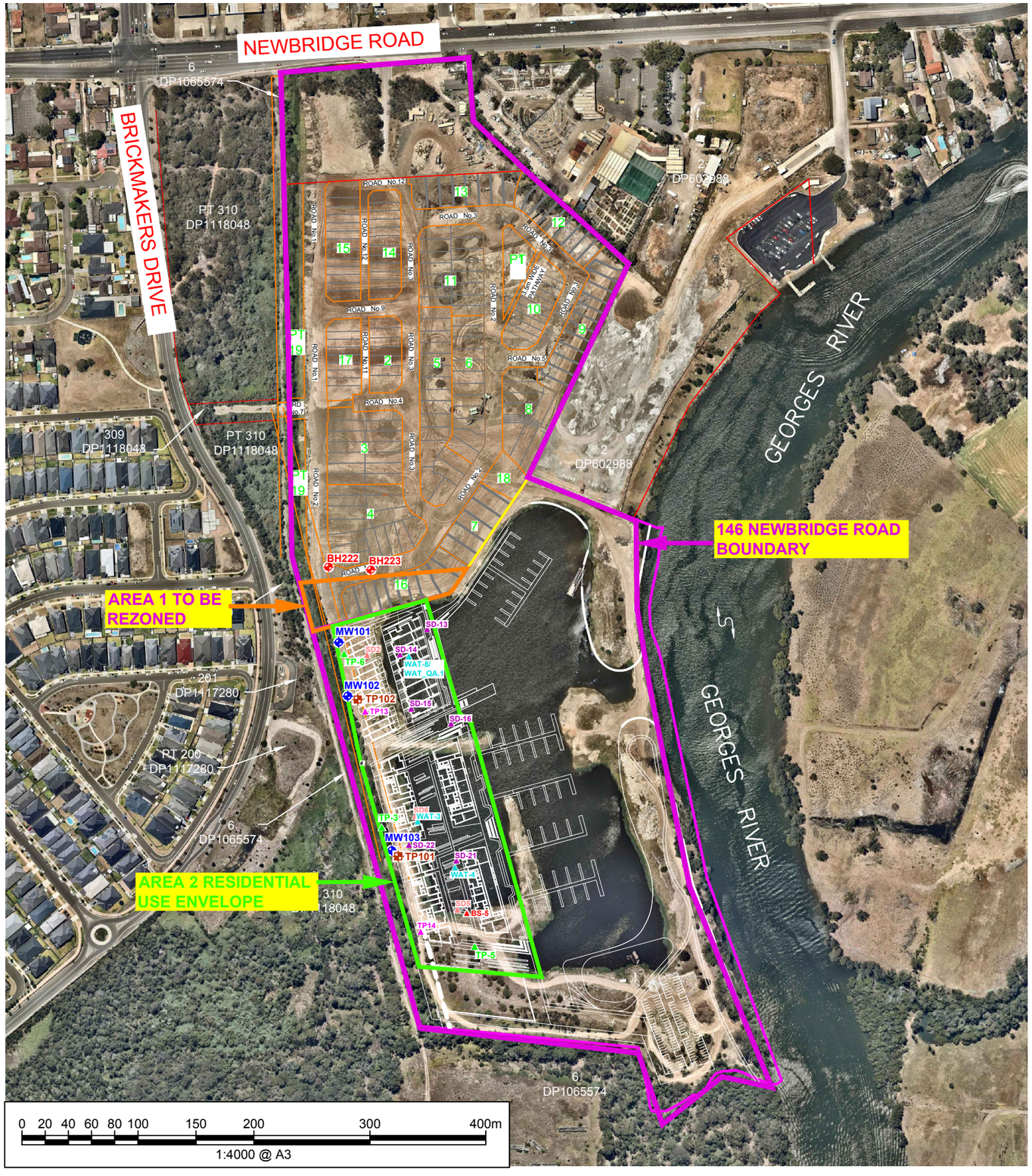
Douglas Partners Pty Ltd

Reviewed by

Nicola Warton
Environmental Scientist

John Russell
Senior Associate

Attachments: Drawing 1
About this Report
Landfill Gas Field sheets



Locality Plan

NOTE:
1: Base image from Nearmap.com (Dated 21.1.2018)
2: Test locations are approximate only and are shown with reference to existing features
3: Survey is from JMD Development Consultants Ref: 14005-GEO1

LEGEND

- Current test pit location
- Previous borehole location
- Gas monitoring bore

INVESTIGATION BY EMM

- SPI Test pit location
- SPI Sediment sample location
- SPI Dregded pond water sample location
- PI Sediment sample location
- PI Test pit location
- # SPI and historic groundwater sample location
- Historic groundwater sample l ocation

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Mirvac Homes Nsw Pty Ltd		TITLE: **Test Locations**
OFFICE: Sydney	DRAWN BY: PSCH	**Proposed Residential Development (Rezoning)**
SCALE: 1:4000 @ A3	DATE: 10.4.2018	**146 Newbridge Road, MOOREBANK**

PROJECT No: 71459.10
DRAWING No: 1
REVISION: 0

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

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Geotechnics / Environment / Groundwater

Landfill Gas Monitoring

Client: **Benedict** Date: 23/11/18

Project: **Landfill Gas Monitoring** Project Number: 71459.10

Location: **146 Newbridge Road, Moorebank**

Well ID: MW101

Time: 0715 Pressure Mb: 1000mb

Time (sec)	Concentration (% v/v)			CO (ppm)	H_2S (ppm)	Flow (l/h)
	CH_4	CO_2	O_2			
0	0.0	9.2	16.0	0	0	-0.0
30	0.0	9.4	8.2	0	0	0.1
60	0.0	9.4	7.4	0	0	-0.1
90	0.0	9.4	7.3	0	0	-0.2
120	0.0	9.3	7.4	0	0	-0.1
150	0.0	9.3	7.4	0	0	-0.2
180	0.0	9.3	7.4	1	0	-0.2
210	0.0	9.4	7.4	1	0	-0.3
240	0.0	9.4	7.3	1	0	-0.3
270	0.0	9.4	7.2	1	0	-0.3
300	0.0	9.5	7.2	1	0	-0.4

Well ID: MW102

Time: 0720 Pressure Mb: 999mb

Time (sec)	Concentration (% v/v)			CO (ppm)	H_2S (ppm)	Flow (l/h)
	CH_4	CO_2	O_2			
0	0.0	11.4	18.0	1	0	-0.1
30	0.0	11.5	9.8	0	0	-0.3
60	0.0	11.5	9.6	0	0	-0.4
90	0.0	11.5	9.5	0	0	-0.5
120	0.0	11.5	9.5	0	0	-0.6
150	0.0	11.4	9.5	0	0	-0.6
180	0.0	11.2	9.7	0	0	-0.6
210	0.0	10.6	10.0	0	0	-0.6
240	0.0	10.2	10.5	0	0	-0.7
270	0.0	9.7	10.9	0	0	-0.6
300	0.0	8.9	11.7	0	0	-0.7
330	0.0	8.6	11.9	0	0	
360	0.0	7.9	12.4	0	0	

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Geotechnics I Environment I Groundwater

Landfill Gas Monitoring

Client: **Benedict**
Project: **Landfill Gas Monitoring**
Location: **146 Newbridge Road, Moorebank**
Well ID: MW103
Time: 0730

Date: 23/11/18
Project Number: 71459.10
Pressure Mb: 1000mb

Time (sec)	Concentration (% v/v)			CO (ppm)	H_2S (ppm)	Flow (l/h)
	CH_4	CO_2	O_2			
0	0.0	8.3	14.0	0	0	0.1
30	0.0	9.4	7.3	0	0	0.0
60	0.0	9.5	7.1	0	0	0.0
90	0.0	9.5	7.0	0	0	0.0
120	0.0	9.6	6.8	1	0	0.1
150	0.0	10.2	6.2	1	0	0.1
180	0.0	10.4	5.6	1	0	0.1
210	0.0	10.6	5.2	1	0	0.0
240	0.0	11.0	4.7	1	0	0.0
270	0.0	11.3	4.3	2	0	-0.1
300	0.0	11.4	4.0	2	0	0.0
330	0.0	11.5	3.9	2	0	

Well ID:
Time:
Pressure Mb:

Time (sec)	Concentration (% v/v)			CO (ppm)	H_2S (ppm)	Flow (l/h)
	CH_4	CO_2	O_2			
0						
30						
60						
90						
120						
150						
180						
210						
240						
270						
300						