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Maitland City Council

Prepared by

Ramboll Australia Pty Ltd

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RS 126-1

SITE AUDIT REPORT

ENVIRONMENTAL

MANAGEMENT PLAN,

EASTERN PORTION OF

LOT 1 DP1243663

6 August 2021

Maitland City Council
Attn.: Catherine Pepper
PO Box 220
Maitland NSW 2320

By email: Catherine.Pepper@maitland.nsw.gov.au

Dear Catherine

**SITE AUDIT REPORT - ENVIRONMENTAL MANAGEMENT
PLAN, EASTERN PORTION OF LOT 1 DP1243663**

I have pleasure in submitting the Site Audit Report for the subject site. The Section B Site Audit Statement RS 126-1, produced in accordance with the NSW *Contaminated Land Management Act 1997*, is included as Appendix B of the Site Audit Report. The Audit was commissioned by Maitland City Council to assess the suitability of an Environmental Management Plan (EMP) to make the site suitable for its intended residential land use.

This Site Audit Report is not currently required by regulation or legislation and is therefore a non-statutory audit.

Thank you for giving me the opportunity to conduct this Audit. Please call me on 9954 8100 if you have any questions.

Yours faithfully,
Ramboll Australia Pty Ltd



Rowena Salmon
EPA Accredited Site Auditor 1002

Ramboll Australia
Level 3, 100 Pacific Highway
PO Box 560
North Sydney NSW 2060

T +61 2 9954 8100
www.ramboll.com

Ref 318001080

Ramboll Australia Pty Ltd
ACN 095 437 442
ABN 49 095 437 442

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Appendix A

Attachments

Appendix B

Site Audit Statement

LIST OF ABBREVIATIONS

Measures

%	percent
% v/v	percent volume by volume
µg/L	Micrograms per Litre
µg/m ³	Micrograms per Cubic Metre
µS/cm	Microsiemens per centimetre
ha	Hectare
km	Kilometres
L/hr	Litres per hour
m	Metre
mAHD	Metres Australian Height Datum
mbgl	Metres below ground level
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Litre
mg/m ³	Milligrams per Cubic Metre
mm	Millimetre
mV	Millivolts
ppm	Parts Per Million

General

ABC	Ambient Background Concentration
ACL	Added Contaminant Limit
ACM	Asbestos Containing Material
AHD	Australian Height Datum
ALS	Australian Laboratory Services
ANZG	Australian & New Zealand Guidelines
ASS	Acid Sulphate Soil
ANZECC	Australian and New Zealand Environment and Conservation Council
BaP	Benzo(a)pyrene
BTEXN	Benzene, Toluene, Ethylbenzene, Xylenes & Naphthalene
CH ₄	Methane
CLM Act	NSW Contaminated Land Management Act 1997
CO ₂	Carbon Dioxide
CO	Carbon Monoxide
COC	Chain of Custody
Council	Maitland City Council
CS	Characteristic Situation
CSM	Conceptual Site Model
DGV	Default Guideline Value
DP	Deposited Plan
DQI	Data Quality Indicator
DQO	Data Quality Objective
EIL	Ecological Investigation Level
EMP	Environmental Management Plan
EPA	Environment Protection Authority (NSW)
ESL	Ecological Screening Level
GHD	GHD Pty Ltd
GIL	Groundwater Investigation Level
GSV	Gas Screening Value
HGG	Hazardous Ground Gas
HIL	Health Investigation Level
HSL	Health Screening Level
LFG	Landfill Gas
Metals	As: Arsenic, Cd: Cadmium, Cr: Chromium, Cu: Copper, Ni: Nickel, Pb: Lead, Zn: Zinc, Hg: Mercury
ML	Management Limits
MS	Matrix Spike
NATA	National Association of Testing Authorities
NC	Not Calculated
ND	Not Detected

NHMRC	National Health and Medical Research Council
NL	Non-Limiting
n	Number of Samples
O ₂	Oxygen
OCPs	Organochlorine Pesticides
OEH	Office of Environment and Heritage
OH&S	Occupational Health & Safety
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PFAS	Per- and poly-fluoroalkyl substances
pH	A measure of acidity, hydrogen ion activity
PID	Photoionisation Detector
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
Ramboll	Ramboll Australia Pty Ltd
RPD	Relative Percent Difference
SAQP	Sampling Analysis and Quality Plan
SAR	Site Audit Report
SAS	Site Audit Statement
Signature Gardens	Signature Gardens Retirement Resorts Pty Ltd
SWL	Standing Water Level
TEQ	Toxic Equivalence Quotient
TPHs	Total Petroleum Hydrocarbons
TRHs	Total Recoverable Hydrocarbons
TV	Trigger Value
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds
-	On tables is "not calculated", "no criteria" or "not applicable"

1. INTRODUCTION

1.1 Audit Details

A site contamination audit has been conducted in relation to the eastern portion of vacant land owned by Maitland City Council (Council) and identified as part of Lot 1 DP1243663 (the site), located to the south of Aaron Cove and Darby Lane, Rutherford NSW.

The Audit was conducted to provide an independent review by an NSW Environment Protection Authority (EPA) Accredited Auditor of what management remains necessary before the land is suitable for any specified use or range of uses i.e. a "Site Audit" as defined in Section 4 (1) (b) (iv) of the NSW *Contaminated Land Management Act 1997* (the CLM Act). The audit has reviewed an Environmental Management Plan (EMP) which documents the required management.

Details of the Audit are:

Requested by:	Catherine Pepper on behalf of Maitland City Council
Request/Commencement Date:	26 October 2020
Auditor:	Rowena Salmon
Accreditation No.:	1002

1.2 Project Background

Council owns a vacant parcel of land identified as Lot 1 DP 1243663 located adjacent and to the east of the former Anambah landfill in Rutherford NSW. The adjacent former landfill ceased operation in approximately 1993.

Council entered into a contract of sale for the site in 2016 with Signature Gardens Retirement Resorts Pty Ltd (Signature Gardens). Subsequent to this, GHD Pty Ltd (GHD) carried out a combined Stage 1 and Stage 2 Contamination Site Assessment of Lot 1 DP 1243663 in 2017. The assessment concluded that Lot 1 DP 1243663 was suitable from a contamination perspective for residential development except for the potential migration of landfill gas (LFG) from the adjacent former Anambah landfill. Numerous other investigations have been carried out on the adjacent former landfill to establish the nature and extent of any contamination and LFG migration.

Based on the findings of the further contamination investigations, Council seeks to determine whether there is a portion of the site that may currently be suitable for residential use. Additional investigation of LFG was undertaken on the vacant parcel of land and GHD recently (June 2021) prepared a Landfill Gas Delineation Assessment Report for Lot 1 DP 1243663. Based on the available data, GHD considered that the eastern portion of the site is suitable (from a landfill gas perspective) for residential development, subject to appropriate gas protection measures being incorporated into any new residential development. GHD prepared an EMP to document the required gas protection measures for the eastern portion.

Council are understood to be in negotiations with Signature Gardens for the purchase of the eastern portion of the site (identified by GHD) and an 18 m wide strip of land immediately west of the eastern portion. Signature Gardens own and operate the adjoining site to the south, which comprises low density residential housing under strata management.

1.3 Scope of the Audit

The scope of the Audit included:

- Review of the following reports:
 - 'Stage 1 and Stage 2 Contamination Site Assessment, Lot 31 DP598354, Aaron Cove, Rutherford', dated 21 April 2017, GHD (*the CSA*).

- 'Anambah landfill site, Installation of additional Landfill Gas monitoring wells', dated 28 February 2020, GHD (*GHD 2020*).
- 'LFG Assessment Sampling, Analysis and Quality Plan, Lot 1 DP1243663, Aaron Cove Rutherford', dated 28 October 2020, GHD (*the SAQP*).
- 'Anambah landfill LFG review – LFG data review and CSM update', dated 29 October 2020, GHD.
- 'Anambah landfill LFG review, Installation of Sale Property landfill gas wells', dated 14 January 2021, GHD.
- 'Anambah Lot 1 DP1243663, Landfill gas delineation assessment report', dated 25 June 2021, GHD (*the LFGDA*).
- 'Anambah - Eastern Portion of Lot 1 DP1243663, Hazardous ground gas EMP,' dated 25 June 2021, GHD (*the EMP*).
- A site visit by the Auditor (remote) and Auditor's Assistant on 4 December 2020.
- Discussions with Council, and with GHD who undertook the investigations and prepared the EMP.

The CSA investigation was completed prior to the Auditor's engagement. The SAQP makes reference to and provides summaries of historical reports prepared by DLA Environmental, Pacific Environmental Limited, Douglas Partners, ERM and GHD for the neighbouring former Anambah landfill. Select reports were provided for review, however the information referenced does not relate to the site and the reports were not reviewed for this Site Audit Report (SAR).

2. SITE DETAILS

2.1 Location

The site locality is shown on Attachment 1, Appendix A.

The site details are as follows:

Street address:	South of Aaron Cove and Darby Lane, Rutherford NSW 2320
Identifier:	Part Lot 1 DP 1243663 (eastern portion) (Attachment 2, Appendix A)
Local Government:	Maitland City Council
Owner:	Maitland City Council
Site Area:	Approximately 4.7 ha (Lot 1 DP1243663 approximately 8.5 ha)

The boundaries of the site are defined by residential property boundary fences to the north, east and south. The western boundary of the site is not well defined by streets/adjoining properties etc, however is positioned 18 m to the west of line E-L1/W-L1 which is the approximate alignment of monitoring features A9, A10, A11 and A12 (Attachment 3, Appendix A).

The Audit area is equivalent to the portion to be sold by Council as shown in the survey plan attached to the EMP (also included as Attachment 2, Appendix A) and is indicated by the yellow boundary on Attachment 3, Appendix A..

2.2 Zoning

The current zoning of the site is R1 General Residential under Maitland Local Environment Plan (LEP) 2011.

2.3 Adjacent Uses

The site is located within an area of residential land uses. The surrounding site use includes:

North: Numerous residential properties with site access available from both Aaron Cove and Darby Lane.

East: Residential properties and Richard Road beyond.

South: The existing Signature Gardens retirement resort.

West: The western portion of Lot 1 DP 1243663, then the former Anambah landfill. Further west is Anambah Road and industrial/commercial land use.

The adjacent former Anambah landfill has the potential to cause groundwater and hazardous ground gas contamination at the site.

Neighbouring residential land uses which surround the site are considered sensitive environments. The closest surface water receptor to the site is a small unnamed creek approximately 400 m to the north that flows north towards the Anambah wetlands and the Hunter River. A tributary of Stoney Creek is located approximately 500 m to the southwest of the property and flows south to join Swamp Creek. Surface runoff from the property is expected to either infiltrate into the subsurface soils or flow towards the southwest with topography into drainage channels that flow into Stoney Creek.

2.4 Site Condition

The CSA, completed in March 2017, noted the following regarding condition of Lot 1 DP 1243663 (formerly Lot 31 DP598354) as shown on Attachment 4, Appendix A:

- The Lot is generally flat with a slight gradient to the north and northwest (suspected error), towards the Anambah wetlands and the Hunter River. The surrounding topography is generally level with the Lot except for the former Anambah landfill, which is approximately 2.5 to 6 m higher in elevation than the Lot and slopes steeply up from the western boundary of the Lot.
- The Lot was undeveloped with moderate to thick grass cover. There were no buildings or structures.
- The Lot was fenced around the east, south and west boundaries. The northern boundary was partly fenced by colourbond steel on existing residential properties, and a derelict stock fence in remaining areas.
- Several mounds/stockpiles of soil were noted to the south of the Lot and household rubbish and building materials were located in two areas close to the northern boundary. No potential asbestos containing materials (ACM) were observed within these waste piles.
- Two dams/depressions were noted in the north-eastern quarter of the Lot. The dams/depressions were initially dry however contained ponded water in subsequent inspections following substantial rainfall.

Similar conditions were noted in the LFGDA and EMP prepared in June 2021, with the following exceptions:

- The topography was generally flat with a slight gradient to the southwest.
- The mounds/stockpiles of soil that were noted in the CSA as being present to the south of the Lot and household rubbish and building materials that were located in two areas close to the northern boundary were not specifically noted.

Similar Lot and site conditions were noted by the Auditor during the site inspection on 4 December 2020 with the following exceptions:

- The two dams/depressions located within the site contained ponded water
- A raised area (approximately 1 m high) was observed in the southwestern corner of the Lot. Building rubble including bricks and concrete were visible within soils at the surface of the raised area where soils were exposed.

2.5 Proposed Development

It is understood that following purchase from Council, Signature Gardens propose a residential seniors housing development consisting of independent living units similar to the existing Signature Gardens residential property located to the south of the site, as shown on Attachment 5, Appendix A. The proposed development includes an 18 m wide strip to the west which is proposed to be used for a road, turning circle, surface drainage and other non-residential uses and which is included in the site area.

For the purposes of this audit, the 'residential with soil access' land use scenario will be assumed.

3. SITE HISTORY

The SAQP included a summary of the site history provided in the CSA, including a review of selected historical aerial photographs, site photographs, EPA records and Council records.

The site history review indicates that the site has been vacant undeveloped grassland potentially used for agricultural/grazing purposes prior to 1958. No buildings or structures have been developed on the site. The former Anambah landfill, neighbouring the site to the west, commenced operation in 1976 and ceased in 1993. Council are understood to have installed landfill gas interception trenches on the eastern and northern boundaries of the former landfill in October 2017.

Residential properties increased in density within the wider area surrounding the site in 1975. Areas directly adjacent to the site to the north, east and south were developed into residential developments between 2001 and present. Urban residential properties bounded the site to the north, east and south by 2014.

A review of the EPA public records did not identify the site or surrounding land uses as being notified as contaminated or of holding licenses under the *Protection of the Environment Operations Act 1997*.

The search of Council records identified development application records for construction related activities and tree removal at three properties within the vicinity of the site however these are considered not likely to be potential contamination sources to the site.

3.1 Auditor's Opinion

In the Auditor's opinion, the site history information presented was limited however, based on the site being undeveloped, is considered to provide an adequate indication of past activities. A review of the EPA public records was conducted by the Auditor which did not identify any notifications for the site or immediate surrounds. The primary sources of contamination are considered to be offsite sources such as building and demolition wastes illegally dumped during the construction stages of the nearby residential developments, and the potential migration of contaminated groundwater and hazardous ground gases to the site from the neighbouring former landfill.

4. CONTAMINANTS OF CONCERN

Based on the site inspection and historical desktop review, the CSA provided a list of the contaminants of concern and potential contamination sources. These have been tabulated in Table 4.1.

Table 4.1: Contaminants of Concern

Activity/Contamination Source	Potential Contaminants
Illegally dumped materials	Metals, total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene, xylene and naphthalene (BTEXN), polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides (OCPs), polychlorinated biphenyls (PCBs) and asbestos. In addition, groundwater impacted by the landfill could also include phenols and volatile organic compounds (VOCs).
Fill material potentially present from site clearing and levelling	
Former use of pesticides or herbicides for weed or pest control	
Contaminants (soil and groundwater) and landfill gases migrating from the adjacent former Anambah landfill	Landfill gases included methane (CH ₄), carbon dioxide (CO ₂), carbon monoxide (CO) and hydrogen sulphide (H ₂ S)

At the completion of the CSA, GHD identified hazardous ground gases (CH₄ and CO₂) as contaminants of concern in the SAQP requiring further investigation.

4.1 Auditor’s Opinion

The Auditor considers that the analyte list used by GHD adequately reflects the site history and condition. The density of sampling for asbestos was low, however, this was supplemented by visual observations afforded by completion of test pit investigation locations.

There has been no assessment by the consultants for the presence of per- and poly-fluoroalkyl substances (PFAS) which can be associated with landfills. Based on the groundwater analytical results for other contaminants (Section 10) and the inferred groundwater flow to the west (Section 5.2), PFAS are not considered contaminants of concern in groundwater below the site.

5. STRATIGRAPHY AND HYDROGEOLOGY

5.1 Stratigraphy

GHD reviewed geological maps and reported that the site is underlain by Permian deposits of the Dalwood Group (Rutherford Formation), comprising sandstone, siltstone, mudstone, shale and erratics.

GHD completed 100 sample locations across the Lot (including the site) as part of the CSA which included 94 test pits and six boreholes, converted to groundwater or landfill gas monitoring wells. Sample locations are shown on Attachment 4, Appendix A. Approximately 50 sample locations are located within the site. The sub-surface profile of the site is summarised by the Auditor in Table 5.1.

Table 5.1: Stratigraphy

Depth (mbgl)	Subsurface Profile
0.0 – 0.3	reworked natural (possibly fill) materials consisting of various fine grained clayey silt mixtures with some trace inclusions of coal fragments and roots
0.2 to depth (up to 14 m)	Natural materials generally consisting of pale yellow, grey and brown to dark brown clay or silty/sandy clay.

mbgl – metres below ground level

GHD installed a further 11 boreholes across the site during GHD 2020 and the LFGDA as shown on Attachment 3, Appendix A. Similar subsurface profiles were encountered to that encountered during the CSA, however, deeper fill/reworked natural materials were logged up to 1 mbgl during the LFGDA. This discrepancy is likely due to the method adopted for installation whereby soil sampling was not required and therefore the depth of fill reporting in the LFGDA may have been inaccurate.

GHD indicated that there was no published mapped evidence to suggest the occurrence of acid sulfate soils (ASS).

5.2 Hydrogeology

GHD undertook a search for registered groundwater bores on 16 February 2017 during the CSA. Three bores were identified within a 500 m radius of the site. The bores were for monitoring purposes. The standing water levels (SWL) ranged from approximately 8.35 to 8.7 mbgl.

GHD installed three groundwater monitoring wells at the Lot as part of the CSA (MW01, MW04 and MW06 shown on Attachment 4, Appendix A). Wells were installed to depths of up to 14 mbgl and screened in the natural clay. SWLs for the three groundwater wells ranged from 8.695 m Australian Height Datum (AHD) in MW01 (north-western corner of the Lot) to 9.18 mAHD in MW06 (central eastern boundary of site). Based on the groundwater observations, GHD prepared a groundwater contour plan which indicated the groundwater at the Lot appears to be flowing in a westerly direction towards the former Anambah landfill.

Additional monitoring wells were installed as part of GHD 2020 and the LFGDA to monitor hazardous ground gas conditions. Additional groundwater observations were made during hazardous ground gas monitoring events undertaken by GHD and others between August 2019 and March 2021. The SWL of the only groundwater well located within the site (MW06) was measured between 11.42 mbgl (9.01 mAHD) and 12.30 mbgl (8.13 mAHD).

Groundwater was also identified towards the base of the GHD 2020 wells and indicated little/no fluctuation. These measurements are likely to be associated with perched seepage water in the base of the well and not regional groundwater. The LFGDA wells remained dry during monitoring between December 2020 and March 2021.

The CSA reported the stabilised groundwater parameters recorded during sampling of wells installed in the aquifer. Results are discussed in Section 10.1 and indicate electrical conductivity (EC) between 8,890 and 18,980 $\mu\text{S}/\text{cm}$.

5.3 Auditor's Opinion

The Auditor considers that the site stratigraphy and hydrogeology are sufficiently well known for the purpose of assessing site suitability. The site stratigraphy comprises natural clay with limited fill material. Regional groundwater is present at depths of over 8 mbgl. The regional groundwater is not anticipated to be extracted for beneficial use due to the lack of registered groundwater bores in the site vicinity, proximity to a landfill and high EC.

6. EVALUATION OF QUALITY ASSURANCE AND QUALITY CONTROL

The Auditor has assessed the overall quality of the data by review of the information presented in the referenced reports, supplemented by field observations. The data sources are summarised in Table 6.1.

Table 6.1: Summary of Investigations

Stage of Works	Field Data	Analytical Data
Stage 1 and Stage 2 CSA (21 April 2017) <i>Fieldwork date: March 2017</i> Attachment 4, Appendix A	100 sample locations - 94 test pits (TP1, TP03, TP04, TP06, TP07, TP09, TP11 to TP35, TP37 to TP84 and TP86 to TP100) and 6 boreholes (MW01 to MW06) providing coverage across the Lot. 3 boreholes (MW01, MW04 and MW06) converted to multi-purpose groundwater/hazardous ground gas (HGG) monitoring wells and 3 boreholes (MW02, MW03 and MW05) converted to HGG monitoring wells. 50 locations located within the site area (TP51 to TP84, TP86 to TP100 and MW06). Groundwater sampling and HGG spot monitoring from one round.	<i>Soil:</i> Discrete samples from site analysed for Metals (16), TRH/BTEX (16), PAHs (16), asbestos (presence/absence) (2) Four-part composite samples from site analysed for Metals (11), TRH/BTEX (11), PAHs (11), OCPs (14), PCBs (14) <i>Groundwater:</i> Metals, TRH/BTEX, PAHs, phenols, OCPs, OPPs, PCBs, VOCs. Gas monitoring undertaken with a gas analyser on a percentage volume/volume basis (%v/v): H ₂ S, CO, CO ₂ , Oxygen (O ₂), and CH ₄ .
Routine monitoring data summarised in SAQP (28 October 2020) <i>Fieldwork date: July to December 2019</i>	Monthly HGG spot monitoring from all (6) wells located within the Lot (6 rounds).	Gas monitoring undertaken with a gas analyser on a percentage volume/volume basis (%v/v): H ₂ S, CO, CO ₂ , O ₂ , and CH ₄ .
Installation of additional Landfill gas monitoring wells (28 February 2020) <i>Fieldwork date: January 2020</i> Attachment 3, Appendix A	Drilling of 17 boreholes (A to J and L to R) to install HGG monitoring wells targeting the area adjacent to the former Anambah landfill. 14 locations were located within the Lot (B to H and L to R) and 5 within the site (M to O, Q and R). HGG spot monitoring from one round from newly installed wells.	Gas monitoring undertaken with a gas analyser (%v/v): H ₂ S, CO, CO ₂ , O ₂ , and CH ₄ .
Routine monitoring data summarised in SAQP (28 October 2020) <i>Fieldwork date: January to September 2020</i>	HGG spot monitoring from all (20) wells located within the Lot monthly (9 rounds).	Gas monitoring undertaken with a gas analyser (%v/v): H ₂ S, CO, CO ₂ , O ₂ , and CH ₄ .
Installation of Sale Property landfill gas wells (14 January 2021) <i>Fieldwork date: December 2020</i> Attachment 3, Appendix A	Drilling of 14 boreholes (A1 to A14) to install HGG monitoring wells in four transect lines within the Lot. Six boreholes were within the site (A9 to A14). HGG spot monitoring from one round from newly installed wells.	Gas monitoring undertaken with a gas analyser (%v/v): H ₂ S, CO, CO ₂ , O ₂ , and CH ₄ .

Stage of Works	Field Data	Analytical Data
Landfill Gas Delineation Assessment (25 June 2021) <i>Fieldwork date: October 2020 to March 2021</i>	HGG spot monitoring from all (34) wells located within the Lot fortnightly between October 2020 and March 2021 (up to 8 rounds). Continuous monitoring via installation of GasClam in two locations (A9 and A10, onsite) and GasfluX in one location (A5, west of site boundary, within the Lot) between December 2020 and March 2021 (around 95 days of monitoring data).	Gas monitoring undertaken with a gas analyser (%v/v): H ₂ S, CO, CO ₂ , O ₂ , and CH ₄ . Continuous monitoring using GasfluX including flow rates (L/hr).

The Auditor’s assessment of data quality follows in Tables 6.2 and 6.3.

Table 6.2: QA/QC – Sampling and Analysis Methodology Assessment

Sampling and Analysis Plan and Sampling Methodology	Auditor’s Opinion
<p><i>Data Quality Objectives (DQO)</i></p> <p>The CSA and LFGDA defined specific DQOs in accordance with the seven-step process outlined in Schedule B2 of NEPM (2013).</p> <p>The following decisions for the CSA were identified in the DQOs:</p> <ul style="list-style-type: none"> • Is the site suitable for potential future residential land use in respect to contaminants of potential concern from historical use and potential filling and illegal dumping? • Is there any impact from potential adjoining off-site contamination sources (former Anambah Landfill) that would pose a potential risk to on-site receptors? • If contamination is identified, does it have the potential to cause impacts to off-site receptors? • Is further assessment or remediation/management required? <p>The following decisions for the LFGDA were identified in the DQOs:</p> <ul style="list-style-type: none"> • Is the methodology proposed adequate to meet the investigation objectives? • To what extent is the site affected by concentrations of LFG (including methane and carbon dioxide) that exceed relevant investigation thresholds? • What is the level of risk associated with these exceedances? • Is there a portion of the site that can be considered suitable, from an LFG perspective, for residential development without further management or remediation? • Is there a need for further assessment, remediation and/or management of LFG at the site? 	<p>The identified DQOs were considered appropriate for the investigations conducted.</p>
<p><i>Sampling pattern and locations</i></p> <p><i>Soil:</i> Investigation locations were spaced on a grid basis across the site.</p> <p><i>Groundwater:</i> three monitoring wells were installed in a triangulated position across the Lot for coverage.</p> <p><i>Ground gas:</i> gas monitoring wells were concentrated in close proximity to the neighbouring former landfill and for further site coverage to assess potential migration. LFGDA locations were installed in transects in order to determine a portion of the Lot suitable for future residential land uses.</p>	<p>In the Auditor’s opinion these investigation locations adequately target the main areas of concern.</p>
<p><i>Sampling density</i></p> <p><i>Soil:</i> The sampling density of 50 locations over approximately 4.7 ha is marginally below the minimum 55 recommended by EPA (1995) <i>Sampling Design Guidelines</i> for sites of 5.0 ha. The coverage provides a 95% confidence of detecting a residual hot spot of approximately 35.6 m diameter.</p> <p>A combination of discrete and composite soil sampling was adopted achieving analytical coverage at all investigation locations. Only two samples were analysed for asbestos.</p>	<p>The soil and groundwater sampling densities for chemical contaminants are considered acceptable in consideration of the consistency of soil materials encountered, the low potential for contamination based on the site history and the lack of soil contamination detections at the site (refer Section 8).</p>

Sampling and Analysis Plan and Sampling Methodology	Auditor’s Opinion
<p><i>Groundwater:</i> A total of three groundwater wells were installed at the Lot (1 on the site), sampled on one occasion.</p> <p><i>Ground gas:</i> A total of 37 wells for assessing ground gas were installed at the Lot (11 located on the site). Wells were monitored over up to 24 events between 2019 and 2021.</p>	<p>As noted in Section 4, the low density of sampling for asbestos was acceptable since test pit investigations were adopted and no evidence of building materials or fragments of ACM were observed.</p> <p>The density of ground gas wells completed for the LFGDA was in accordance with the SAQP and was adequate to delineate the extent of LFG impact.</p> <p>Overall, in the Auditor’s opinion the sampling densities were appropriate.</p>
<p><i>Sample depths</i></p> <p>Soil samples were collected and analysed from a range of depths, with the primary intervals being within the shallow fill (0.0 -0.2 mbgl) and at and around the reworked natural/natural interface (around 0.3 mbgl).</p> <p>Groundwater wells were installed to a depth of 14 mbgl.</p> <p>Ground gas wells were installed to a depth of around 6 to 7.2 mbgl.</p>	<p>In the Auditor’s opinion, this sampling strategy was appropriate and adequate to characterise the primary material types present on site.</p>
<p><i>Well construction</i></p> <p><i>Groundwater:</i> The monitoring wells were typically installed to depths of 14 mbgl, with screen intervals of 13 m placed in gravel. Wells were constructed of 50 mm uPVC. A bentonite seal of 0.5 m thickness was placed above the screen and the well backfilled with soil cuttings or cement grout to the ground surface.</p> <p><i>Ground gas:</i> CSA wells were typically installed to depths of 6 mbgl, with screen intervals of 5 m placed in gravel which was placed to 0.3 m above the screen. Wells were constructed of 50 mm uPVC. A bentonite seal of 0.5 m thickness was placed above the screen and the well backfilled with soil cuttings or cement grout to the ground surface. GHD 2020 and LFGDA wells were typically installed to depths of 7.2 mbgl, with screen intervals of 6 m placed in gravel which was placed to 0.3 m above the screen. Wells were constructed of 50 mm uPVC. A donut shaped geofabric separation layer was placed above the gravel before a bentonite seal of 0.7 m thickness was placed above the screen and cement grout to the ground surface. Wells were fitted with gas monitoring caps. The three groundwater wells were also fitted with gas monitoring caps.</p>	<p>The Auditor notes that, whilst it is preferable for groundwater monitoring wells to screen over a discrete short vertical interval, considering the site specific conditions and SWLs recorded, the wells are considered sufficient to provide an adequate indication of the groundwater conditions at the site.</p> <p>The ground gas well construction was appropriate and adequately consistent between installation events. LFGDA wells were constructed in accordance with the SAQP.</p>
<p><i>Sample collection method</i></p> <p><i>Soil:</i> Samples which were composited were in accordance with the EPA (1995) <i>Sampling Design Guidelines</i> in that samples were collected adjacent to each other and from the same material types, however, samples were analysed for volatile contaminants include TRH/BTEXN which is not recommended. Compositing of samples was completed by the laboratory.</p> <p>Test pit samples were collected by hand, either directly from the excavation or from the excavator bucket. Borehole samples were collected via hand auger flights or push tube sleeve.</p> <p>50 g samples were collected for laboratory analysis for asbestos. Samples analysed for asbestos were not collected according to the asbestos quantification methodology outlined in NEPM (2013) (Schedule B1).</p> <p><i>Groundwater:</i> Wells were installed by solid flight augers, developed with a foot valve and samples were collected by low flow peristaltic pump with dedicated sample tubing.</p> <p><i>Ground gas:</i> Samples were not collected for laboratory analysis however GHD utilised a calibrated LFG instrument (GA5000) to collect gas flow and component concentration readings at each well location during monitoring events. No leak testing was undertaken as the measurement procedure requires pumping of gas directly into the instrument when taking measurements from the wells.</p>	<p>Overall, the sample collection methods are considered to be acceptable based on the site conditions. Compositing of soil samples prior to analysis for TRH/BTEXN may have resulted in loss of volatiles therefore these results have been considered as indicative only.</p> <p>The potential for the gas monitoring results to be impacted by changes in monitoring methods and/or personnel has been considered when interpreting the results.</p>

Sampling and Analysis Plan and Sampling Methodology	Auditor's Opinion
<p>The LFGDA indicates that data from October 2020 and November 2020 events was sourced by another consultant, VGT, using a GFM430 gas analyser.</p> <p>The SAQP notes that there was a distinct increase in carbon dioxide concentrations in the September 2020 monitoring results compared with earlier results. GHD has not been able to confirm whether these concentrations may be attributable to a change in monitoring method or personnel.</p>	
<p><i>Decontamination procedures</i></p> <p><i>Soil:</i> Sampling equipment was cleaned with detergent, tap water and then de-ionised water prior to sampling and between sampling events to prevent cross contamination. New gloves were reportedly used for each new sample.</p> <p><i>Groundwater:</i> Dedicated sampling equipment was used for each well. New gloves were reportedly used for each new sample.</p> <p><i>Ground gas:</i> Decontamination procedures were not described by GHD and it is not clear whether the LFG instrument (GA5000) tubing was purged between locations.</p>	Acceptable
<p><i>Sample handling and containers</i></p> <p>Samples were placed into prepared and preserved sampling containers provided by the laboratory and chilled during storage and subsequent transport to the labs. Samples for asbestos analysis were placed in plastic zip-lock bags.</p> <p>Groundwater samples to be analysed for heavy metals were field filtered.</p>	Acceptable
<p><i>Chain of Custody (COC)</i></p> <p>Completed COC forms were provided in the CSA report.</p>	Acceptable
<p><i>Detailed description of field screening protocols</i></p> <p><i>Soil:</i> Field screening for volatiles was undertaken using a photoionisation detector (PID) during the CSA. Soil sub-samples were placed in ziplock plastic bags and the headspace measured for VOCs after allowing time for equilibration.</p> <p><i>Groundwater:</i> Field parameters including pH, EC, oxidation/reduction (redox) potential, dissolved oxygen (DO) and temperature were measured during well sampling.</p> <p><i>Ground gas:</i> A GA5000 portable landfill gas analyser was used for the collection of gas readings. The GA5000 was used to assess concentrations of methane, oxygen, carbon dioxide, hydrogen sulphide and carbon monoxide. The analyser was connected to gas taps fitted to 50 mm wells.</p>	Acceptable
<p><i>Calibration of field equipment</i></p> <p>The reports indicated that calibration had been undertaken prior to use and checks were performed during use. Calibration certificates from the equipment supplier were provided for the PID and landfill gas analyser.</p>	Acceptable
<p><i>Sampling logs</i></p> <p>Soil logs are provided within the reports, indicating sample depth, PID readings (CSA only) and lithology. The logs report no indications of contamination were found, however, black soil staining was reported in the body of the report, in at least three investigation locations in the natural silty clays (discussed in Section 8.1).</p> <p>Groundwater field sampling records were not provided, however field data were tabulated in the CSA report which indicates that SWL, field parameters, methodology and observations were recorded.</p> <p>Ground gas field monitoring sheets were not provided however summary records were provided in tables presented in the appendices of the reports.</p>	Acceptable

Table 6.3: QA/QC – Field and Lab Quality Assurance and Quality Control

Field and Lab QA/QC	Auditor's Opinion
<p><i>Field quality control samples</i></p> <p>Field quality control samples including field intra-laboratory and inter-laboratory duplicates were undertaken for discrete soil and groundwater analyses during the CSA.</p> <p>No trip blanks or trip spikes were analysed as significant volatile contamination was not expected or evident.</p> <p>GHD stated wash blanks were not required since dedicated sampling equipment was used for each location however the Auditor notes drilling equipment was reused.</p>	<p>The absence of wash blank samples for drilling equipment is considered acceptable given the lack of contaminant detections made (refer Section 8).</p>
<p><i>Field quality control results</i></p> <p>The results of field quality control samples were generally within appropriate limits. Relative percentage differences (RPDs) for three inter-laboratory soil duplicate samples and two intra-laboratory duplicate samples for four metals exceeded the adopted acceptance limits. GHD reported that these exceedances were due to the heterogeneous nature of surface materials and relatively low concentrations, where a relatively small difference in concentrations generates an elevated RPD. The highest concentration was also adopted.</p>	<p>Overall, in the context of the dataset reported, the elevated RPD results are not considered significant and the field quality control results are acceptable.</p>
<p><i>NATA registered laboratory and NATA endorsed methods</i></p> <p>Laboratories used included: ALS, and Eurofins mgt. Laboratory certificates were NATA stamped.</p>	<p>Acceptable</p>
<p><i>Analytical methods</i></p> <p>Analytical methods were included in the laboratory test certificates. Both laboratories provided brief method summaries of in-house NATA accredited methods used based on USEPA and/or APHA methods (excluding asbestos) for extraction and analysis in accordance with the NEPM (2013).</p> <p>Asbestos identification was conducted using polarised light microscopy with dispersion staining by method AS4964-2004 <i>Method for the Qualitative Identification of Asbestos Bulk Samples</i>.</p>	<p>The analytical methods are considered acceptable for the purposes of the site audit, noting that the AS4964-2004 is currently the only available method in Australia for analysing asbestos. DOH (2009) and enHealth (2005) state that "until an alternative analytical technique is developed and validated the AS4964-2004 is recommended for use".</p>
<p><i>Holding times</i></p> <p>Review of the COCs and laboratory certificates indicate that the holding times had generally been met. Holding time non-compliances were noted in two laboratory certificates for PAHs/TPH/TRH/BTEX (10-12 days overdue) and Chromium VI (36 and 4 days overdue) in selected soils samples. GHD reported that "Once samples are received by the laboratory, they are held in temperature controlled conditions. It is considered unlikely that these breaches in holding times have significantly affected the results and therefore the interpretation of the data". GHD also noted that as the valence state of chromium is considered generally stable in a soil matrix, it is unlikely that these breaches in holding times have significantly affected the results and therefore the interpretation of the data.</p>	<p>Acceptable</p>
<p><i>Practical Quantitation Limits (PQLs)</i></p> <p>PQLs were less than the threshold criteria for the contaminants of concern.</p>	<p>The soil and groundwater PQLs were acceptable and detection levels for the landfill gas analyser were appropriate for the purpose of the LFG assessment.</p>
<p><i>Laboratory quality control samples</i></p> <p>Laboratory quality control samples including laboratory control samples, matrix spikes, surrogate spikes, blanks and duplicates were undertaken by the laboratory.</p> <p>No laboratory duplicates or matrix spikes were completed for the batch of groundwater samples, however laboratory control spikes were undertaken.</p>	<p>Acceptable</p>

Field and Lab QA/QC	Auditor's Opinion
<p><i>Laboratory quality control results</i></p> <p>The results of laboratory quality control samples were generally within appropriate limits, with the following exceptions:</p> <p><i>Soil:</i></p> <p>Laboratory duplicate for lead with RPD (22.9%), greater than data quality acceptance limit (20%). Lead concentrations in primary data are generally low (<60 mg/kg) and well below the assessment criteria. GHD did not consider this outlier to affect interpretation of the data.</p> <p>The recovery for the TRH/BTEX sample surrogate (71.9%) was slightly below the lower data quality objective (72%). As the outlier was only slightly under the lower range limit, it was not considered that this indicated any significant inaccuracy in the testing methods and did not affect the interpretation of the data.</p> <p>Laboratory duplicate for four PAHs with RPDs (91% to 200%) greater than data quality acceptance limit (30%). The elevated RPD was considered to result from low concentrations where small differences result in larger RPD%.</p> <p>Surrogate recoveries for phenol-D5-surrogate were below ANZECC control limits for one batch, however, USEPA limits were met. Phenols were only detected in one project sample at a concentration around 10 times lower than the threshold concentration therefore this discrepancy is not considered significant. Remaining matrix spikes were within control limits.</p> <p><i>Groundwater:</i></p> <p>Laboratory quality control results were acceptable with the exception of one PAH surrogate recovery of 132% in water.</p>	<p>In the context of the dataset reported, the laboratory quality control non compliances are not considered to significantly impact the reliability of the data set.</p>
<p><i>Data Quality Indicators (DQI) and Data Evaluation (completeness, comparability, representativeness, precision, accuracy)</i></p> <p>Predetermined data quality indicators (DQIs) were set for laboratory analyses including blanks, replicates, duplicates, laboratory control samples, matrix spikes and surrogate spikes. These were discussed with regard to the five category areas. GHD considered in the CSA that "the data is of adequate quality from which to draw conclusions for the purposes of this report" and in the LFGDA that "the data used is appropriate for the purposes of the assessment".</p>	<p>An assessment of the data quality with respect to the five category areas has been undertaken by the Auditor and is summarised below.</p>

6.1 Auditor's Opinion

In considering the data as a whole the Auditor concludes that:

- The data from the investigations is likely to be representative of the overall site conditions.
- The data is considered to be adequately complete.
- There is a high degree of confidence that data is comparable for each sampling and analytical event noting multiple rounds of ground gas data were collected by GHD and consideration has been given to possible effects of using different LFG monitors during some sampling events.
- The primary laboratory provided sufficient information to conclude that data is of sufficient precision.
- There is a high degree of confidence that the data is accurate with the exception of composite samples analysed for TRH/BTEXN which may underestimate concentrations present.

7. ENVIRONMENTAL QUALITY CRITERIA

The Auditor has assessed the results against Tier 1 criteria from National Environmental Protection Council (NEPC) *National Environmental Protection (Assessment of Site Contamination) Measure 1999*, as Amended 2013 (NEPM, 2013). Other guidance has been adopted where NEPM (2013) is not applicable or criteria are not provided. Based on the proposed future low density residential development, the human health criteria for 'residential with garden/accessible soil' and ecological criteria appropriate for 'urban residential and public open space' were adopted.

7.1 Soil Assessment Criteria

7.1.1 Human Health Assessment Criteria

The Auditor has adopted human health assessment criteria from the following sources:

- NEPM (2013) Health Investigation Levels (HILs) for 'Residential' (HIL A) land use.
- NEPM (2013) Health Screening Levels (HSLs) for 'Low-High Density Residential' (HSL A&B) land use. The HSLs were adopted for a clay soil type with depth to source <1 m as an initial screen.
- NEPM (2013) Management Limits (MLs) for petroleum hydrocarbons for 'Residential and Open Space' land use and assuming fine soil texture.
- Presence/absence of asbestos.

7.1.2 Ecological Assessment Criteria

The Auditor has adopted ecological soil assessment criteria from the following sources:

- NEPM (2013) Ecological Screening Levels (ESLs) for 'Urban Residential and Public Open Space' land use, assuming fine soil.
- NEPM (2013) Ecological Investigation Levels (EILs) for 'Urban Residential and Public Open Space' land use. In the absence of site-specific soil data on pH, clay content, cation exchange capacity and background concentrations, the published range of the added contaminant limits (ACL) have been applied as an initial screen.

7.1.3 Soil Aesthetic Considerations

The Auditor has considered the need for soil remediation based on 'aesthetic' contamination as outlined in *Section 3.6 Aesthetic Considerations* of NEPM (2013) Schedule B1, which acknowledges that there are no chemical-specific numerical aesthetic guidelines. Instead, site assessment requires a balanced consideration of the quantity, type and distribution of foreign material or odours in relation to the specific land use and its sensitivity.

7.2 Groundwater Assessment Criteria

7.2.1 Human Health Assessment Criteria

The Auditor has adopted human health assessment criteria from the following sources:

- NEPM (2013) HSLs for 'Low-High Density Residential' (HSL A&B) land use. The HSLs assumed a clay soil type and a depth to groundwater of >8 m.

7.2.2 Ecological Assessment Criteria

The Auditor has adopted ecological groundwater assessment criteria from the following sources:

- ANZG (2018) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia (www.waterquality.gov.au/anz-guidelines). Criteria for freshwater and 95% level of protection were adopted.

7.3 Ground Gas Considerations

In considering landfill gas, the Auditor has referred to the EPA (2016) *Environmental Guidelines, Solid waste landfills* and EPA (2020) *Assessment and Management of Hazardous Ground Gases, Contaminated Land Guidelines*.

There are no criteria produced by the EPA for landfill gas specific to the assessment of contaminated sites. Guidelines are provided, however, in the EPA (January 1996) *Environmental Guidelines: Solid Waste Landfills*. The following requirements for monitoring of landfill gas are specified:

- Action level for subsurface gas monitoring to detect off-site migration is 1% methane by volume (v/v) and 1.5% carbon dioxide v/v.
- Action level for gas accumulation in buildings is 1% methane (v/v).
- Action level for surface gas emission monitoring is 500 ppm (v/v) of methane at any point on the landfill surface (5 cm above the ground surface on a calm day).

The risk posed by ground gases was assessed by determining the Gas Screening Value (GSV) and Characteristic Situation (CS) in accordance with EPA (2020).

7.4 Auditor's Opinion

The environmental quality criteria referenced by the Auditor are consistent with those adopted by GHD with the exception of the following:

- GHD adopted site specific characteristics based on pH and cation exchange capacity (CEC) analysis performed on selected samples across the Lot when deciding on the ACL suitable for the EILs at the site. The pH and CEC values adopted for the upper soil layers were an average pH of 5.5 (range 4.7 to 6.6) and CEC of 13 cmolc/kg (range 7.8 to 18.5). A 10% clay content was also assumed.
- The CSA adopted the EPA (2012) *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases*. These guidelines have since been updated and replaced with the EPA (2020) *Assessment and Management of Hazardous Ground Gases* adopted for this SAR. It is noted that they have not materially changed with respect to criteria and the more recent reports by GHD have adopted the updated (2020) guidelines.

Given the results obtained, the Auditor considers that these discrepancies do not affect the overall conclusions reached by GHD and the Auditor.

8. EVALUATION OF SOIL RESULTS

As outlined in Section 6, GHD undertook investigations as part of the CSA to assess soil, groundwater and hazardous ground gas (HGG) within Lot 1, including the site. The CSA included the excavation of 94 test pits, drilling of six boreholes and installation of monitoring wells (groundwater and HGG) across Lot 1. The CSA sample locations are shown as Attachment 4, Appendix A and included 50 sample locations within the site (TP51 to TP84, TP86 to TP100 and MW06).

The following sections outline the soil field and analytical results from the CSA for the site.

8.1 Field Results

The CSA identified trace inclusions of coal fragments within both fill and natural soils at approximately 25% of the sample locations located within the site. Glass was also identified in the surface fill at TP94. ACM was not observed within soils or on the ground surface.

No hydrocarbon or other odours were noted during sampling. Black staining was noted by GHD in the natural silty clays at TP71, TP72 and TP81. No odours were associated with the staining and GHD considered that the staining was potentially from coal fines or other natural organic materials. Relevant samples from these locations were selected for laboratory analysis. PID readings were taken from all soil samples collected with results ranging between 1 ppm and 10.5 ppm.

8.2 Analytical Results

Soil samples collected during the CSA were analysed for a variety of contaminants including petroleum hydrocarbons, PAHs, asbestos and heavy metals. Sampling consisted of discrete samples from near surface and at depth and four-part composite samples comprising either surface or near surface soil samples. The results from discrete and composite samples have been assessed against the environmental quality criteria outlined in Section 7 and are summarised in Table 8.1 and Table 8.2 below, respectively.

Table 8.1: Evaluation of Discrete Soil Sample Analytical Results

Analyte	n	Detections	Maximum (mg/kg)	n > Human Health Screening Criteria	n > Terrestrial Ecological Screening Criteria
Asbestos in soil	2	0		0 above 0.1 g/kg	
BTEX	11	0	<PQL	0 above HSL A&B 0-1 m, clay	0 above ESL (urban residential) (fine)
F1 (TRH C ₆ -C ₁₀ minus BTEX)	11	0	<PQL	0 above HSL A&B 0-1 m, clay 50 mg/kg	0 above ESL (urban residential) 180 mg/kg
F2 (TRH >C ₁₀ -C ₁₆ minus naphthalene)	11	0	<PQL	0 above HSL A&B 0-1 m, clay 280 mg/kg	-
TRH C ₆ -C ₁₀	11	0	<PQL	0 above ML (urban residential) 800 mg/kg	-
TRH >C ₁₀ -C ₁₆	11	0	<PQL	0 above ML (urban residential) 1000 mg/kg	0 above ESL (urban residential) 120 mg/kg
TRH >C ₁₆ -C ₃₄	11	0	<PQL	0 above ML (urban residential) 3500 mg/kg	0 above ESL 1300 mg/kg

Analyte	n	Detections	Maximum (mg/kg)	n > Human Health Screening Criteria	n > Terrestrial Ecological Screening Criteria
TRH >C ₃₄ -C ₄₀	11	0	<PQL	0 above ML (urban residential) 10,000 mg/kg	0 above ESL 5600 mg/kg
Naphthalene	11	0	<PQL	0 above HSL A&B 0-1 m, clay 5 mg/kg	0 above EIL (urban residential) 170 mg/kg
Benzo(a)pyrene	11	0	<PQL	-	0 above ESL (urban residential) 0.7 mg/kg
Benzo(a)pyrene TEQ	11	0	<PQL	0 above HIL A 3 mg/kg	-
Total PAHs	11	0	<PQL	0 above HIL A 300 mg/kg	-
Arsenic	16	5	9	0 above HIL A 100 mg/kg	0 above EIL (urban residential) 100 mg/kg
Cadmium	16	5	2	0 above HIL A 20 mg/kg	-
Chromium	16	16	136	4 above HIL A for Chromium VI 100 mg/kg	0 above most conservative ACL (urban residential) 190 mg/kg
Chromium VI	3	0	<PQL	0 above HIL A 100 mg/kg	
Copper	16	12	12	0 above HIL A 6000 mg/kg	0 above most conservative ACL (urban residential) 60 mg/kg
Lead	16	16	42	0 above HIL A 300 mg/kg	0 above generic ACL (urban residential) 1100 mg/kg
Mercury	16	0	<PQL	0 above HIL A 40 mg/kg	-
Nickel	16	16	28	0 above HIL A 400 mg/kg	0 above most conservative ACL (urban residential) 30 mg/kg
Zinc	16	8	17	0 above HIL A 7400 mg/kg	0 above most conservative ACL (urban residential) 70 mg/kg

n number of samples
 - No criteria available/used
 NL Non-limiting
 <PQL Less than the practical quantitation limit

Table 8.2: Evaluation of Four-Part Composite Soil Sample Analytical Results

Analyte	n	Detections	Maximum (mg/kg)	n > Human Health Screening Criteria*	n > Terrestrial Ecological Screening Criteria*
BTEX	11	0	<PQL	0 above HSL A&B 0-1 m, clay	0 above ESL (urban residential) (fine)
F1 (TRH C ₆ -C ₁₀ minus BTEX)	11	0	<PQL	0 above HSL A&B 0-1 m, clay	0 above ESL (urban residential)
F2 (TRH >C ₁₀ -C ₁₆ minus naphthalene)	11	0	<PQL	0 above HSL A&B 0-1 m, clay	-

Analyte	n	Detections	Maximum (mg/kg)	n > Human Health Screening Criteria*	n > Terrestrial Ecological Screening Criteria*
TRH C ₆ -C ₁₀	11	0	<PQL	0 above ML (urban residential) 200 mg/kg	-
TRH >C ₁₀ -C ₁₆	11	0	<PQL	0 above ML (urban residential) 250 mg/kg	0 above ESL (urban residential) 40 mg/kg
TRH >C ₁₆ -C ₃₄	11	0	<PQL	0 above ML (urban residential) 875 mg/kg	0 above ESL 325 mg/kg
TRH >C ₃₄ -C ₄₀	11	0	<PQL	0 above ML (urban residential) 2,500 mg/kg	0 above ESL 1,400 mg/kg
Naphthalene	11	0	<PQL	0 above HSL A&B 0-1 m, clay 1 mg/kg	0 above EIL (urban residential) 40 mg/kg
Benzo(a)pyrene	11	0	<PQL	-	0 above ESL (urban residential) 0.2 mg/kg
Benzo(a)pyrene TEQ	11	0	<PQL	0 above HIL A 0.8 mg/kg	-
Total PAHs	11	0	<PQL	0 above HIL A 75 mg/kg	-
Arsenic	11	2	5	0 above HIL A 25 mg/kg	0 above EIL (urban residential) 25 mg/kg
Cadmium	11	0	<PQL	0 above HIL A 20 mg/kg	-
Chromium	11	11	72	10 above HIL A Chromium VI 25 mg/kg	2 above most conservative ACL (urban residential) 50 mg/kg
Copper	11	8	12	0 above HIL A 1,500 mg/kg	0 above most conservative ACL (urban residential) 15 mg/kg
Lead	11	16	28	0 above HIL A 75 mg/kg	0 above generic ACL (urban residential) 280 mg/kg
Mercury	11	0	<PQL	0 above HIL A 10 mg/kg	-
Nickel	11	11	12	0 above HIL A 100 mg/kg	7 above most conservative ACL (urban residential) 8 mg/kg
Zinc	11	10	18	0 above HIL A 1,850 mg/kg	0 above most conservative ACL (urban residential) 20 mg/kg
PCB	14	0	<PQL	0 above HIL A 0.3 mg/kg	-
OCP	14	0	<PQL	0 above HIL A	0 above EIL

n number of samples
 - No criteria available/used
 NL Non-limiting
 <PQL Less than the practical quantitation limit
 * Criteria divided by four to account for composite samples consisting of four parts

In reviewing the analytical results, the Auditor notes the following:

- Concentrations of TRH, BTEX, PAHs, OCP and PCBs were all reported below the laboratory PQL and below the adopted human health and ecological criteria.
- Asbestos was not observed during sampling or detected in the samples analysed.
- Elevated concentrations of total chromium were identified in four discrete samples (TP60_0-0.2, TP60_0.3-0.5, TP70_0.3-0.5 and field duplicate of sample TP80_0-0.2), above the Chromium VI human health criteria adopted. Three discrete samples were subject to Chromium VI analysis with all results reporting below the laboratory PQL and below the adopted human health criteria. Elevated concentrations of total chromium were also identified in 10 composite samples above the factored Chromium VI human health criteria adopted (25 mg/kg). GHD considered that as the human health criteria value adopted is for Chromium VI and there are no apparent sources of Chromium VI at the site, it is likely that the majority of the elevated total chromium concentrations are made up of Chromium III. GHD analysis of deeper samples indicated very slight reductions or increases in total chromium concentrations, which suggests that the higher total chromium concentrations at the site are attributable to natural/background levels in the regional soils. GHD considered it unlikely that there would be significant contamination from Chromium VI on site and hence the detected exceedances do not represent a significant risk to human health or the environment.
- Concentrations of chromium and zinc above the factored most conservative ACL criteria adopted for ecological receptors were identified in two and seven of the composite samples respectively. GHD adopted EILs based on the ACL and site-specific soil characteristics such as pH and cation exchange capacity (CEC). The identified chromium and zinc concentrations were below the EILs adopted by GHD.
- Remaining concentrations of metals were below both the adopted human health and ecological criteria.

8.3 Auditor's Opinion

In the Auditor's opinion, the soil analytical results are consistent with the site history and field observations. As there are no sources of Chromium VI at the site and Chromium VI was not detected in three samples subject to speciated analysis, the Auditor agrees with GHD that it is likely that total chromium results are made up of Chromium III and do not present a risk to human health. The identified elevated concentrations of total chromium are likely attributable to natural/background levels in the regional soils. The Auditor is satisfied that no further investigations are needed with respect to chemical contaminants in soil and that the site criteria for residential land uses have been met.

9. EVALUATION OF GROUND GAS RESULTS

9.1 Overview of Ground Gas Monitoring

As outlined in Table 6.1, GHD undertook investigations to assess contamination on the wider Lot including the site which included the installation of 37 monitoring wells (groundwater and ground gas) as shown on Attachment 3, Appendix A. As part of the CSA, GHD initially undertook ground gas monitoring over one event from six monitoring wells within the Lot (MW01 to MW06) as well as offsite wells to the west within the landfill site. Due to the detection of methane above 1% v/v in the two wells within the Lot closest to the landfill (MW02 and MW03), monitoring was undertaken monthly between July 2019 and December 2019 before additional wells were installed by GHD in January 2020 targeting areas adjacent to the former Anambah landfill. Fourteen locations were placed within the Lot (B to H and L to R) with five within the site (M to O, Q and R). Monitoring continued monthly from January 2020 to March 2021.

14 additional wells (A1 to A14) were installed by GHD as part of the LFGDA in an attempt to delineate a portion of the Lot suitable for residential development. These wells were generally monitored fortnightly between December 2020 and March 2021. Continuous monitoring equipment was placed in three of the newly installed wells based upon the initial round of monitoring. Two GasClam continuous monitors were installed on 18 December 2020 in closest proximity on the next transect to the east of the GasFlux, A9 and A10. A GasfluX continuous monitor was installed on 23 December 2020 at the well with the highest methane concentrations on the furthest-east transect of wells at the time of installation, A5. The GasClam devices were removed on 18 March 2021, and the GasfluX device was removed on 26 March 2021.

The following sections outline the ground gas field results.

9.2 Spot Monitoring Results

Ground gas concentrations (CH₄, H₂S, CO₂, CO and O₂) and flow measurements were recorded using a handheld landfill gas analyser (GA5000) for each monitoring event.

Methane

The SAQP provides a summary of monitoring data collated for the Lot and the adjoining former landfill area. The summary indicates that between November 2015 to September 2020 there were a number of monitoring wells which contain methane concentrations above the investigation threshold of 1% v/v methane. All of the wells that contain methane above the threshold are situated towards the western boundary of the Lot. The most easterly wells that contained methane were wells B and C which are situated approximately 60 m east of the western Lot boundary with the landfill.

The LFGDA provides a summary of the data obtained after the SAQP from October 2020 to March 2021. The following wells recorded peak methane exceedances above the 1% v/v criteria and the locations, along with the average and peak concentrations, are presented in Attachment 6, Appendix A:

- B (max peak concentration 45.9% v/v)
- C (max peak concentration 41.1% v/v)
- D (max peak concentration 56.7% v/v)
- E (max peak concentration 33.8% v/v)
- F (max peak concentration 17.2% v/v)
- J (max peak concentration 44.9% v/v)
- A1 (max peak concentration 42.6% v/v)

- A2 (max peak concentration 1.7% v/v)
- A3 (max peak concentration 9.8% v/v)
- A5 (max peak concentration 9.1% v/v)
- G210 (max peak concentration 73.3% v/v)
- G211 (max peak concentration 55.4% v/v)
- G212 (max peak concentration 58.8% v/v)
- MW01 (max peak concentration 14.9% v/v)

All the above wells are located outside the site in either the western portion of the Lot, in the services easement or on the former landfill itself, to the immediate west of the Lot. Concentrations of methane were not detected at the site during the spot monitoring events summarised in the SAQP and the LFGDA.

Carbon Dioxide

The SAQP summary indicates many of the wells within the Lot contain carbon dioxide above the relevant threshold of 1.5% v/v. However, background concentrations of carbon dioxide have not been determined and therefore it is unknown if these elevated readings are naturally occurring, derived from the adjacent landfill, derived from the adjacent sewer and/or some mix of these sources. The SAQP notes that there was a distinct increase in carbon dioxide concentrations in the September 2020 monitoring results compared with earlier results. GHD has not been able to confirm whether these concentrations may be attributable to a change in monitoring method or personnel.

The LFGDA summary indicates all wells within the Lot recorded concentrations of carbon dioxide above the 1.5% v/v threshold with the maximum concentration of 9% v/v recorded at well O during the September 2020 event. Peak concentrations of 10.3% v/v were recorded at wells M and N during the monitoring event on 2 March 2021. Locations M, N and O are located on the southern boundary of the site (eastern portion of Lot). Methane was not detected in these locations.

Gas Well Flow

The SAQP summary indicates that during the initial four rounds of available monitoring data (October 2019 - January 2020), gas flow rates in most wells within the Lot were generally close to zero or negative. However, during the most recent round reported in the SAQP (September 2020), some of the wells were reported to have an increased flow rate (maximum of 10.9 L/hr). It is noted that the September 2020 round was during a period of high pressure (1024.00-1025.50 millibars). The maximum recorded positive flow for locations within the site was 6.1 L/hr at MW06 (located in the east of the site) during the September 2020 event.

The LFGDA summary indicates all wells within the Lot had negative or low (eg. < 2 L/hr) flow rates except for well J (peak 9.9 L/hr reported in November 2020), G208 (peak 14.5 L/hr reported in October 2020) and G210 (peak 10.6 L/hr reported in November 2020). The maximum recorded positive flow for locations within the site was 1.1 L/hr at well Q during the September 2020 event.

9.3 Continuous Monitoring

In addition to the discrete monitoring rounds, continuous monitors were installed by GHD as part of the LFGDA in three monitoring wells. A GasfluX continuous monitor was installed at well A5 and the two GasClam continuous monitors were installed at wells A9 and A10.

Results for the GasfluX monitoring in well A5, located within the Lot, beyond the western boundary of the site, are presented in Figure 9.1 below.

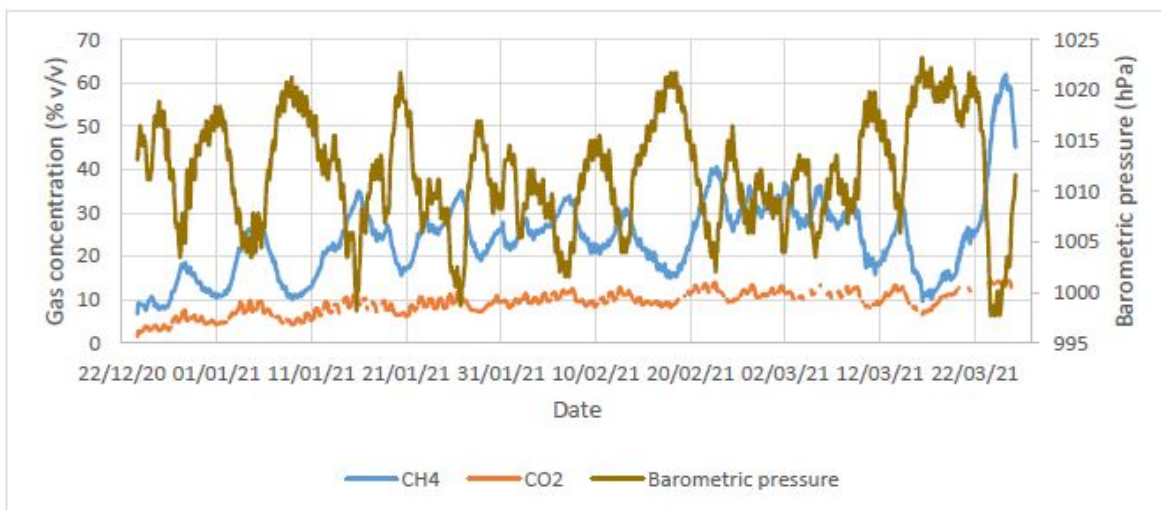


Figure 7-1 Comparison of methane and carbon dioxide concentrations with barometric pressure at well A5 – 23 December 2020 to 26 March 2021

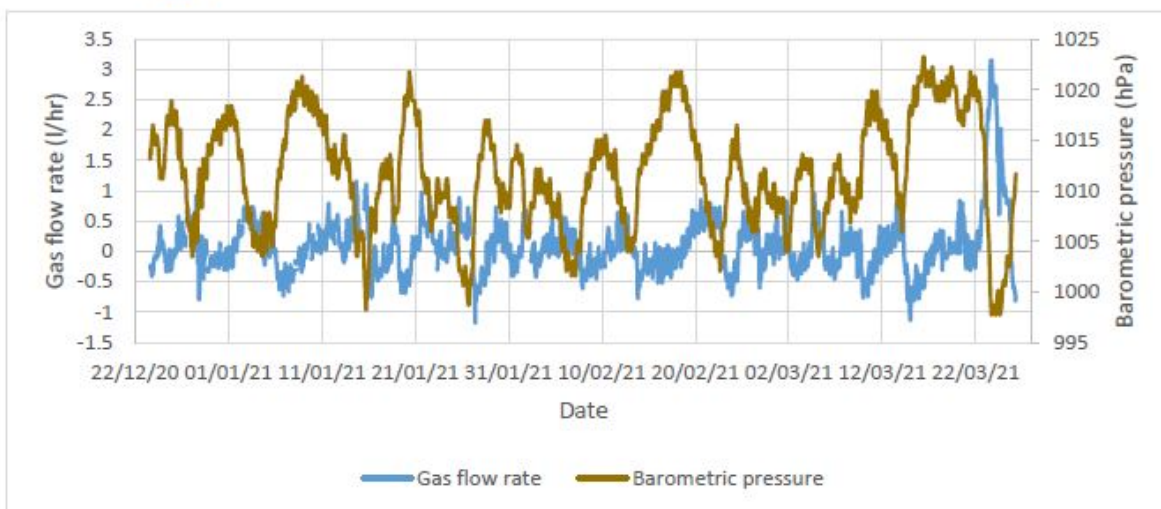


Figure 7-2 Comparison of gas flow rate with barometric pressure at well A5 – 23 December 2020 to 26 March 2021

Figure 9.1: Summary of A5 GasfluX results (Source: LFGDA)

Figure 9.1 indicates that methane concentrations and gas flow rates were at their greatest during or immediately after periods of falling barometric pressure. Carbon dioxide concentration trends reflect methane trends. Methane concentrations and gas flow rates were observed to reach their peaks during the largest and most sustained drop in barometric pressure which occurred at the end of the monitoring period. These peaks were also directly after a period of heavy rainfall, which would be expected to saturate surface soils and increase the tendency for lateral migration of LFG.

The GasClam continuous monitors were installed in wells A9 and A10, located toward the centre of the Lot. These locations are along the boundary defined by GHD between the eastern and western portions and are close to the western site boundary which is 18 m from the GHD defined boundary. Methane concentrations of 0.1% v/v were recorded at A9 while a maximum methane concentration of 0.6% v/v was reported for A10. Carbon dioxide concentrations were recorded at 5.8% v/v at A9 and 11.1% v/v at A10. A comparison of methane and carbon dioxide concentrations with barometric pressure for location A10 is presented in Figure 9.2 below.

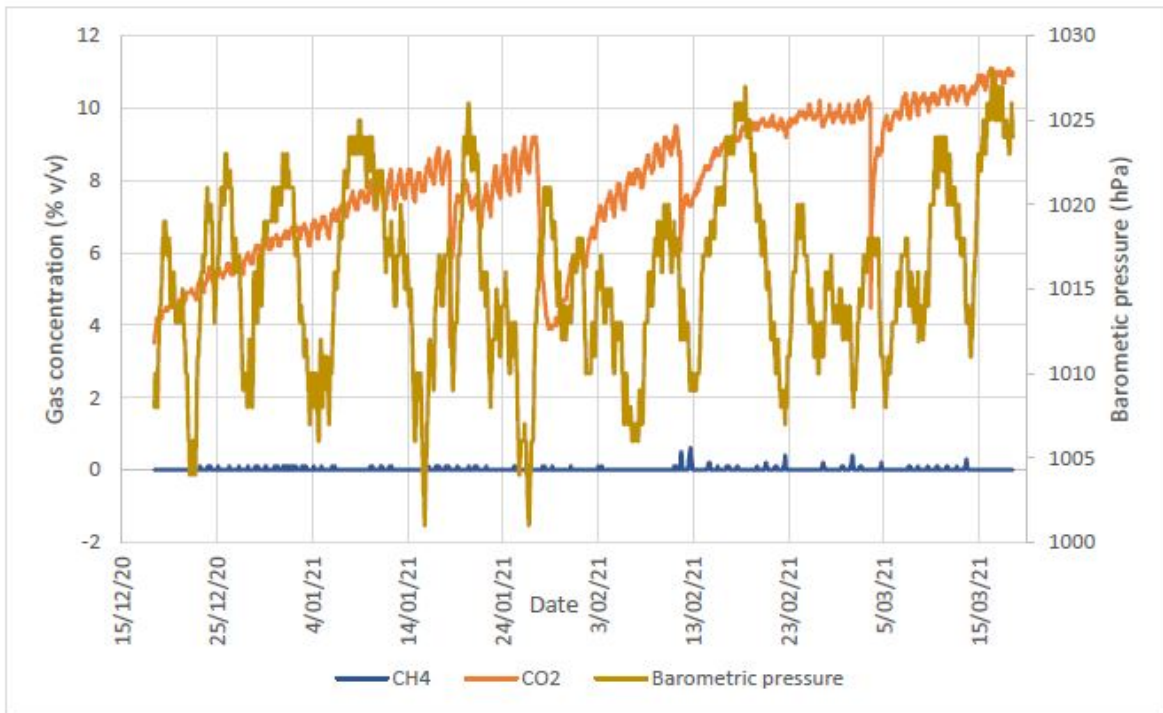


Figure 7-5 Comparison of methane and carbon dioxide concentrations with barometric pressure at well A10

Figure 9.2: Summary of A10 GasClam results (Source: LFGDA)

Figure 9.2 indicates methane concentrations in well A10 were insignificant in comparison with carbon dioxide concentrations, which showed an overall increasing trend over the period of monitoring. GHD indicated that the main fluctuations in carbon dioxide concentrations generally corresponded with removal of the GasClam for battery changes where the well would have vented and concentrations slowly increased after the well was re-sealed. The duration of recovery appears proportional to the duration of venting which GHD suggests indicates that carbon dioxide generation rates are relatively low, and may be due primarily to bacterial oxidation within the soil profile (of natural compounds as well as methane) rather than pressure-driven migration from the former landfill. GHD indicates that the slower drop in carbon dioxide concentrations on 27 – 28/01/2021 was not due to a battery change and was likely due to rising barometric pressures at that time, resulting in negative flow conditions.

EPA (2020) *Assessment and Management of Hazardous Ground Gases, Contaminated Land Guidelines* defines a “worst case” meteorological event as a 5th percentile 3-hour pressure decrease (using two years of data), which was calculated by GHD to be 3.1 hPa over 3 hours (based on a 2 year dataset from Maitland Airport BOM AWS (Station no. 061428)). GHD reported in the LFGDA that the data recorded by the GasfluX device in well A5 indicates that this threshold was exceeded on 11 occasions during the monitoring period.

9.4 Gas Assessment

As part of the CSA, SAQP and LFGDA, GHD evaluated the risks posed by methane and carbon dioxide by calculation of the worst-case Gas Screening Values (GSV) and Characteristic Situation (CS) following the Wilson and Card Method. Based on the CS and the intended site use, a gas protection value and applicable gas protection measures are then determined based on the EPA (2020) Guidelines.

The GSV is calculated by multiplying the maximum borehole flow rate (L/hr) and the maximum gas concentration (% v/v) divided by 100. The CS is determined based on the GSV value

following the EPA (2020) Guidelines. Table 9.1 below provides a summary of the maximum calculated GSV and CS at each well located at the site.

Table 9.1: Summary of GSV and CS Results

Monitoring Well	Monitoring Round	Calculated GSV (L/hr)		CS	
		CH ₄	CO ₂	CH ₄	CO ₂
MW06	24/11/2020	0	0.39	1	2
M	11/2/2021	0	0.03	1	2
N	2/3/2021	0	0.03	1	2
O	17/9/20	0	0.03	1	2
Q	26/11/2020	0	0.03	1	2
R	27/1/2021	0	0.02	1	2
A9	24/11/2020	0	0.365	1	2
A10	24/11/2020	0	0.699	1	2
A11	2/3/2021	0	0.03	1	2
A12	2/3/2021	0	0.02	1	2
A13	27/1/2021	0	0.03	1	2
A14	2/3/2021	0	0.03	1	2

No methane concentrations exceeding the assessment criteria of 1 % v/v have been recorded on the site. As shown above in Table 9.1, all wells on the site have a CS of 2 (low risk) and are governed by carbon dioxide. It is noted that all wells have experienced at least one round with a carbon dioxide reading above 5% v/v, therefore triggering the CS of 2, even if the GSV is below 0.07. GHD considered that these carbon dioxide concentrations may be attributable in part to natural sources.

Based on the Level 2 risk assessment performed by GHD, gas protection measures in accordance with Section 5.3 of EPA (2020) Guidelines will be required to allow development of the site. This risk classification is on the basis of carbon dioxide concentrations (whether it is naturally occurring, landfill derived or otherwise derived), regardless of no exceedances of methane concentrations being recorded within the site. For a Level 2 risk assessment outcome of CS 2, a gas protection guidance value of "3" is required for low-density residential use. Examples of measures identified in the EPA (2020) Guidelines (Table 9) to achieve a gas protection score of 3 are provided in the EMP, discussed in Section 14.

The LFGDA indicates that all wells in the western portion of the Lot have a CS of 2 (low risk) except for wells D (CS 3), G208 (CS 3), G210 (CS 4). A CS of greater than 2 was also calculated at well J (CS 4), within the north-eastern corner of the adjacent landfill, and wells G211 (CS 3) and G212 (CS 3), located within the services easement to the southwest of the Lot.

Approximately one third of the wells located in the western portion of the Lot and within the former landfill have a GSV and CS governed by methane.

9.5 Auditor's Opinion

In the Auditor's opinion, the ground gas monitoring undertaken was adequate to assess ground gas conditions at the site and delineate the extent of methane impact migrating from the landfill towards the site over an appropriate range of conditions. GHD identified a boundary within the Lot to separate the western portion which is not considered suitable for development at this time due to high methane concentrations.

Concentrations of ground gas (carbon dioxide) have been identified within the eastern portion and, although occurring at relatively low concentrations, have potential to present unacceptable risks to site users. GHD considered that these carbon dioxide concentrations may be attributable in part to natural sources. The Auditor agrees with GHD's findings and that gas protection measures are required to make the site suitable for the proposed future residential use. These are proposed to be implemented via an EMP, discussed in Section 14.

10. EVALUATION OF GROUNDWATER RESULTS

The groundwater monitoring network within the Lot comprises three wells (MW01, MW04 and MW06) installed by GHD during the CSA. One groundwater monitoring well, MW06, is located within the site while MW01 and MW04 are located outside the site boundary, in the northwest and southwest of the Lot, respectively. The monitoring well locations are shown on Attachment 4, Appendix A.

Groundwater wells were sampled by GHD during the CSA. The following sections outline the groundwater field and analytical results from the CSA.

10.1 Field Results

GHD monitored and sampled the groundwater in March 2017. No phased separated hydrocarbons, sheens or odours were noted by GHD. Groundwater field parameters (pH, EC, DO and redox potential) were measured continuously during sampling to ensure representative samples were collected. General observations were:

- pH ranged between 6.59 and 6.86 indicating almost neutral conditions.
- EC ranged between 8,890 $\mu\text{s}/\text{cm}$ and 18,980 $\mu\text{s}/\text{cm}$ indicating that the groundwater was saline.
- DO ranged between 3.1 mg/L and 3.4 mg/L and redox ranged between 66 mV and 115 mV indicating that the groundwater is moderately aerobic.

10.2 Analytical Results

Groundwater analytical results from the CSA are summarised in Table 10.1.

Table 10.1: Summary of Maximum Groundwater Investigation Analytical Results ($\mu\text{g}/\text{L}$)

Analyte	n	Detections	Maximum	n > HSL A&B clay, >8 m NEPM (2013)	n > GILs Fresh ANZG (2018)
TRH C ₆ -C ₁₀ less BTEX (F1)	3	0	<PQL	0 above HSL of NL	-
TRH >C ₁₀ -C ₁₆ less naphthalene (F2)	3	0	<PQL	0 above HSL of NL	-
TRH >C ₁₆ -C ₃₄	3	0	<PQL	-	-
TRH >C ₃₄ -C ₄₀	3	0	<PQL	-	-
Benzene	3	0	<PQL	0 above HSL of 5,000	0 above GIL of 950
Toluene	3	1	6	0 above HSL of NL	0 above GIL of 180
Ethylbenzene	3	0	<PQL	0 above HSL of NL	0 above GIL of 80
Xylenes	3	0	<PQL	0 above HSL of NL	0 above GIL of 200
Naphthalene	3	0	<PQL	0 above HSL of NL	0 above GIL of 16
Benzo(a)pyrene	3	0	<PQL	-	0 above GIL of 0.2
Anthracene	3	0	<PQL	-	0 above GIL of 0.4
Fluoranthene	3	0	<PQL	-	0 above GIL of 1.4
Phenanthrene	3	0	<PQL	-	0 above GIL of 2
Arsenic	3	1	1	-	0 above GIL of 13
Cadmium	3	1	0.1	-	0 above GIL of 0.2
Chromium	3	0	<PQL	-	0 above GIL of 1

Analyte	n	Detections	Maximum	n > HSL A&B clay, >8 m NEPM (2013)	n > GILs Fresh ANZG (2018)
Copper	3	3	10	-	1 above GIL of 1.4
Lead	3	0	<PQL	-	0 above GIL of 3.4
Mercury	3	0	<PQL	-	0 above GIL of 0.06
Nickel	3	3	8	-	0 above GIL of 11
Zinc	3	3	17	-	1 above GIL of 8
OCP	3	0	<PQL	-	
OPP	3	0	<PQL	-	
PCBs	3	0	<PQL	-	
VOCs	3	0	<PQL	-	
Phenols	3	0	<PQL	-	

n number of samples
 - No criteria available/used
 <PQL Less than the practical quantitation limit
 NL non limiting

In assessing the analytical results, the Auditor makes the following observations:

- A low concentration of toluene was detected in the MW04 (southwest) sample and its duplicate (FD01), significantly below the adopted criteria. No other volatile compounds (BTEXN, TRH and VOCs) were detected above the PQL.
- Elevated concentrations of copper and zinc above the adopted ecological criteria were identified in the groundwater sample from well MW04 and its duplicate (FD01). MW04 is located close to the former landfill and no elevated concentrations of copper and zinc were identified in the soils analysed. The elevated concentrations were considered by GHD to be indicating some impact from the adjacent former landfill however it was further noted that concentrations may be representative of natural conditions. GHD stated that *“given the depth to groundwater and that it is unlikely that groundwater would be extracted for use at the Site, these impacts are not considered to pose a risk to either human health or the environment.”*
- Concentrations of all other analytes were below the PQL and the adopted criteria.

10.3 Auditor’s Opinion

In the Auditor’s opinion, the groundwater analytical results are consistent with the field observations and indicate that significant groundwater contamination is not present at the site. The Auditor agrees with GHD that the copper and zinc impacts are not considered to pose a risk to human health or the environment.

11. EVALUATION OF CONCEPTUAL SITE MODEL

A conceptual site model (CSM) is a representation of the contaminant source, pathway and receptor linkages at a site. GHD developed a CSM and used it iteratively throughout the site assessment to inform decisions around investigation and management requirements. The CSM was initially developed following the CSA and has been updated as new information became available. Table 11.1 provides the Auditor’s review of the final CSM used by GHD in the LFGDA to inform further management/decisions on site suitability.

Table 11.1: Review of the Conceptual Site Model

Element of CSM	Consultant	Auditor Opinion
Contaminant source and mechanism	Hazardous ground gas (carbon dioxide) from either natural sources or landfill gas migration from the former landfill	The sources of contamination and contaminants of concern including the mechanism of contamination have generally been appropriately identified.
Affected media	Ground gas	The affected media have been appropriately identified.
Receptor identification	Receptors include both on-site and off-site human receptors, comprising: <ul style="list-style-type: none"> • Future on-site workers (construction and maintenance workers) for both intrusive and non-intrusive works • Future on-site residents and visitors following future residential development • Off-site residents and visitors on nearby lands, and maintenance workers for both intrusive and non-intrusive works. 	The receptors have been appropriately identified.
Exposure pathways	Potential exposure pathways for the receptors identified include: <ul style="list-style-type: none"> • Inhalation of LFG during excavations or enclosed space entry at the site • Asphyxiation and explosion hazards from accumulation of LFG in buildings or services. 	The exposure pathways have been appropriately identified.
Presence of preferential pathways for contaminant movement	The main potential migration pathways are considered to be: <ul style="list-style-type: none"> • The subsurface soil profile • Preferential pathways for landfill gases to accumulate in enclosed spaces, including service trenches. 	Potential for preferential pathways for migration, including planned subsurface structures and buildings, will need to be appropriately identified and considered in the design of gas protection measures.
Potentially complete source-pathway-receptor (SPR) linkages requiring remediation or management	The LFGDA did not clearly identify the potentially complete SPR linkages however GHD considered that the site is suitable for residential development, provided appropriate building protection measures are implemented which is interpreted to be an identified SPR linkage.	This description is considered reasonable, noting the following: <ul style="list-style-type: none"> • Management measures are required during construction. • Ongoing management will be required to ensure future works do not expose intrusive maintenance workers. • Construction and ongoing management of gas protection measures is required.

Element of CSM	Consultant	Auditor Opinion
Evaluation of data gaps	<p>GHD identify data gaps specifically relating to the site, which would need to be addressed as part of a more detailed assessment of LFG risks to future development (and potentially allow a lesser degree of building protection measures), include the following:</p> <ul style="list-style-type: none"> • Vertical distribution of methane and carbon dioxide concentrations and flows within the soil profile (e.g. by means of nested wells) • Further understanding of flow (e.g. advective or diffusive) and surface emission rates (eg. by means of flux hood measurements; purging wells and measuring recovery of LFG concentrations) • Detailed logs of site lithology using a drilling method where thin bedding planes of potential preferential high-permeability soil lenses are mapped to explain why some, but not all, wells have impacts when located a similar distance from the adjacent landfill boundary • Background sub-surface carbon dioxide levels sourced from an off-site 'background' well • How future remedial designs may affect current LFG concentrations and rates of migration at the site. 	<p>The data gaps have been appropriately described and the significance of those data gaps considered.</p>

11.1 Auditor’s Opinion

The Auditor is of the opinion that the CSM was a reasonable representation of the contamination at the site. Management measures are required for the control of HGG to allow residential development of the eastern portion of the Lot.

12. CONTAMINATION MIGRATION POTENTIAL

No significant levels of contaminants were detected in soil over the site and therefore there is little or no potential for migration of contamination from the site or vertically to groundwater. The groundwater assessment undertaken does not indicate significant contamination at the site although indicate potential impact to groundwater by heavy metals from the landfill.

There is potential for the migration of HGG (carbon dioxide) during excavation/development works from the underlying subsurface. There is also potential for migration of LFG from the former offsite landfill onto the site. Appropriate building protection measures and a long term EMP will be required to be implemented to reduce these potential risks to residential development within the eastern portion.

13. ASSESSMENT OF RISK

There is a potential risk to human receptors at the site from HGG (carbon dioxide), however the risks are likely to be relatively low subject to the implementation and management of gas protection measures under an EMP. The implementation of gas protection measures and management via an EMP are considered adequate to address the identified risks from HGG within the any new buildings based on the CSM. Gas protection mitigates the risk from HGG by preventing ingress of HGG into the buildings. An EMP has been prepared and reviewed in Section 14 of this SAR which documents the process for selection and implementation of appropriate gas protection measures in accordance with Section 5 of EPA (2020) *Assessment and management of hazardous ground gases, Contaminated Land Guidelines* and the management and monitoring requirements required to allow the proposed residential development to be undertaken on the site.

Because beneficial re-use of groundwater is not proposed at the site, the risks to human health are low (i.e. no direct contact with seepage and no groundwater abstraction). However, any future use of groundwater would require appropriate groundwater assessment and regulatory approvals from the NSW Office of Water.

14. ONGOING SITE MANAGEMENT

GHD has prepared the following document for site management during the development phase, which is attached to the Site Audit Statement (SAS) in Appendix B:

- ‘Anambah – Eastern Portion of Lot 1 DP1243663 – Hazardous ground gas EMP’ dated 25 June 2021 by GHD Pty Ltd.

Table 14.1 presents the Auditor’s assessment of the EMP.

Table 14.1: Assessment of the EMP

Item	Auditor Comments
<p><i>Purpose of the EMP</i></p> <p>The purpose of the EMP is to document the process for selection and implementation of appropriate gas protection measures in accordance with Section 5 of EPA (2020) <i>Assessment and management of hazardous ground gases</i>, and the management and monitoring requirements required to allow the proposed residential development to be undertaken on the site.</p> <p>The EMP requires appropriate gas protection measures to be designed by an appropriately qualified consultant on behalf of Signature Gardens, together with documented procedures for verification of appropriate installation of the measures, and incorporated in a revised EMP (which will also include inspection and maintenance requirements for the gas protection measures). The revised EMP will be reviewed by an accredited site auditor, and subject to installation verification procedures that are acceptable to the site auditor. A Section A2 SAS will be issued following design (and potentially installation) of the gas protection measures, confirming the site is suitable for the proposed residential development subject to implementation of the revised EMP.</p> <p>Following installation of the gas protection measures, it is anticipated that ongoing management will require maintenance of passive control systems only.</p>	<p>The EMP provides an appropriate level of background information and is a standalone document.</p> <p>The purpose and the applicability of the EMP is considered appropriate, noting that a revised EMP will be required following completion of the gas protection measures.</p> <p>The EMP is not intended to address other risks or management requirements during site development (such as, but not limited to management of surface water or environmental impacts from construction works). The EMP is not applicable for development of the site for purposes other than the proposed development.</p>
<p><i>The Nature and Location of Contamination Remaining</i></p> <p>Carbon dioxide (CO₂) is the main hazardous ground gas that has been identified as requiring management at the site. The EMP notes that the available monitoring data indicates the Eastern Portion is not affected by methane (CH₄) concentrations exceeding the investigation threshold.</p> <p>No sources of gas or vapours other than the adjacent former landfill or natural organic matter have been identified.</p>	<p>The contaminants of concern and general contamination status are appropriately identified.</p> <p>The EMP covers the Eastern Portion of Lot 1 which is appropriate, noting that no structures or services are to be constructed within the 18 m wide strip in the west of the site (west of the boundary of the Eastern Portion).</p>
<p><i>Management Activities</i></p> <p>Section 5 of the EMP outlines the management activities. These include:</p> <p><u>Detailed Assessment</u></p> <p>An option remains to undertake a more detailed assessment of HGG at the site to demonstrate whether a lower CS can be justified, in which case gas protection measures may not be required.</p> <p><u>Detailed Design of Gas Protection Measures</u></p> <p>The EMP does not intend to be prescriptive in regard to the design and verification of appropriate gas protection measures. Rather, it is the responsibility of Signature Gardens and their consultants to select measures that suit their particular requirements while achieving the performance characteristics required by EPA (2020), and by means of review by an</p>	<p>The management activities outlined in the EMP are considered appropriate until a revised EMP is prepared detailing the selected designed gas protection measures and verification requirements.</p> <p>If a detailed assessment was undertaken this could consider the data gaps identified by GHD as discussed in the CSM.</p>

Item	Auditor Comments
<p>accredited site auditor are considered sufficient to make the site suitable for residential land use.</p> <p>Examples of gas protection measures that may be combined to achieve the required score of 3 are shown in Table 5.1 of the EMP (from Table 9 of the EPA (2020) Guidelines).</p> <p><u>Verification of gas protection measures</u></p> <p>The verification procedures shall have regard to Section 5.7 of the EPA (2020) Guidelines. The verification procedures must be specific and appropriate to the gas protection measures that have been selected, including all inspection and testing requirements and qualifications of installers and verifiers.</p> <p><u>Ongoing Monitoring</u></p> <p>Council is currently undertaking periodic monitoring of landfill gas concentrations, flow rates and groundwater levels in monitoring wells at the former landfill and selected wells on the property. This monitoring should continue on at least a quarterly basis, and should include at least half the wells available on the western portion of the property (to allow for consideration of passive venting from other wells), plus wells M, Q and A9 to A14 as shown on Attachment 3 in Appendix A. This data should be used to confirm that the basis on which the EMP has been prepared is still valid, and that a CS of 2 is still applicable to the Eastern Portion.</p> <p>Data from the ongoing monitoring should be provided to the site auditor for review as part of preparation of the revised EMP.</p> <p>The requirements for continued monitoring should be defined in the revised EMP, including a decision process to allow reduction or eventual cessation of monitoring. It is expected that monitoring will continue at least until rehabilitation of the former Anambah landfill adjoining the property.</p>	<p>The Auditor notes that an alternative form of documentation for the selected designed gas protection measures and verification requirements (i.e. alternate to EMP) may be adopted, provided it is reviewed as suitable by a site auditor.</p> <p>The Auditor notes that management measures for the protection of construction workers are required during construction.</p>
<p><u>Inspections, Maintenance, Sampling, Analysis and Reporting</u></p> <p>Inspection and maintenance procedures including frequency, response actions and contingency measures shall be established, specific to the selected gas protection measures. These shall be documented for review by the site auditor as part of a revised EMP.</p>	<p>It is appropriate for the revised EMP to include long term inspection and maintenance procedures.</p>
<p><u>EMP Review</u></p> <p>It is expected the EMP will be replaced by the revised version before review is required. The revised EMP must incorporate procedures for periodic monitoring of the applicability of the EMP, and review and revision as may be required.</p> <p>If the EMP has not been replaced within 12 months, review of the EMP should be undertaken, including consideration of the following to confirm that the provisions of the EMP are still applicable:</p> <ul style="list-style-type: none"> - Review of landfill gas monitoring results from the property and from the adjacent landfill - Observations and liaison with Council regarding the progress of works at the adjacent landfill - Legislative and regulatory requirements or changes in industry best practice in place at the time. <p>Review should be undertaken by an appropriately experienced and qualified person who should provide written verification to Council that the provisions of the EMP are still applicable. Such review may be undertaken as part of preparation of the revised EMP for review by an accredited site auditor prior to proceeding with construction of the proposed development.</p>	<p>The EMP review process is considered appropriate.</p> <p>It is appropriate for the revised EMP to include a long term EMP review process.</p>
<p><u>Responsibilities</u></p> <p>Table 3.1 of the EMP provides a list of actions and responsibilities for the implementation of the EMP as have been summarised below:</p> <p><u>Council or approving authority</u></p> <ul style="list-style-type: none"> • Incorporate requirement for implementation of the EMP into consent conditions • Incorporate requirement for SAS certifying the suitability of the site (and verification reports if issued subsequent to the SAS) prior to occupancy into consent conditions 	<p>The identified responsibilities are considered appropriate. As noted above, design and verification details of gas protection measures may be documented in alternate documentation to a revised EMP.</p> <p>The EMP notes that if more detailed investigations</p>

Item	Auditor Comments
<p><u>Signature Gardens/owners corporation</u></p> <ul style="list-style-type: none"> Implement the EMP to ensure the Eastern Portion will be made suitable for the proposed development Inform residents, site workers and any contractors or other parties intending to carry out work on the site, of the EMP or the subsequent approved EMP, and carry out such inductions as may be required. Periodic inspections, maintenance and review of EMP, in accordance with requirements of the approved subsequent EMP during operation of the residential development. <p><u>Signature Gardens (by an appropriately qualified consultant)</u></p> <ul style="list-style-type: none"> Design and document verification procedures for gas protection measures. To be approved by an accredited site auditor by way of Interim Advice. Preparation of a revised EMP on behalf of Signature Gardens, incorporating design and verification details of gas protection measures and inspection and maintenance requirements (if applicable) Verification of appropriate installation of gas protection measures, in accordance with approved procedures. If required by the site auditor, installation and verification of gas protection measures may be required for each stage of the development prior to the issue of the Section A2 SAS for that stage. If this is the case, approval of revised EMP could be certified by Interim Advice, and the Section A2 SAS certifying the suitability of the site or stage of the site subject to implementation of the revised EMP would be completed following verification. <p><u>Site Auditor (engaged by Signature Gardens)</u></p> <ul style="list-style-type: none"> Approval of gas protection measure design and verification procedures. Approval of revised EMP and assessment of site suitability by an accredited site auditor by way of a Section A2 SAS. 	<p>demonstrate to the satisfaction of an accredited site auditor that gas protection measures are not required, some of these responsibilities will not be required.</p> <p>If more detailed investigations demonstrate to the satisfaction of an accredited site auditor that the site is suitable for the proposed development without an EMP, approval of a revised EMP would not be required and the site suitability would be addressed by a Section A1 SAS.</p>
<p><u>Public notification mechanisms to ensure potential purchasers or other interested parties are aware of contamination and EMP</u></p> <p>Public notification of the EMP is not considered necessary, as it is an intermediate step towards certification of the suitability of the site. The relevant stakeholders have been consulted in preparation of the EMP.</p> <p>It is anticipated that public notification of the revised EMP will be by way of the Section 10.7 Planning Certificate (which will reference the Section A2 SAS and attached EMP which will be the outcome of the site audit of the revised EMP and gas protection measures), and by incorporating it in the owners' corporation management plans for the site.</p> <p>Notification would also be achieved by a positive covenant on the title for the land, under s.88B of the <i>Conveyancing Act 1919</i>.</p>	<p>Acceptable for the current EMP. Public notification mechanisms will be considered further by auditor review of the revised EMP.</p>
<p><u>How will the EMP be made legally enforceable?</u></p> <p>Implementation of the EMP is intended to be a requirement of the development consent for the proposed development. This will make implementation of the EMP enforceable under the <i>Environmental Planning and Assessment Act 1979</i>. The development consent may also include a condition requiring implementation of the revised EMP as reviewed and approved under the Section A2 audit process (unless further investigations satisfy the site auditor that the suitability of the site can be certified by way of a Section A1 SAS, without the need for an EMP).</p> <p>It is anticipated that the revised EMP (or subsequent approved versions) will be enforceable by way of a positive covenant on the title for the land, under s.88B of the <i>Conveyancing Act 1919</i>. The covenant would require that any development or use of the burdened lot must at all times be conducted in accordance with the EMP or subsequent EMP approved by a NSW EPA accredited site auditor to replace this EMP, until such time as a NSW EPA accredited site auditor verifies by way of a site audit under the CLM Act that an EMP is no longer required.</p> <p>Council would be the person empowered to release, vary or modify restriction on use of the land.</p>	<p>The current EMP will be made legally enforceable by inclusion in development consent conditions.</p> <p>The legal enforcement mechanisms identified for the revised EMP and to achieve a Section A SAS are appropriate.</p>

14.1 Auditor's Opinion

The Auditor considers that the EMP will provide an adequate framework for the process for selection and implementation of appropriate gas protection measures and the management and monitoring requirements required to allow the proposed residential development to be undertaken on the site. It is recommended that implementation of the EMP be made a condition of consent for the development. The EMP does not address management measures required during construction.

Following construction of gas protection measures, a revision to the EMP will be required to document the long term inspection and maintenance requirements.

At that time, and in order to achieve a Section A SAS, it will be required to demonstrate that the appropriate conditions for the implementation of an EMP stated under Section 3.4.6 of EPA (2017) *Guidelines for the NSW Site Auditor Scheme (3rd Ed.)* have been met, namely:

- The (revised) EMP has been reviewed by the Auditor.
- The (revised) EMP can reasonably be made to be legally enforceable.
- There will be appropriate public notification of restrictions applying to the site through a notification on the Section 10.7 Certificate for the site and covenant on title (if this is completed).
- The remnant contamination is not considered to pose an unacceptable risk to onsite or offsite environments.

The Auditor is satisfied that the above requirements will be met by following the process outlined in the EMP.

In order to facilitate legal enforceability of the revised EMP it is recommended that the requirement for a SAS certifying the suitability of the site be made a condition of consent for the development (prior to occupancy). Any conditions of the SAS would be made conditions of consent.

15. COMPLIANCE WITH REGULATORY GUIDELINES AND DIRECTIONS

15.1 General

The Auditor has used guidelines currently made and approved by the EPA under section 105 of the NSW *Contaminated Land Management Act 1997*.

The investigations were generally conducted in accordance with SEPP 55 Planning Guidelines and reported in accordance with the OEH (2011) *Guidelines for Consultants Reporting on Contaminated Sites* and EPA (2020) *Consultants Reporting on Contaminated Land* (whichever was applicable at the time the reports were prepared).

15.2 Duty to Report

Consideration has been given to the requirements of the EPA (2015) *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*. Based on the findings of this SAR, the Auditor considers that the site is not required to be notified under the Duty to Report requirements.

15.3 Conflict of Interest

The Auditor has considered the potential for a conflict of interest in accordance with the requirements of Section 3.2.3 of the EPA (2017) *Guidelines for the NSW Site Auditor Scheme*.

The Auditor considers that there are no conflicts of interest, given that:

1. The Auditor is not related to a person by whom any part of the land is owned or occupied.
2. The Auditor does not have a pecuniary interest in any part of the land or any activity carried out on any part of the land.
3. The Auditor has not reviewed any aspect of work carried out by, or a report written by, the site auditor or a person to whom the site auditor is related.

16. CONCLUSIONS AND RECOMMENDATIONS

GHD concluded in the CSA that:

- *"The site is considered suitable from a contamination perspective for residential development except for the potential migration of landfill gas from the adjacent former Anambah landfill.*
- *The potential for impacts to human health or sensitive environmental receptors from soils at the site is considered to be low and unlikely to be of concern for future site users. Specific remediation or management of soils is not required at this time.*
- *The detection of copper and zinc above the GILs in groundwater from well MW04 suggests there may have been some impact to groundwater from the former landfill site, although the groundwater conditions at the site are not considered to represent significant impacts, may be representative of natural conditions and do not require specific remediation or management for residential/open space land use.*
- *The detections of methane (CH₄), elevated carbon dioxide (CO₂), carbon monoxide (CO) and hydrogen sulphide (H₂S) in various wells along the western boundary indicate some potential migration of landfill gas from the former Anambah landfill to the west. Based on the results, there is a potential for landfill gases to accumulate to either toxic or explosive levels on Site. Further assessment and/or control and management of landfill gas is required to address the potential risks to future users/occupants of the Site".*

GHD concluded in the LFGDA that:

- *"Based on available data, it is considered that the eastern portion of the site (the "Eastern Portion") is suitable (from a LFG perspective) for residential development, subject to appropriate gas protection measures being incorporated into any new residential development...*
- *...These drawings include a strip of approximately 18 m width adjoining the Eastern Portion, proposed to be used for road, turning circle, services, surface drainage and other non-residential use. As this strip is situated largely to the west of the Eastern Portion..., no structures or underground services should be installed within the 18 m strip without further assessment to demonstrate there is no risk associated with such installations.*
- *For the proposed residential development (which based on the above drawings is entirely within the Eastern Portion), appropriate gas protection measures should be selected in accordance with Section 5 of EPA (2020) Assessment and management of hazardous ground gases, and the requirements for installation and monitoring of appropriate measures should be incorporated into a site Environmental Management Plan (EMP).*
- *A site EMP should be prepared to document appropriate building protection measures, management and monitoring requirements required to allow the residential development to be undertaken on the Eastern Portion.*
- *More detailed assessment may be considered to potentially allow a lesser degree of building protection measures".*

Based on the information presented in GHD reports and observations made on site, and following the Decision-making process for assessing urban redevelopment sites in EPA (2017) *Guidelines for the NSW Site Auditor Scheme (3rd Edition)*, the Auditor concludes that the site can be made suitable for the proposed residential (seniors housing) land use except an 18 m wide strip along the western boundary which is suitable for use as a road, turning circle and surface drainage with no structures or underground services, subject to compliance with the following environmental management plan:

- 'Anambah – Eastern Portion of Lot 1 DP1243663 – Hazardous ground gas EMP' dated 25 June 2021 by GHD Pty Ltd.

The following remains necessary before the site is suitable for the proposed use:

1. Design appropriate gas protection measures with documented procedures for appropriate installation, to be prepared by an appropriately qualified consultant and reviewed by a site auditor.
2. Implementation of appropriate management measures during construction of the development to protect construction workers.
3. Verification of appropriate installation of gas protection measures in accordance with approved procedures.
4. Preparation of a revised EMP incorporating long term inspection, maintenance and EMP review requirements.
5. Preparation of a Section A Site Audit Statement by a NSW EPA accredited site auditor confirming the suitability of the site for the intended use.

It is noted that steps 1 to 4 may not be required if further assessment is undertaken to demonstrate to the satisfaction of an accredited site auditor that the site is suitable for the proposed development without gas protection measures and an EMP, and that ground gas conditions do not present a risk to construction or maintenance workers.

Groundwater has not been assessed for beneficial re-use. Any future use of groundwater would require appropriate assessment and regulatory approvals from the NSW Office of Water.

17. OTHER RELEVANT INFORMATION

This Audit was conducted on the behalf of Maitland City Council for the purpose of assessing what management remains necessary before the land is suitable for any specified use or range of uses i.e. a "Site Audit" as defined in Section 4 (definition of a 'site audit' (b) (iv)) of the CLM Act.

This summary report may not be suitable for other uses. GHD included limitations in their reports. The Audit must also be subject to those limitations. The Auditor has prepared this document in good faith, but is unable to provide certification outside of areas over which the Auditor had some control or is reasonably able to check.

The Auditor has relied on the documents referenced in Section 1 of the Site Audit Report in preparing the Auditors' opinion. If the Auditor is unable to rely on any of those documents, the conclusions of the audit could change.

It is not possible in a Site Audit Report to present all data which could be of interest to all readers of this report. Readers are referred to the referenced reports for further data. Users of this document should satisfy themselves concerning its application to, and where necessary seek expert advice in respect to, their situation.

APPENDIX A ATTACHMENTS

Attachment 1: Site Location

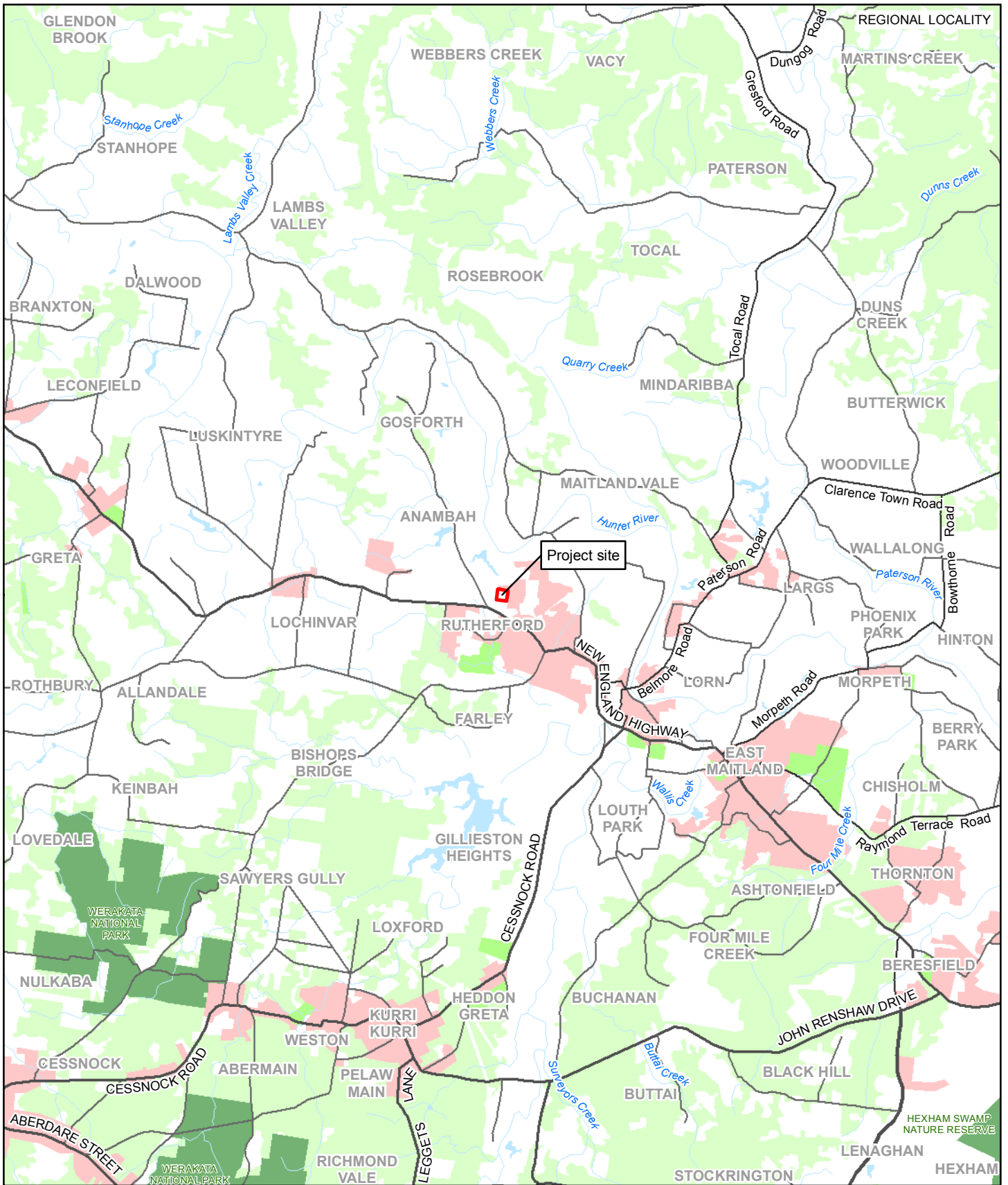
Attachment 2: Site Survey

Attachment 3: Site Boundary and LFG Assessment Locations

Attachment 4: Site Layout and Contamination Assessment Locations

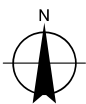
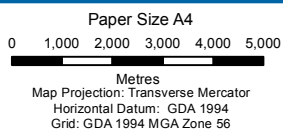
Attachment 5: Proposed Development Layout

Attachment 6: Average and Peak Methane Concentrations



LEGEND

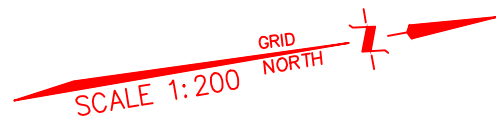
- Site boundary
- Dual Carriageway
- Principal Road
- Secondary Road
- Minor Road
- Watercourse
- Waterbody
- Built Up Area
- Recreation Area
- Nature Conservation Reserve
- Forest Or Shrub



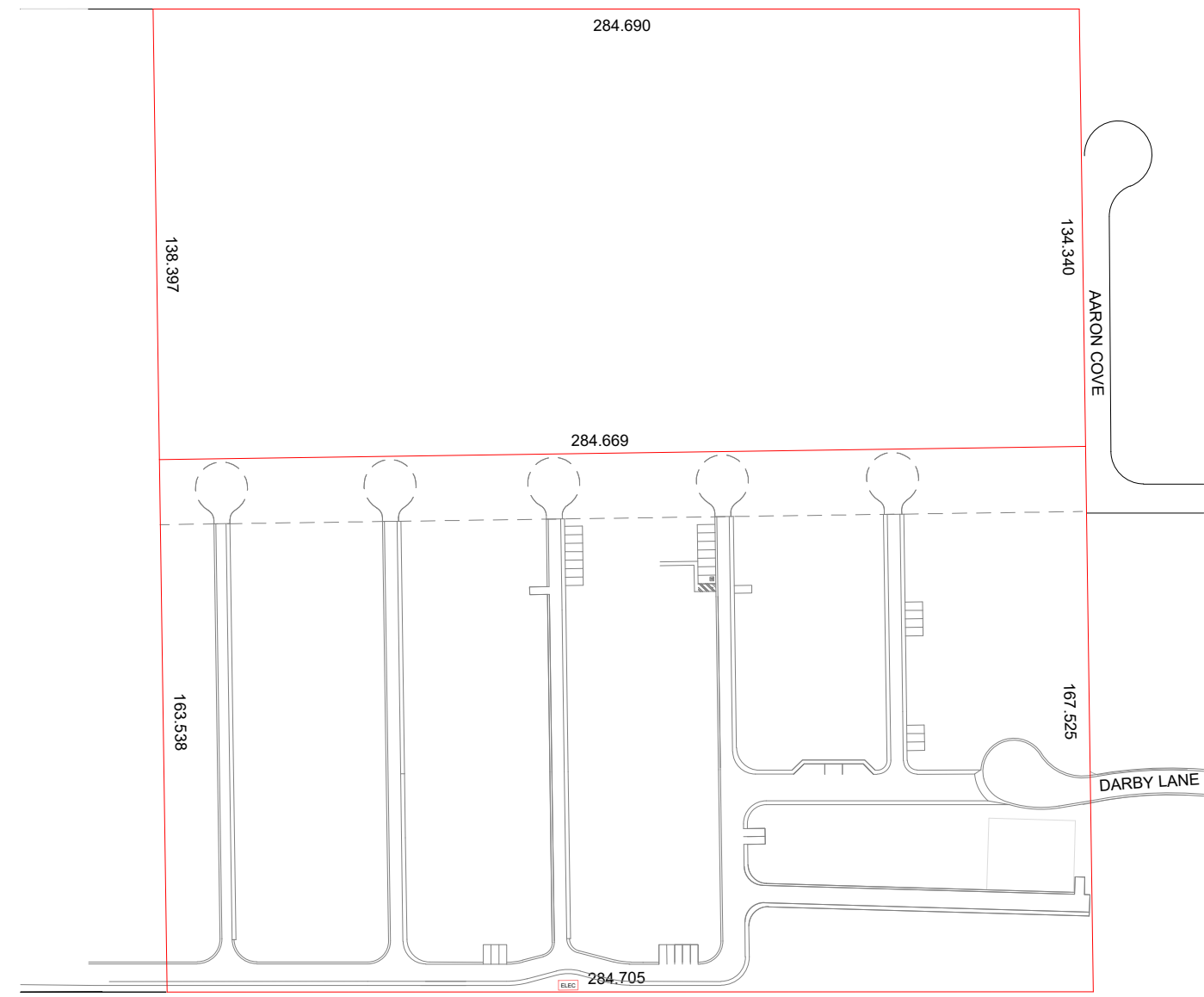
Signature Gardens Retirement Resorts Pty Ltd Job Number 22-18797
 Lot 31, DP 598354, Aaron Cove, Rutherford Revision 0
 Stage 1 and Stage 2 Contamination Site Assessment Date 13 Apr 2017

Site Locality

Figure 1



NOTE: ALL DIMENSIONS, AREAS, LOT NUMBERS EASEMENTS & NUMBER OF LOTS ARE SUBJECT TO THE APPROVAL OF COUNCIL & OTHER AUTHORITIES AND TO THE FINAL SURVEY & LINEN PLAN AND SHOULD BE CONSIDERED AS CONCEPTUAL ONLY. DO NOT RELY ON THE INFORMATION IN THIS PLAN FOR ANY PURCHASE, DISPOSAL OR OTHER MATTER.



JOB No. > 21035
 DATE > 21/06/2021
 REVISION > A

Proposed Subdivision

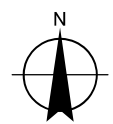
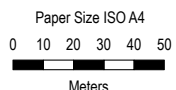
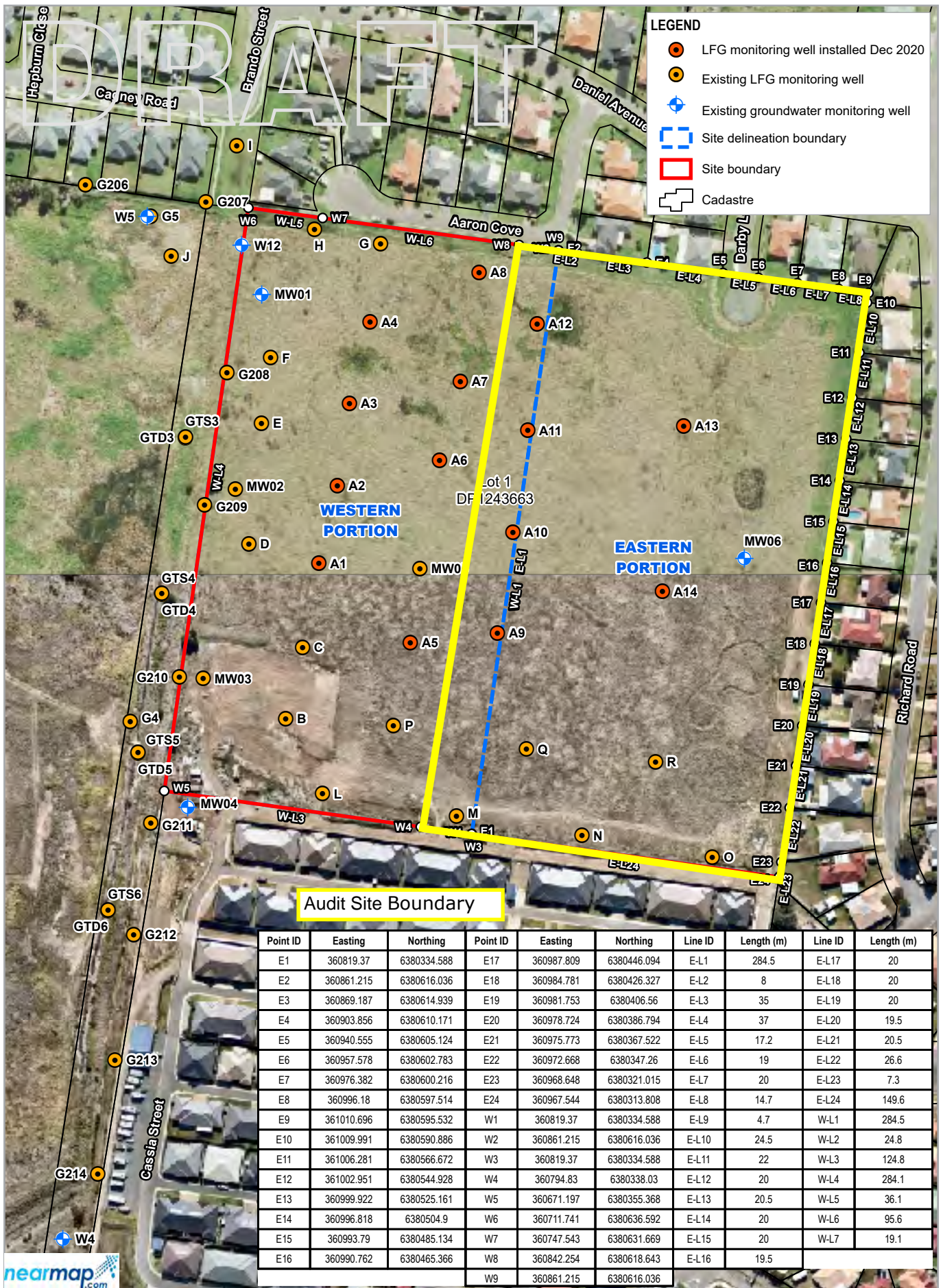
Lot 1, DP1243663

New England Highway, Rutherford

SCALE: 1:500 (A3)
 DRAWN BY: JM

PO Box 40 Maitland NSW 2320
 1st Floor, 44 Church Street
 Maitland NSW 2320
 T: 02 4933 6682
 F: 02 4933 6683
 www.hdb.com.au





Maitland City Council
Anambah Landfill Site
Soil Gas Delineation Assessment Report

Project No. 12509993
Revision No. A
Date 08/04/2021

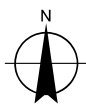
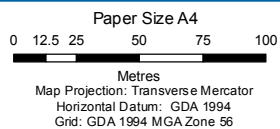
Lot 1 DP1243663
Site delineation plan

FIGURE 1



LEGEND

- ▭ Site boundary
- + Cadastre
- + Existing landfill gas monitoring wells
- + Test pit
- + Groundwater monitoring wells - March 2017
- + Landfill gas monitoring wells - March 2017
- Rubbish waste
- Surface ponding
- X Access to site
- + + Broken fence



Signature Gardens Retirement Resorts Pty Ltd Job Number 22-18797
 Lot 31, DP 598354, Aaron Cove, Rutherford Revision 0
 Stage 1 and Stage 2 Contamination Site Assessment Date 13 Apr 2017

Site Layout

Figure 2

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 Entmailto:ghd.com W www.ghd.com.au

© 2017. Whilst every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: LPI: Aerial imagery, 2015; DCDB/DTDB, 2012. Created by: tmorton



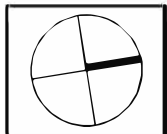
OVERALL SITE PLAN & STAGING

INDEPENDENT LIVING UNITS

SIGNATURE GARDENS RETIREMENT RESORT PTY LTD

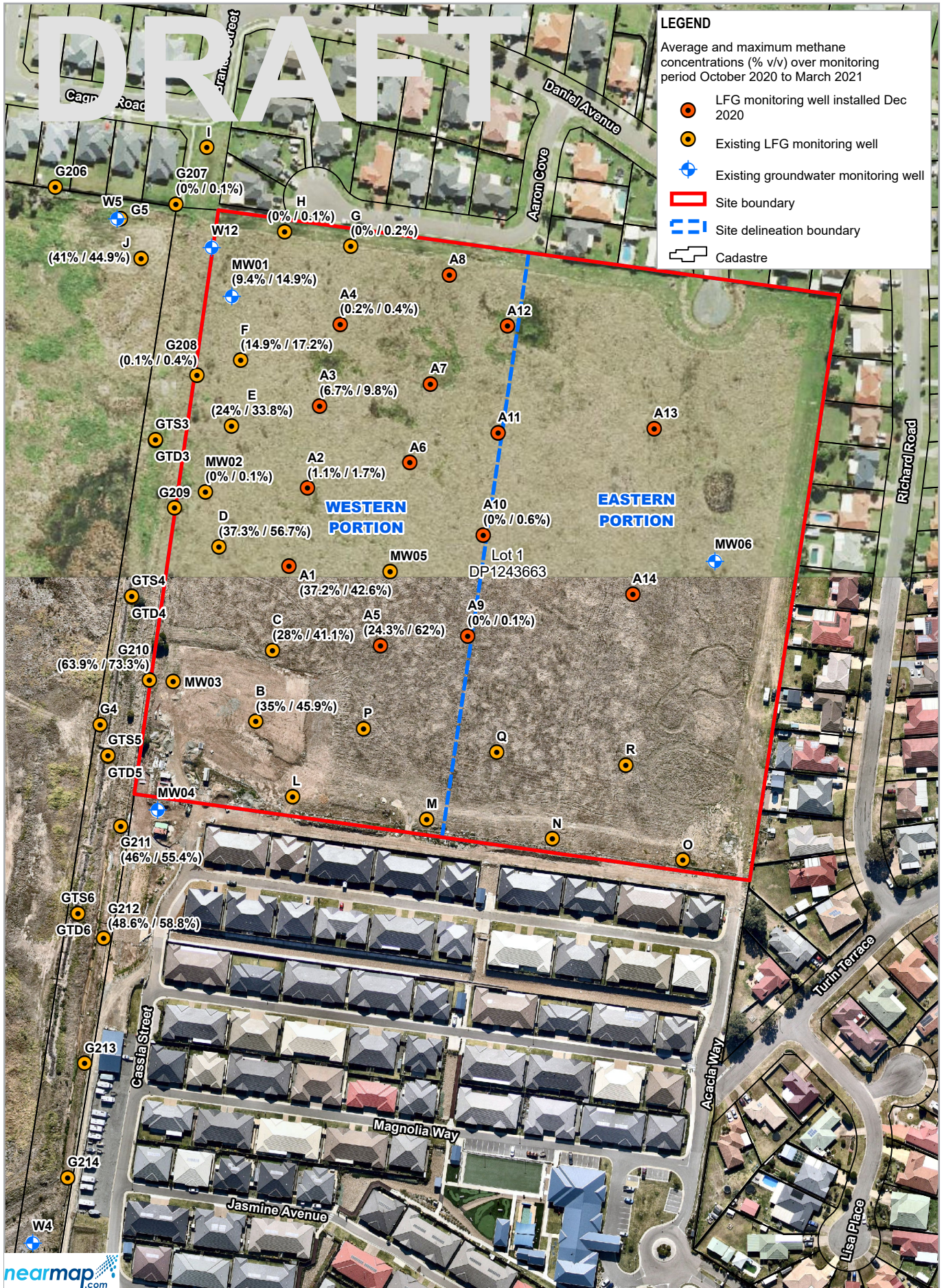
THIS DRAWING HAS BEEN PRODUCED BASED ON INFORMATION SUPPLIED BY OTHERS WHILE ALL ATTEMPTS HAVE BEEN MADE TO ENSURE THE ACCURACY OF THE DRAWING HAMILTON HAYES HENDERSON ARCHITECTS WILL NOT BE HELD RESPONSIBLE FOR THE ACCURACY OF THE INFORMATION PROVIDED. INCONSISTENCIES IN THE METES AND BOUNDS INFORMATION HAVE BEEN INCLUDED AND WILL REQUIRE ADJUSTMENT BEFORE PROCEEDING WITH DETAILED SITE PLANNING.

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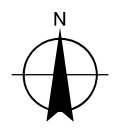
PROJ No. : 5169
DATE : 07/06/2021
SCALE : 1:2000 @ A3
DRG No. : SK-09 A

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t:(07)5528 0088 w:HHH.com.au e:Architects@HHH.com.au



Paper Size ISO A4
 0 10 20 30 40 50
 Meters

Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



Maitland City Council
 Anambah Landfill Site
 Soil Gas Delineation Assessment Report
 Lot 1 DP1243663
 Average and maximum
 methane concentrations

Project No. 12509993
 Revision No. A
 Date 13/04/2021

FIGURE 2

APPENDIX B
SITE AUDIT STATEMENT



NSW Site Auditor Scheme

Site Audit Statement

A site audit statement summarises the findings of a site audit. For full details of the site auditor's findings, evaluations and conclusions, refer to the associated site audit report.

This form was approved under the *Contaminated Land Management Act 1997* on 12 October 2017.

For information about completing this form, go to Part IV.

Part I: Site audit identification

Site audit statement no. RS 126-1

This site audit is a:

- statutory audit
- non-statutory audit

within the meaning of the *Contaminated Land Management Act 1997*.

Site auditor details

(As accredited under the *Contaminated Land Management Act 1997*)

Name Rowena Salmon

Company Ramboll Australia Pty Ltd

Address Level 3

100 Pacific Highway, North Sydney

Postcode 2060

Phone 02 9954 8100

Email rsalmon@ramboll.com

Site details

Address: Eastern Portion Lot 1 DP1243663, south of Aaron Cove and Darby Lane,
Rutherford NSW

Postcode: 2320

Property description

(Attach a separate list if several properties are included in the site audit.)

Eastern Portion Lot 1 DP1243663 (see attachments at end of Part I, includes 18 m strip west of 'Eastern Portion' defined by GHD)

Local government area: Maitland City Council

Area of site (include units, e.g. hectares): 4.7 hectares

Current zoning: R1 General Residential under Maitland Local Environment Plan 2011

Regulation and notification

To the best of my knowledge:

the site is the subject of a declaration, order, agreement, proposal or notice under the *Contaminated Land Management Act 1997* or the *Environmentally Hazardous Chemicals Act 1985*, as follows: (provide the no. if applicable)

Declaration no.

Order no.

Proposal no.

Notice no.

the site is not the subject of a declaration, order, proposal or notice under the *Contaminated Land Management Act 1997* or the *Environmentally Hazardous Chemicals Act 1985*.

To the best of my knowledge:

the site **has** been notified to the EPA under section 60 of the *Contaminated Land Management Act 1997*

the site **has not** been notified to the EPA under section 60 of the *Contaminated Land Management Act 1997*.

Site audit commissioned by

Name: Catherine Pepper

Company: Maitland City Council

Address: PO Box 220, Maitland NSW

Postcode 2320

Phone: 0414 803 737

Email: Catherine.Pepper@maitland.nsw.gov.au

Contact details for contact person (if different from above)

Name N/A

Phone

Email

Nature of statutory requirements (not applicable for non-statutory audits)

- Requirements under the *Contaminated Land Management Act 1997* (e.g. management order; please specify, including date of issue)

- Requirements imposed by an environmental planning instrument (please specify, including date of issue)

- Development consent requirements under the *Environmental Planning and Assessment Act 1979* (please specify consent authority and date of issue)

- Requirements under other legislation (please specify, including date of issue)

Purpose of site audit

- A1** To determine land use suitability

Intended uses of the land: _____

OR

- A2** To determine land use suitability subject to compliance with either an active or passive environmental management plan

Intended uses of the land: _____

OR

(Tick all that apply)

- B1** To determine the nature and extent of contamination
- B2** To determine the appropriateness of:
 - an investigation plan
 - a remediation plan
 - a management plan
- B3** To determine the appropriateness of a **site testing plan** to determine if groundwater is safe and suitable for its intended use as required by the *Temporary Water Restrictions Order for the Botany Sands Groundwater Resource 2017*
- B4** To determine the compliance with an approved:
 - voluntary management proposal** or
 - management order** under the *Contaminated Land Management Act 1997*
- B5** To determine if the land can be made suitable for a particular use (or uses) if the site is remediated or managed in accordance with a specified plan.

Intended uses of the land: Residential (seniors housing) except for an 18 m wide strip along the western edge which is suitable for use as a road, turning circle and surface drainage with no structures or underground services.

Information sources for site audit

Consultancies which conducted the site investigations and/or remediation:

GHD Pty Ltd (GHD)

Titles of reports reviewed:

'Stage 1 and Stage 2 Contamination Site Assessment, Lot 31 DP598354, Aaron Cove, Rutherford', dated 21 April 2017, GHD

'Anambah landfill site, Installation of additional Landfill Gas monitoring wells', dated 28 February 2020, GHD

'LFG Assessment Sampling, Analysis and Quality Plan, Lot 1 DP1243663, Aaron Cove Rutherford', dated 28 October 2020, GHD

'Anambah landfill LFG review – LFG data review and CSM update', dated 29 October 2020, GHD

'Anambah landfill LFG review, Installation of Sale Property landfill gas wells', dated 14 January 2021, GHD.

'Anambah Lot 1 DP1243663, Landfill gas delineation assessment report', dated 25 June 2021, GHD

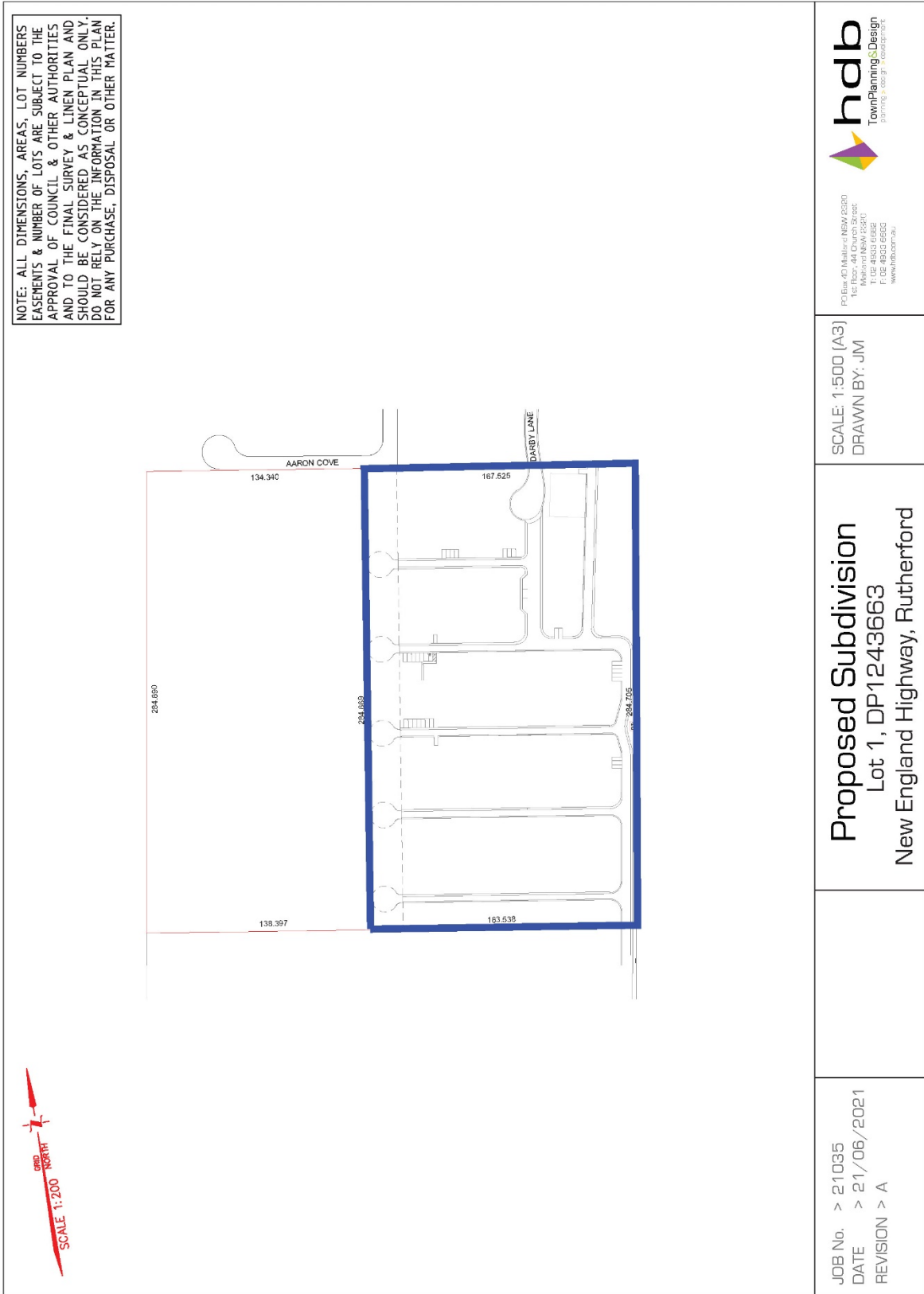
'Anambah-Eastern Portion of Lot 1 DP1243663, Hazardous ground gas EMP,' dated 25 June 2021, GHD

Other information reviewed, including previous site audit reports and statements relating to the site:

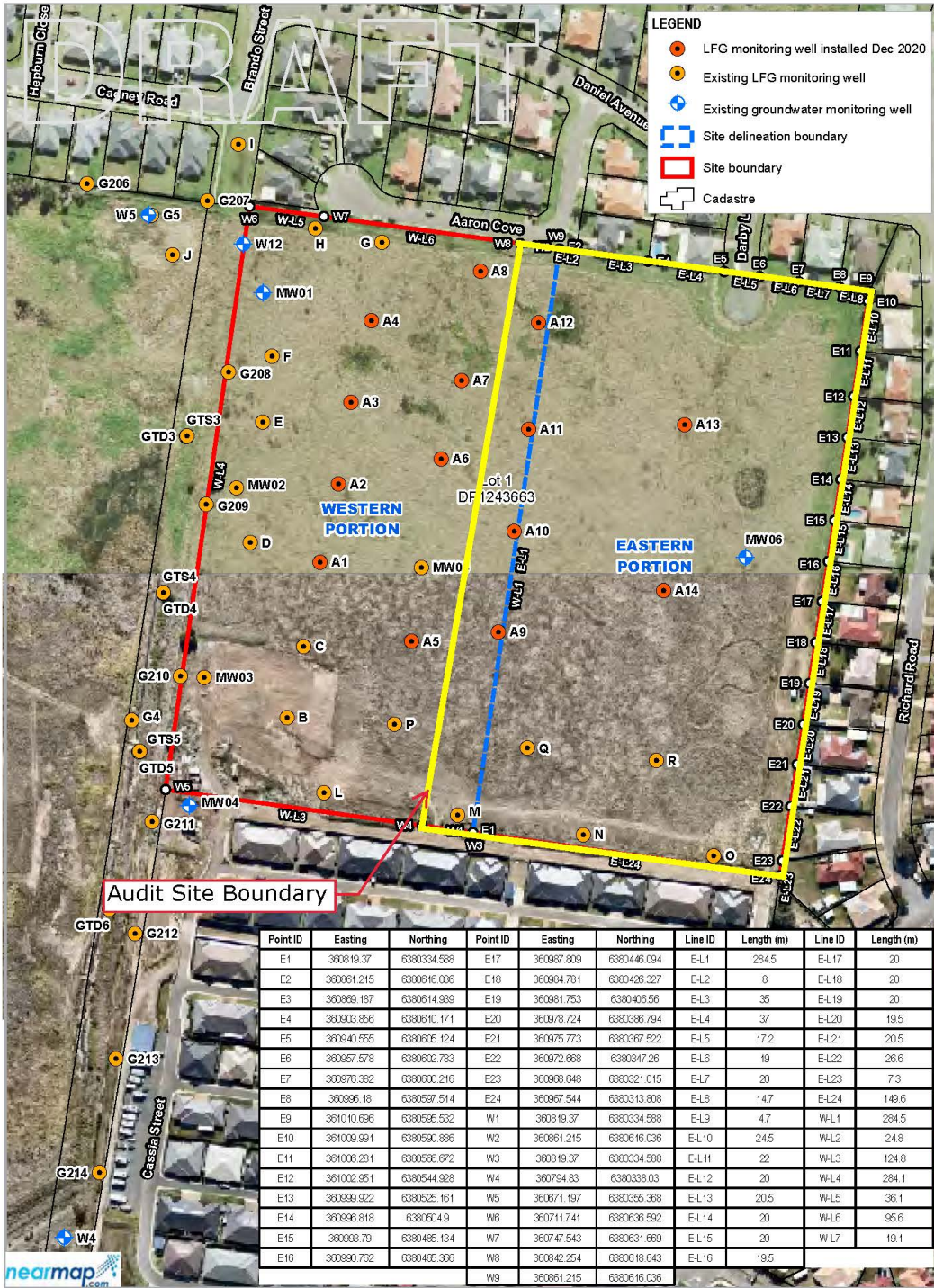
Site audit report details

Title Site Audit Report – Environmental Management Plan, Eastern Portion of Lot 1 DP1243663

Report no. RS 126-1 (Ramboll Ref: 318001080) Date 6 August 2021



Site Audit Statement RS 126-1



Paper Size ISO A4
0 10 20 30 40 50
Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

Maitland City Council
Anambah Landfill Site
Soil Gas Delineation Assessment Report

Lot 1 DP1243663
Site delineation plan

Project No. 12509993
Revision No. A
Date 08/04/2021

FIGURE 1

G:\2021\5609993\GIS\Map\12509993_Anambah_Landfill\12509993_SoilGasDelineation\RP_A-apr12509993_S08AR001_SitePlan_Delineated_A
Print date: 08 Apr 2021 - 10:07 Data source: Nearmap; Aerial Imagery; 2019/01/14; LPI: DT08DC06; 2017; RM Survey; WAE data; 2019; public_NSW_Imagery; © Department of Customer Service 2020. Created by: Invision

Part II: Auditor's findings

Please complete either Section A1, Section A2 or Section B, not more than one section. (Strike out the irrelevant sections.)

- Use **Section A1** where site investigation and/or remediation has been completed and a conclusion can be drawn on the suitability of land uses **without the implementation** of an environmental management plan.
- Use **Section A2** where site investigation and/or remediation has been completed and a conclusion can be drawn on the suitability of land uses **with the implementation** of an active or passive environmental management plan.
- Use **Section B** where the audit is to determine:
 - (B1) the nature and extent of contamination, and/or
 - (B2) the appropriateness of an investigation, remediation or management plan¹, and/or
 - (B3) the appropriateness of a site testing plan in accordance with the *Temporary Water Restrictions Order for the Botany Sands Groundwater Source 2017*, and/or
 - (B4) whether the terms of the approved voluntary management proposal or management order have been complied with, and/or
 - (B5) whether the site can be made suitable for a specified land use (or uses) if the site is remediated or managed in accordance with the implementation of a specified plan.

¹ For simplicity, this statement uses the term 'plan' to refer to both plans and reports.

Section A1

I certify that, in my opinion:

The **site is suitable** for the following uses:

(Tick all appropriate uses and strike out those not applicable.)

- Residential, including substantial vegetable garden and poultry
- Residential, including substantial vegetable garden, excluding poultry
- Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry
- Day care centre, preschool, primary school
- Residential with minimal opportunity for soil access, including units
- Secondary school
- Park, recreational open space, playing field
- Commercial/industrial
- Other (please specify):

OR

I certify that, in my opinion, the **site is not suitable** for any use due to the risk of harm from contamination.

Overall comments:

Section A2

I certify that, in my opinion:

Subject to compliance with the **attached** environmental management plan² (EMP), the site is suitable for the following uses:

(Tick all appropriate uses and strike out those not applicable.)

- Residential, including substantial vegetable garden and poultry
 - Residential, including substantial vegetable garden, excluding poultry
 - Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry
 - Day care centre, preschool, primary school
 - Residential with minimal opportunity for soil access, including units
 - Secondary school
 - Park, recreational open space, playing field
 - Commercial/industrial
 - Other (please specify):
-

EMP details

Title

Author

Date

No. of pages

EMP summary

This EMP (attached) is required to be implemented to address residual contamination on the site.

The EMP: (Tick appropriate box and strike out the other option.)

- requires operation and/or maintenance of **active** control systems³
- requires maintenance of **passive** control systems only³.

² Refer to Part IV for an explanation of an environmental management plan.

³ Refer to Part IV for definitions of active and passive control systems.

Purpose of the EMP:

Description of the nature of the residual contamination:

Summary of the actions required by the EMP:

How the EMP can reasonably be made to be legally enforceable:

How there will be appropriate public notification:

Overall comments:

Section B

Purpose of the plan⁴ which is the subject of this audit:

The purpose of the landfill gas investigation reports is to determine the portion of Lot 1 DP1243663 that can be considered suitable, from a landfill gas perspective, for residential development and what further assessment, remediation and/or management of landfill gas is required.

The purpose of the environmental management plan (EMP) is to document the process for selection and implementation of appropriate gas protection measures in accordance with Section 5 of EPA (2020) *Assessment and management of hazardous ground gases*, and the management and monitoring requirements required to allow the proposed residential development to be undertaken on the site.

I certify that, in my opinion:

(B1)

- The nature and extent of the contamination **has** been appropriately determined
 ~~The nature and extent of the contamination **has not** been appropriately determined~~

AND/OR (B2)

- The investigation, ~~remediation~~ or management plan **is** appropriate for the purpose stated above
 ~~The investigation, remediation or management plan **is not** appropriate for the purpose stated above~~

AND/OR (B3)

- ~~The site testing plan:~~
 ~~**is** appropriate to determine~~
 ~~**is not** appropriate to determine~~
~~if groundwater is safe and suitable for its intended use as required by the *Temporary Water Restrictions Order for the Botany Sands Groundwater Resource 2017*~~

AND/OR (B4)

- ~~The terms of the approved voluntary management proposal* or management order** (strike out as appropriate):~~
 ~~**have** been complied with~~
 ~~**have not** been complied with.~~

~~*voluntary management proposal no.~~

~~**management order no.~~

⁴ For simplicity, this statement uses the term 'plan' to refer to both plans and reports.

AND/OR (B5)

- The site **can be made suitable** for the following uses:

(Tick all appropriate uses and strike out those not applicable.)

- ~~Residential, including substantial vegetable garden and poultry~~
- ~~Residential, including substantial vegetable garden, excluding poultry~~
- ~~Residential with accessible soil, including garden (minimal home grown produce contributing less than 10% fruit and vegetable intake), excluding poultry~~
- ~~Day care centre, preschool, primary school~~
- ~~Residential with minimal opportunity for soil access, including units~~
- ~~Secondary school~~
- ~~Park, recreational open space, playing field~~
- ~~Commercial/industrial~~
- Other (please specify):

Residential (seniors housing) except 18 m wide strip along western edge suitable for road, turning circle, surface drainage with no structures or underground services.

IF the site is ~~remediated~~/managed* in accordance with the following plan (**attached**):

*Strike out as appropriate

Plan title: Anambah – Eastern Portion of Lot 1 DP1243663 – Hazardous ground gas EMP

Plan author: GHD Pty Ltd

Plan date: 25 June 2021

No. of pages: 35

SUBJECT to compliance with the following condition(s):

1. Design appropriate gas protection measures with documented procedures for appropriate installation, to be prepared by an appropriately qualified consultant and reviewed by a site auditor.

2. Implementation of appropriate management measures during construction of the development to protect construction workers.

3. Verification of appropriate installation of gas protection measures in accordance with approved procedures.

4. Preparation of a revised EMP incorporating long term inspection, maintenance and EMP review requirements.

5. Preparation of a Section A Site Audit Statement by a NSW EPA accredited site auditor confirming the suitability of the site for the intended use.

It is noted that conditions 1 to 4 may not be required if further assessment is undertaken to demonstrate to the satisfaction of an accredited site auditor that the site is suitable for the proposed development without gas protection measures and an EMP, and that ground gas conditions do not present a risk to construction or maintenance workers.

Overall comments:

The site is currently undeveloped vacant land adjacent to a former landfill. Investigations of the site did not identify soil or groundwater contamination. Hazardous ground gas (carbon dioxide) has been identified at the site, although at relatively low concentrations, which has potential to present unacceptable risks to site users without the design and implementation of gas protection measures for future residences.

An EMP has been prepared and reviewed and documents the process for selection and implementation of appropriate gas protection measures and management and monitoring requirements to allow development of the proposed residential development. Documentation regarding the gas protection design and verification of the installation is required. A revised EMP will be prepared to address long term inspection and maintenance requirements at the site.

It is recommended that implementation of the EMP be made a condition of consent for the development. In addition, compliance with the conditions of this Site Audit Statement should be made conditions of consent (prior to occupancy), in particular the requirement for a Site Audit Statement certifying the suitability of the site for the development. Any conditions of the SAS would be made conditions of consent.

Groundwater has not been assessed for beneficial re-use. Any future use of groundwater would require appropriate assessment and regulatory approvals from the NSW Office of Water.

Part III: Auditor's declaration

I am accredited as a site auditor by the NSW Environment Protection Authority (EPA) under the *Contaminated Land Management Act 1997*.

Accreditation no. 1002

I certify that:

- I have completed the site audit free of any conflicts of interest as defined in the *Contaminated Land Management Act 1997*, and
- with due regard to relevant laws and guidelines, I have examined and am familiar with the reports and information referred to in Part I of this site audit, and
- on the basis of inquiries I have made of those individuals immediately responsible for making those reports and obtaining the information referred to in this statement, those reports and that information are, to the best of my knowledge, true, accurate and complete, and
- this statement is, to the best of my knowledge, true, accurate and complete.

I am aware that there are penalties under the *Contaminated Land Management Act 1997* for wilfully making false or misleading statements.

Signed



Date 6 August 2021

Part IV: Explanatory notes

To be complete, a site audit statement form must be issued with all four parts.

How to complete this form

Part I

Part I identifies the auditor, the site, the purpose of the audit and the information used by the auditor in making the site audit findings.

Part II

Part II contains the auditor's opinion of the suitability of the site for specified uses or of the appropriateness of an investigation, or remediation plan or management plan which may enable a particular use. It sets out succinct and definitive information to assist decision-making about the use or uses of the site or a plan or proposal to manage or remediate the site.

The auditor is to complete either Section A1 or Section A2 or Section B of Part II, **not** more than one section.

Section A1

In Section A1 the auditor may conclude that the land is *suitable* for a specified use or uses OR *not suitable* for any beneficial use due to the risk of harm from contamination.

By certifying that the site is *suitable*, an auditor declares that, at the time of completion of the site audit, no further investigation or remediation or management of the site was needed to render the site fit for the specified use(s). **Conditions must not be** imposed on a Section A1 site audit statement. Auditors may include **comments** which are key observations in light of the audit which are not directly related to the suitability of the site for the use(s). These observations may cover aspects relating to the broader environmental context to aid decision-making in relation to the site.

Section A2

In Section A2 the auditor may conclude that the land is *suitable* for a specified use(s) subject to a condition for implementation of an environmental management plan (EMP).

Environmental management plan

Within the context of contaminated sites management, an EMP (sometimes also called a 'site management plan') means a plan which addresses the integration of environmental mitigation and monitoring measures for soil, groundwater and/or hazardous ground gases throughout an existing or proposed land use. An EMP succinctly describes the nature and location of contamination remaining on site and states what the objectives of the plan are, how contaminants will be managed, who will be responsible for the plan's implementation and over what time frame actions specified in the plan will take place.

By certifying that the site is suitable subject to implementation of an EMP, an auditor declares that, at the time of completion of the site audit, there was sufficient information satisfying guidelines made or approved under the *Contaminated Land Management Act 1997*

(CLM Act) to determine that implementation of the EMP was feasible and would enable the specified use(s) of the site and no further investigation or remediation of the site was needed to render the site fit for the specified use(s).

Implementation of an EMP is required to ensure the site remains suitable for the specified use(s). The plan should be legally enforceable: for example, a requirement of a notice under the CLM Act or a development consent condition issued by a planning authority. There should also be appropriate public notification of the plan, e.g. on a certificate issued under s.149 of the *Environmental Planning and Assessment Act 1979*.

Active or passive control systems

Auditors must specify whether the EMP requires operation and/or maintenance of active control systems or requires maintenance of passive control systems only. Active management systems usually incorporate mechanical components and/or require monitoring and, because of this, regular maintenance and inspection are necessary. Most active management systems are applied at sites where if the systems are not implemented an unacceptable risk may occur. Passive management systems usually require minimal management and maintenance and do not usually incorporate mechanical components.

Auditor's comments

Auditors may also include **comments** which are key observations in light of the audit which are not directly related to the suitability of the site for the use(s). These observations may cover aspects relating to the broader environmental context to aid decision-making in relation to the site.

Section B

In Section B the auditor draws conclusions on the nature and extent of contamination, and/or suitability of plans relating to the investigation, remediation or management of the land, and/or the appropriateness of a site testing plan in accordance with the *Temporary Water Restrictions Order for the Botany Sands Groundwater Source 2017*, and/or whether the terms of an approved voluntary management proposal or management order made under the CLM Act have been complied with, and/or whether the site can be made suitable for a specified land use or uses if the site is remediated or managed in accordance with the implementation of a specified plan.

By certifying that a site *can be made suitable* for a use or uses if remediated or managed in accordance with a specified plan, the auditor declares that, at the time the audit was completed, there was sufficient information satisfying guidelines made or approved under the CLM Act to determine that implementation of the plan was feasible and would enable the specified use(s) of the site in the future.

For a site that *can be made suitable*, any **conditions** specified by the auditor in Section B should be limited to minor modifications or additions to the specified plan. However, if the auditor considers that further audits of the site (e.g. to validate remediation) are required, the auditor must note this as a condition in the site audit statement. The condition must not specify an individual auditor, only that further audits are required.

Auditors may also include **comments** which are observations in light of the audit which provide a more complete understanding of the environmental context to aid decision-making in relation to the site.

Part III

In **Part III** the auditor certifies their standing as an accredited auditor under the CLM Act and makes other relevant declarations.

Where to send completed forms

In addition to furnishing a copy of the audit statement to the person(s) who commissioned the site audit, statutory site audit statements must be sent to

- the **NSW Environment Protection Authority**:
nswauditors@epa.nsw.gov.au or as specified by the EPA

AND

- the **local council** for the land which is the subject of the audit.



Ramboll Australia Pty Ltd
Level 3, 100 Pacific Highway
PO Box 560
North Sydney NSW 2060

T +61 2 9954 8100

www.ramboll.com