

Information sheet for environmental audits and preliminary risk screen assessments (PRSAs)



Publication 2009 June 2021

Victoria's audit system

An environmental audit system has operated in Victoria since 1989. The *Environment Protection Act 2017* (the Act) provides for the appointment of environmental auditors. It also provides for Environment Protection Authority (EPA or the Authority) to have a system of preliminary risk screen assessments (PRSAs) and environmental audits. These are used in the planning, approval, regulation and management of activities, and in protection of human health and the environment.

Under the Act, the functions of an environmental auditor include to:

- conduct PRSAs and environmental audits
- prepare and issue PRSA statements and reports, and environmental audit statements and reports.

The purpose of a PRSA is to:

- assess the likelihood of the presence of contaminated land
- determine if an environmental audit is required
- recommend a scope for the environmental audit if an environmental audit is required.

The purpose of an environmental audit is to:

- assess the nature and extent of the risk of harm to human health or the environment from contaminated land, waste, pollution, or any activity
- recommend measures to manage the risk of harm to human health or the environment from contaminated land, waste, pollution, or any activity
- make recommendations to manage any contaminated land, waste, pollution or activity.

Upon completion, all PRSAs and environmental audits require preparation of either a PRSA statement, accompanied by a PRSA report, or an environmental audit statement, accompanied by an environmental audit report.

A person may engage an environmental auditor to conduct a PRSA or an environmental audit.

EPA administers the environmental audit system and ensures an acceptable quality of environmental auditing is maintained. This is achieved by assessing auditor applications and conducting a quality assurance program. These measures ensure that PRSAs and environmental audits that environmental auditors undertake are completed in accordance with the relevant sections of the Act or any other Act, and with the guidelines the Authority or other government agencies have published.

Information sheet for environmental audits and preliminary risk screen assessments (PRSAs)

File structures

EPA stores digital statements and reports from PRSAs and environmental audits in three parts:

- Part A, the PRSA or environmental audit report
- Part B, report appendices
- Part C, the PRSA statement and executive summary or environmental audit statement and executive summary.

Report executive summaries, findings and recommendations should be read and relied upon only in the context of the whole document, including any appendices and the PRSA statement or environmental audit statement.

Currency of PRSAs and environmental audits

PRSAs and environmental audits are based on the conditions encountered and information reviewed at the time of preparation. They don't represent any changes that may have occurred since the completion date. As it's not possible for the PRSA or audit report to present all data that could be of interest to all readers, consideration should be made to any appendices or referenced documentation for further information.

When information about the site changes from what was available at the time the PRSA or environmental audit was completed, or where an administrative error is identified, an environmental auditor may amend or withdraw PRSA or environmental audit statements and/or reports. Users are advised to check EPA's website to ensure documents' currency.

PDF searchability and printing

EPA can only provide PRSAs and environmental audit statements, reports and appendices that the environmental auditor provided to EPA via the EPA portal on the EPA website.

All statements and reports should be in a Portable Document Format (PDF) and searchable; however at times some appendices may be provided as image-only PDFs, which can affect searchability.

The PDF is compatible with Adobe Acrobat Reader, which is downloadable free from Adobe's Website (www.adobe.com).

Further information

For more information on Victoria's environmental audit system, visit EPA's website or contact EPA's Environmental Audit Unit.

Web: www.epa.vic.gov.au

Email: environmental.audit@epa.vic.gov.au



For languages other than English, please call **131 450**.

Visit epa.vic.gov.au/language-help for next steps.

If you need assistance because of a hearing or speech impairment, please visit relay.service.gov.au

APPENDICES



APPENDIX A

Current and Historical Certificates of Title



Date Registered: 18/06/2021

Volume 849 Folio 156

Duplicate Certificate as to Title issued? No

SEARCH CERTIFICATE

N.T. Portion 830 from plan(s) A 000315

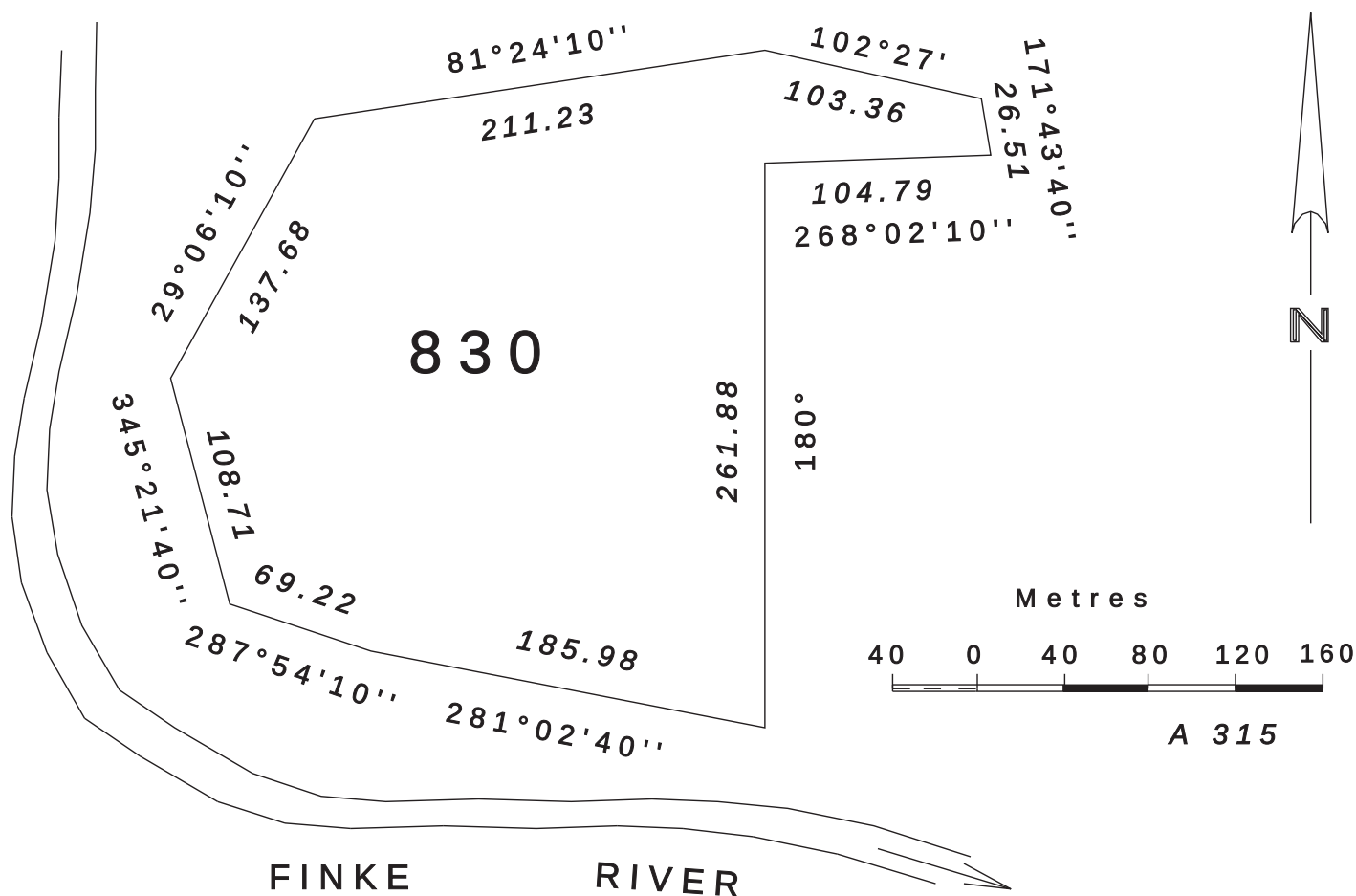
Area under title is 7 hectares 1800 square metres

Owner:

Beston Parks Land Co Pty Ltd (ACN 111 783 423) as trustee for Beston Accommodation Parks Trust (ABN 86 203 376 744)

of Level 7, 60 Light Square Adelaide SA 5000

Registered Date	Dealing Number	Description
		Previous title is Volume 848 Folio 674
15/12/2021	962792	Mortgage Westpac Administration Pty Limited
17/12/1992	277321	Lease to Discovery Holiday Parks Pty Ltd - expiring 14/12/2091
End of Dealings		





NORTHERN TERRITORY OF AUSTRALIA

Record of Administrative Interests and Information

Record of Administrative Interests and Information

The information contained in this record of Administrative Interests only relates to the below parcel reference.

Parcel Reference: N.T. Portion 00830 plan(s) A 000315

(See section 38 of the Land Title Act)

Note: The Record of Administrative Interests and Information is not part of the Land Register and is not guaranteed by the Northern Territory of Australia, and the NT Government accepts no Liability for any omission, misstatement or inaccuracy contained in this statement.

Registrar General

Government Land Register

(none found)

Custodian - Registrar General (+61 8 8999 6252)

Current Title

CUFT 849 156 (order 1)

Tenure Type

ESTATE IN FEE SIMPLE

Tenure Status

Current

Area Under Title

7 hectares 1800 square metres

Owners

Beston Parks Land Co Pty Ltd (ACN 111 783 423) as trustee for Beston Accommodation Parks Trust (ABN 86 203 376 744)
Level 7, 60 Light Square Adelaide SA 5000

Easements

(none found)

Scheme Name

(none found)

Scheme Body Corporate Name

(none found)

Reserved Name(s)

(none found)

Unit Entitlements

(none found)

Transfers

01/06/2021 for \$2,300,000 (nil GST)
17/12/1992 for \$1,750,000
17/12/1992 for \$1,750,000
15/12/1992 for \$1,750,000
13/05/1985 for \$350,000
27/02/1980 for \$144,000
03/10/1973 for n/a
02/08/1969 for n/a
10/06/1964 for n/a

Tenure Comments

(none found)

Historic Titles

CUFT 848 674 (order 1)
CUFT 804 302 (order 1)
CUFT 764 472 (order 1)
CUFT 747 376 (order 1)
CUFT 747 374 (order 1)
CUFT 747 114 (order 1)
CUFT 660 968 (order 1)
CUFT 629 801 (order 1)
CUFT 615 123 (order 1)
CUFT 288 150 (order 1)
CUFT 288 148 (order 1)
CUFT 288 147 (order 1)
CUFT 121 148 (order 2)
CUFT 121 148 (order 1)
CUCL 053 076 (order 5)
CUCL 053 076 (order 4)
CUCL 053 076 (order 3)
CUCL 053 076 (order 2)
CUCL 053 076 (order 1)

Visit the website http://www.nt.gov.au/justice/bdm/land_title_office/

Custodian - Surveyor General (+61 8 8995 5354)**Address**

8495 NAMATJIRA DR, MOUNT ZEIL

Survey Plan

A 000315

Survey Status

Approved

Parcel Status

CURRENT

Parcel Area

7 hectares, 1800 square metres

Map Reference

Code 010 Scale 500000 Sheet 00.20

Parent Parcels

(none found)

Parcel Comments

PROP CHALET. CONVERSION OF SPL 136 TO FREEHOLD, NTG G26 1/7/1983. PROPOSED HERITAGE DECLARATION OF "GLEN HELEN MEAT HOUSE" - NTG S105, 03/11/2015 - LI2015/0007~0063. REVOCATION OF PROVISIONAL DECLARATION OF HERITAGE PLACE NTG G16 20/4/2016 LI2016/0021~0014. PROVISIONAL DECLARATION OF HERITAGE PLACE - NTG G46, 16/11/2016 - LI2016/0021~0034. "GLEN HELEN MEAT HOUSE" DECLARED A HERITAGE PLACE - NTG G25 - 24/06/2020.

Survey Comments

(none found)

Proposed Easements

(none found)

Local Government Area

MACDONNELL SHIRE

Region

ALICE SPRINGS

Custodian - Valuer General (+61 8 8995 5375)**Owner's Last Known Address**

Beston Parks Land Co Pty Ltd (ACN 111 783 423) as trustee for Beston Accommodation Parks Trust (ABN 86 203 376 744), LEVEL 7, 60 LIGHT SQUARE ADELAIDE SA 5000

Parcels in Valuation

N.T. Portion 00830

Unimproved Capital Value

\$250,000 on 01/07/2021

\$38,000 on 01/07/2018

\$38,000 on 01/07/2015

\$38,000 on 01/07/2012

\$38,000 on 01/07/2010

\$50,000 on 01/07/1991

Custodian - Property Purchasing (+61 8 8999 6886)**Acquisitions**

(none found)

Custodian - Building Advisory Service (+61 8 8999 8965)**Building Control Areas**

(none found)

Building Permits

(none found)

Visit the website <http://www.nt.gov.au/building/>

Custodian - Town Planning and Development Assessment Services (+61 8 8999 6046)

Planning Scheme Zone

NOZONE (No NT Planning Scheme zone applies)

Overlays: The following overlays may apply to your land

- CNV - Clearing of Native Vegetation

Refer to the NT Planning Scheme 2020 for more information.

Strategic Frameworks:

(none found)

Interim Development Control Orders

(none found)

Planning Notes

The NT Planning Scheme may apply to development on this land.

Planning Applications

(none found)

Custodian - Pastoral Estate - Vegetation Assessment Unit (+61 8 8999 4454)

(none found)

Visit the website for information on Pastoral land permits.

Custodian - Power and Water Corporation (1800 245 092)

Meters on Parcel

Power Water - Electricity (none found)

Power Water - Water (none found)

For Account balances, contact the Power and Water Corporation.

Custodian - Pool Fencing Unit (+61 8 8924 3641)

Swimming Pool/Spa Status

(none found)

For more information, contact the Pool Fencing Unit (+61 8 8924 3641).

Custodian - Mines and Energy (+61 8 8999 5322)

For information on possible Mineral Titles or Petroleum Titles, contact Mines and Energy or visit the website <http://strike.nt.gov.au>

Custodian - NT Environment Protection Authority (+61 8 8924 4218)

Results of site contamination assessment

(none found)

For further information contact Environment Protection Authority or visit the website <https://ntepa.nt.gov.au/your-business/public-registers/contaminated-land-audits>

Custodian - Heritage Branch (+61 8 8999 5039)

Heritage Listing:
(none found)

For further information on heritage places contact Heritage Branch or visit the website
<https://nt.gov.au/property/land/heritage-register-search-for-places-or-objects>

Other Interests

For Account balances, contact MacDonnell Shire Council

Locality Diagram



APPENDIX B

Section 48 Notice



NOTICE TO CARRY OUT ENVIRONMENTAL AUDIT PROGRAM

(Issued pursuant to Section 48(1) of the *Waste Management and Pollution Control Act 1998*)

ISSUED TO: Ngurratjuta/Pmara Ntjarra Aboriginal Corporation
ABN 79 602 462 309
c/o Cameron Miller and Amy Driver

OF: 7 Leichhardt Terrace
ALICE SPRINGS, NT 0870

WHEREAS the Northern Territory Environment Protection Authority ("NT EPA") is satisfied for the reasons stated in **Attachment A** of this notice that you are a person required to carry out an Environmental Audit Program in relation to the property located at 8495 Namatjira Drive, Mount Zeil, Northern Territory (NT Portion 830), as delineated in **red** in **Attachment C** (the premises) to evaluate:

- (i) **the types, amount, distribution and mobility of contaminants and wastes present in the environment resulting from or in any way connected with fuel storage and fuel use activities at the premises, as defined in Attachment A;**

NOW TAKE NOTICE that you are required to comply with each of the requirements specified in **Attachment B** to this notice on and from the date of issue of this notice.

ISSUE DATE: 26 August 2021



AMY DENNISON
EXECUTIVE DIRECTOR
ENVIRONMENTAL REGULATION
DELEGATE OF THE NT EPA

Important Notice

Failure to comply with this notice is an offence under Section 52 of the *Waste Management and Pollution Control Act 1998* and may incur significant penalties and/or other statutory action.

This notice takes effect on the date on which it is served upon you. Pursuant to Section 108 of the *Waste Management and Pollution Control Act 1998*, **you have the right to apply for a review of the decision to issue you with this Notice to carry out an Environmental Audit. If you intend to apply for a review, YOU MUST MAKE AN APPLICATION NOT LATER THAN 28 DAYS after the day on which this Notice of the decision was given.** For information on how to lodge an application for review, contact the Northern Territory Environment Protection Authority, telephone 8924 4041.

Pursuant to Section 112 of the *Waste Management and Pollution Control Act 1998* the person issued with this notice must fulfil certain obligations before selling, leasing, sub-leasing, giving or exchanging land, premises, a vehicle or business which is the subject of this Notice.

ATTACHMENT A

REASONS FOR ISSUING THIS NOTICE

1. Ngurratjuta/Pmara Ntjarra Aboriginal Corporation (Ngurratjuta) was the owner of the land located at 8495 Namatjira Drive, Mount Zeil, Northern Territory (NT Portion 830), as delineated in **red** in **Attachment C** (the premises);
2. On 01 June 2021 the premises was sold to Beston Parks Land Co Pty Ltd (ACN 111 783 423), the final transfer of ownership and control of the premises is subject to Ngurratjuta completing remediation of any contamination at the premises;
3. Beston Parks Land Co Pty Ltd engaged Low Ecological Services P/L (LES) to conduct a due diligence assessment for the purchase of the premises;
4. The premises is situated within the West McDonnell National Park, approximately 50 metres north of the Finke River riparian zone and 450 metres north west of Glen Helen Gorge;
5. The West McDonnell National Park is considered to be an area of ecological and cultural significance;
6. On 04 June 2021, LES submitted a report to the NT EPA titled "*Glen Helen Lodge Investigation for fuel Leakage from UPSS*" (the report), dated 03 June 2021;
7. The report referred to in 6 above states:
 - (a) An underground petroleum storage system (UPSS) comprised of a 5,000L diesel tank, a 12,300 litres opal (unleaded) tank and a petroleum tank (of unidentified volume) was identified at the premises, as presented in **Attachment D**;
 - (b) The UPSS was excavated and disposed offsite by Territory Electrical and Refrigeration under LES supervision;
 - a. It is noted that the report is unclear whether the associated tank infrastructure (bowzers, fuel lines and vent pipes) were removed as part of the works, or if they remain *in situ*;
 - (c) A photo-ionisation detector (PID) was used throughout the works to screen for volatile compounds associated with potential hydrocarbon impacts;
 - (d) During excavation the diesel and opal tanks were noted to be in poor condition with visible signs of corrosion (rust and leakage points) identified;
 - (e) Material immediately surrounding the diesel and opal tanks was excavated during the UPSS removal and managed via:
 - a. Offsite disposal of approximately 10 m³ of the most highly contaminated soils (determined via elevated PID readings); and
 - b. Stockpiling of material on site for future management;
 - (f) Elevated PID readings (up to 1730 ppm) were reported at several locations within the diesel and opal tank pits, extending down to bedrock (approximately 3.7 metres below ground surface (bgs)) in some areas;
 - (g) Samples were collected from the diesel and opal tank pits and submitted for laboratory analysis;
 - (h) The samples referred to in (g) above reported:
 - a. Total recoverable hydrocarbons (TRH) C10-C16 (F2) between 9,580 mg/kg and 14,900 mg/kg, exceeding the *Assessment of Site Contamination National Environment protection Measure 1999* (ASC NEPM) *TRH Management Limits*

- for Residential, Park land and Public Open Spaces (F2 C10-C16) criteria of 1000 mg/kg;*
- b. TRH C16-C34 (F3) between 11,000 mg/kg and 13,100 mg/kg, exceeding the ASC NEPM TRH *Management limits for Residential, Park land and Public Open Spaces (F3 C16-C34) criteria of 2,500 mg/kg;*
 - c. Concentrations of Ethylbenzene between 3.3 mg/kg and 7.2 mg/kg, exceeding the ASC NEPM Ecological Screening Limits (ESL) for Areas of Ecological Significance criteria of 1.5 mg/kg;
 - d. Concentrations of total Xylenes between 13.4 mg/kg and 36.5 mg/kg, exceeding the ASC NEPM ESL for Areas of Ecological Significance criteria of 10 mg/kg; and
 - e. It is noted that the report is unclear whether the samples collected from the tank pits were for validation purposes, as detected TRH and BTEX concentrations are in excess of validation criteria suggesting that contamination impacts remain *in situ*;
- (i) The diesel and opal tank pits were left as open (roped off) excavations for future management;
 - (j) The material immediately surrounding the petroleum tank did not report elevated PID readings, as such, the tank pit was deemed 'validated' and the excavated material was used to immediately backfill the petroleum tank pit excavation;
 - a. It is noted that no validation samples were collected nor submitted for laboratory analysis to confirm the validation of the tank pit excavation;
 - (k) Eight boreholes were excavated via drill rig in the anticipated contaminant migration pathway (primarily to the east of the UPSS location), as depicted in [blue](#) in **Attachment D**;
 - (l) Samples were collected from the boreholes referred to in (j) above for laboratory analysis and did not identify hydrocarbon impacts;
 - a. It is noted that the sample locations have not adequately assessed the anticipated migration pathway for contaminants of concern given the topography of the area suggests that the potential pathway for migration would be to the south and south east, rather than to the east;
 - (m) Groundwater was not encountered during the investigation;
 - a. It is noted that no groundwater bores were installed during the investigation;
 - (n) The report concluded that there was "*no indication that contamination from either fuel tank has or will migrate into the surrounding environment*" as a layer of rock was "*consistently struck and would prevent hydrocarbons from seeping to greater depths*";
 - (o) TRH and BTEX impacts have been identified within the diesel and opal tank pits (see results in (h) above) this constitutes contamination;
 - (p) Similarly, given the investigation did not adequately target the inferred migration pathway (south east towards the Finke River), the potential for contaminant migration remains unconfirmed;
 - (q) The report recommended a remedial strategy of "*natural source zone depletion*", involving the burial of excavated impacted materials within the diesel and opal tank pits with placement of 'clean fill' on top, whilst adding water and fertiliser to assist the biodegradation process;
8. Petroleum hydrocarbons are a wide group of chemicals that comprise oil and products refined from oil such as diesel, opal and petroleum fuels;

9. Hydrocarbons and hydrocarbon contaminated soils are defined as a contaminant and as a waste pursuant to section 4 of the *Waste Management and Pollution Control Act 1998* (WMPC Act);
10. It is noted that burial of wastes is an offence under the WMPC Act and as such is not considered an appropriate remedial strategy;
11. Hydrocarbons have the potential to kill or inhibit microbial species and reduce water/nutrient uptake by plants which can result in toxicity to some plant species and impaired ecosystem functioning¹;
12. Human health may also be impacted as a result of hydrocarbon contamination whereby impacts migrate into surface/groundwater used for consumption²;
13. Hydrocarbon and BTEX impacts have been identified as remaining in soils which has the potential to migrate and impact nearby sensitive receptors including the Finke River and Glen Helen Gorge; and
14. An assessment is required in order to evaluate the types, amount, distribution and mobility of contaminants and wastes present in the environment in order to suggest appropriate remediation methods (if necessary).

¹ Truskewycz A, Gundry TD, Khudur LS, et al. *Petroleum Hydrocarbon Contamination in Terrestrial Ecosystems-Fate and Microbial Responses* in *Molecules*. (2019), accessed via: [Petroleum Hydrocarbon Contamination in Terrestrial Ecosystems—Fate and Microbial Responses \(nih.gov\)](#)

² Kuppusamy S., Maddela N.R., Megharaj M., Venkateswarlu K. (2020) *Impact of Total Petroleum Hydrocarbons on Human Health* in *Total Petroleum Hydrocarbons* pp 139-165, Springer, Cham. Accessed via [Petroleum Hydrocarbon Contamination in Terrestrial Ecosystems—Fate and Microbial Responses \(nih.gov\)](#).

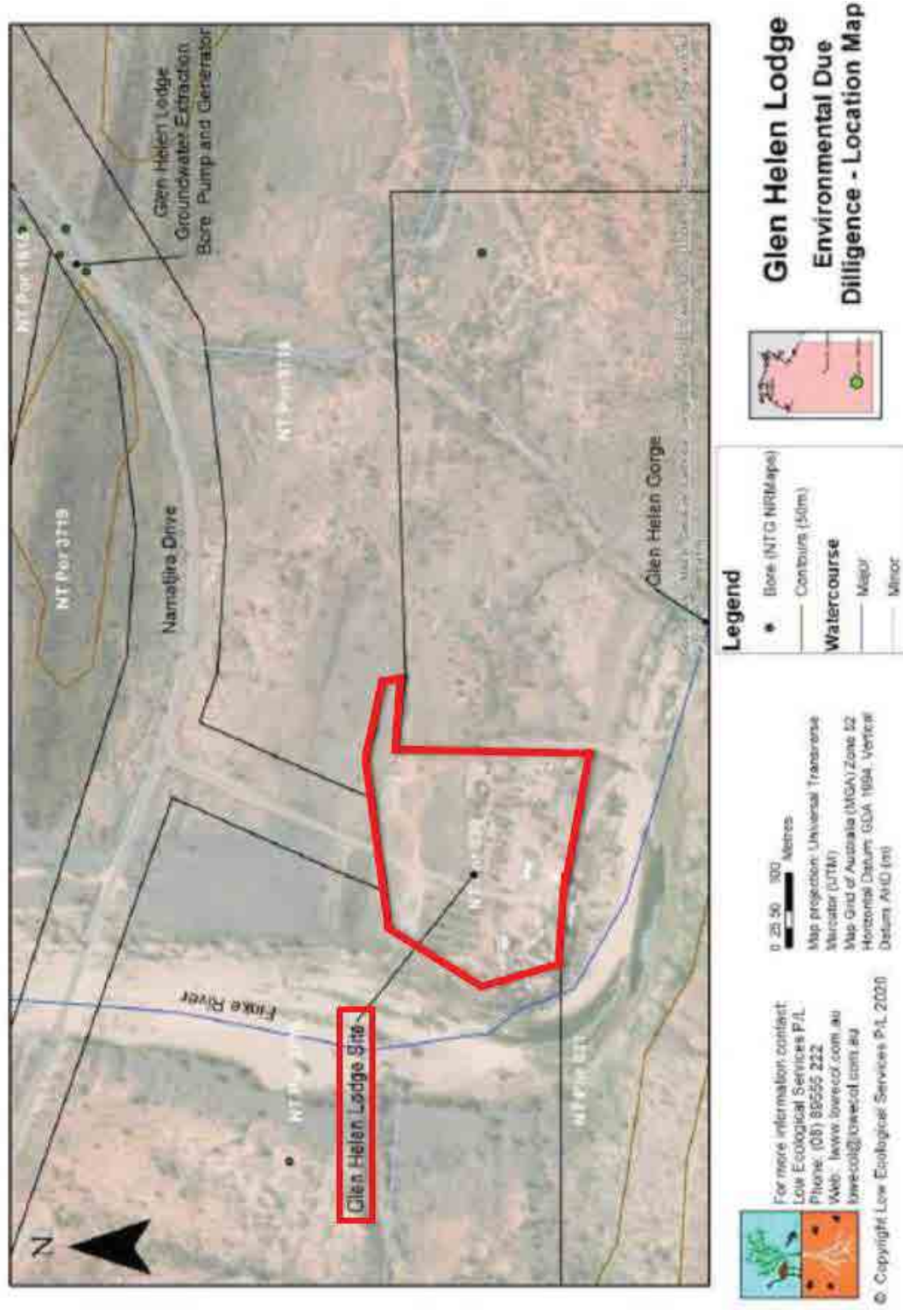
ATTACHMENT B

NOTICE REQUIREMENTS

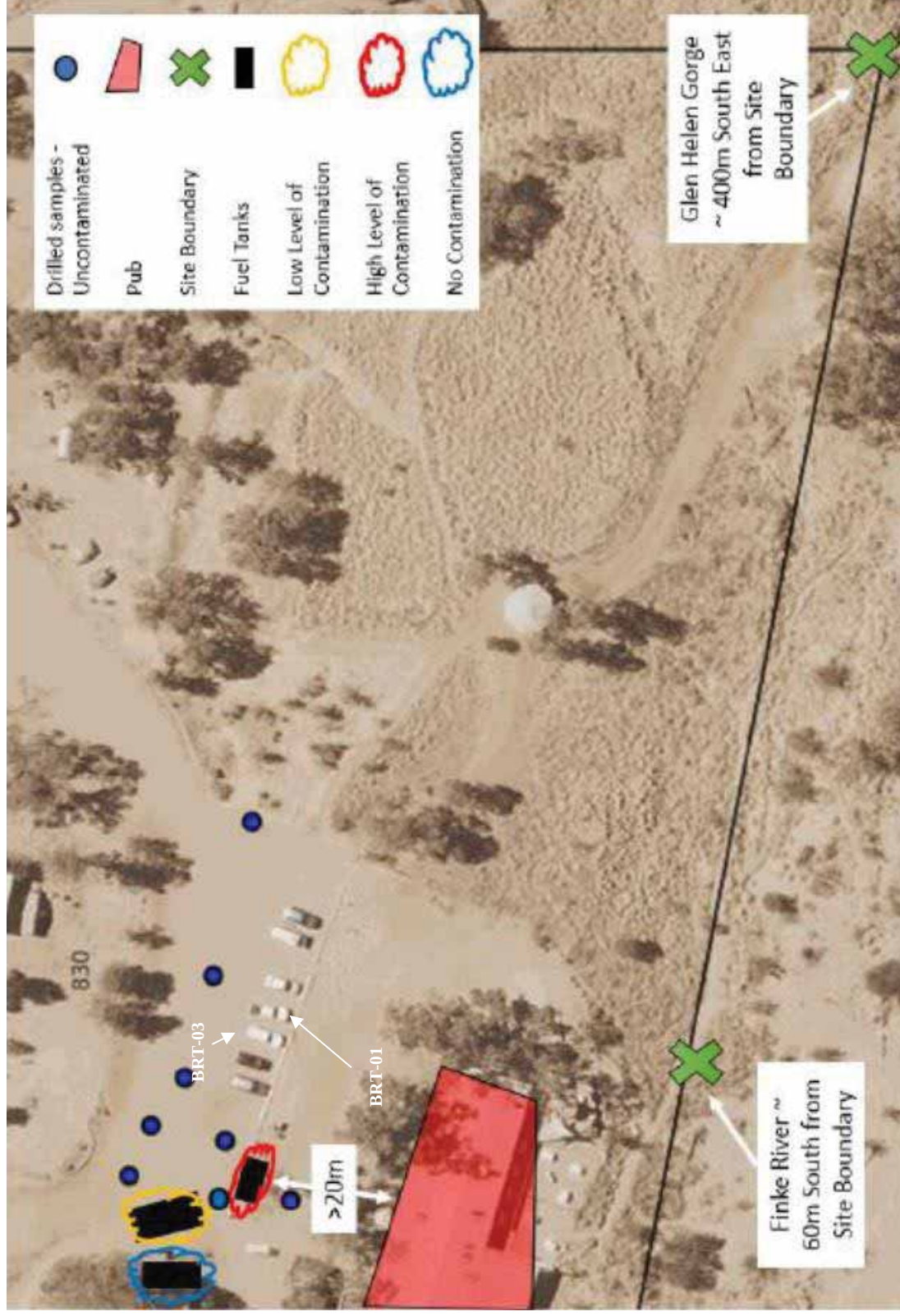
1. The environmental audit program (the program) must be performed by a person registered under section 68 of the *Waste Management and Pollution Control Act 1998*, in this case an environmental auditor specifically accredited under the New South Wales or Victorian auditor accreditation schemes;
2. Within one month from the date of issue of this notice you must engage the environmental auditor referred to in requirement 1 above;
3. Within two months from the date of issue of this notice you must submit a scope of works for the program to the NT EPA for review;
4. Within six months from the date of issue of this notice you must submit an **Environmental Audit Report** prepared by the person referred to in requirement 1 above;
5. The **Environmental Audit Report** referred to in requirement 4 above must relate to the risk of any possible harm or detriment to the land, surface water and groundwater environments caused by activities conducted at the premises, as determined by:
 - (a) collection and/or modelling of any data as the auditor sees fit; and
 - (b) review of any data, records, reports, monitoring programs or other information relevant to the scope of the audit;
6. The **Environmental Audit Report** referred to in requirement 4 must provide an independent expert opinion based on reports prepared by a reputable environmental consultant engaged by Ngurratjuta which:
 - (a) determines the types, amount, distribution and mobility of contaminants and wastes present in the environment resulting from the site activities, processes and operations at and beyond the boundary of the premises;
 - (b) determines the risk of any possible harm or detriment to the land, surface water and groundwater environments as a result of identified contamination;
 - (c) where a risk of any possible harm or detriment to a segment of the environment has been determined in 6(b) recommend any further assessment, risk analysis (human health and/or ecological) or remedial measures necessary to reduce the risk to an acceptable level; and
 - (d) includes an indicative implementation timetable for any recommended clean-up and/or management works referred to in requirement 6(c).

ATTACHMENT C

THE PREMISES - SITE LOCATION AND PROPERTY BOUNDARY (DELINEATED IN RED) AND ECOLOGICALLY SENSITIVE RECEPTORS (DELINEATED IN YELLOW)



ATTACHMENT D LOCATIONS OF UPSS AND APPROXIMATE DRILLED DELINEATION BOREHOLES



APPENDIX C

Glen Helen Groundwater Investigation 1991-1995 (Water Resources Branch of the Power and Water Authority, 1996)





Report No: 42/1993A

GLEN HELEN
GROUNDWATER INVESTIGATION
West MacDonnells National Park
1991-1995

I Matthews
Hydrogeologist
WATER RESOURCES BRANCH, ALICE SPRINGS

May 1996

SYNOPSIS

A groundwater investigation was undertaken to appraise the prospects for attaining a reliable long-term water supply for the resort at Glen Helen and for the Western MacDonnells Park Headquarters. Maximum demand is expected to be about 5 L/s, with perhaps 0.7 L/s of this required to be potable.

Four bores were drilled in three different formations. A high yield (8+ L/s) of non-potable water was attained from bore RN 16368, drilled into the Goyder Formation. It is believed that the resource is adequate for sustained extraction at 5 L/s, although further drilling and some pump testing is required to validate this.

The water is non-potable with a TDS of about 2000 mg/L. Work was terminated at this stage due to land tenure constraints. Desalination will be required for domestic use. Irrigation needs may be met with untreated borewater or a blend of 'grey' waste water and untreated water.

The only aquifers in the local area containing potable water are south of the Pacoota/Mereenie Sandstone ridges and are not accessible.

Recommendations for production and monitoring bore construction and siting are included.

KEYWORDS

SUBJECT	Glen Helen Resort water supply Investigation drilling
GEOLOGY	Amadeus Basin Goyder Formation Arumbera Sandstone
LOCATION	West MacDonnells National Park Glen Helen

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ABBREVIATIONS

AHD	Australian Height Datum
bgl	below ground level
EC	Electrical conductivity
ID	inside diameter
km	kilometres
L/ S	litres per second
m	metres
mg/L	milligrams per litre
RN	registered number
SWL	standing water level
TDS	total dissolved solids (in mg/L)
μ S/cm	microsiemens per centimetre

DISTRIBUTION

PARKS AND WILDLIFE COMMISSION	2
DEPARTMENT OF TRANSPORT AND WORKS	2
WATER RESOURCES LIBRARY, ALICE SPRINGS	3
WATER RESOURCES LIBRARY, DARWIN	4
PAWA LIBRARY DARWIN	1
PRINCIPAL ENGINEER GROUNDWATER	1
AUTHOR	1

1. INTRODUCTION

Proposed developments at Glen Helen Lodge are part of the Parks and Wildlife Commissions Western MacDonnell Park Strategy. This includes a 100 - 200 room motel, a hostel and caravan park. See Figure 1 for a location map. A single bore yielding 0.4 L/s of marginally unpotable water currently supplies the resort.

The Water Resources Branch of the Power and Water Authority (PAWA) was requested to assess the groundwater resources in the Glen Helen Gorge area by the Department of Transport and Works, who are managing the infrastructure planning for the resort redevelopment. This included delineating the most prospective aquifers (with regard to yield and quality) and identifying the optimum sustainable resource for the resort. Funds permitting - and subject to investigation results - it was also planned to drill, construct and test 2 production and a number of monitoring bores. The estimated cost for the investigation phase was \$ 120 000. (See Appendix A for the full project brief).

It was estimated that a peak supply of 5 L/s may be required to fully service the resort although accurate visitor numbers, and therefore demand, is difficult to estimate.

2.0. AQUIFER SELECTION

2.1 REGIONAL HYDROLOGY

The resort is located on the northern margin of the Amadeus Basin on the Finke River immediately north of the MacDonnell Ranges. The more prospective aquifers of the basin sequence, including the Mereenie Sandstone and the Pacoota Sandstone lie south of the entrance to Glen Helen Gorge. It would be necessary to lay a pipeline either over the sandstone ridges directly south of the resort or through Glen Helen Gorge to be able to utilise water from the Pacoota or Mereenie Sandstone. Following discussions with the Commission this option was not pursued further due to conservation and aesthetic concerns. The Pacoota Sandstone forms ranges of steeply dipping strata and could not be targeted north of the range due to drill rig access problems.

Shallow groundwater and surface water supplies associated with the Finke River in this area are invariably non-potable and are not considered a viable resource. See Section 4.3 for further discussion on the groundwater/surface water relationships associated with the Finke River.

Published geological maps (see Figure 3) indicate that the most prospective accessible targets within a reasonable distance of Glen Helen would be the Jay Creek Limestone and the Goyder Formation. A further target would be the Arumbera Sandstone, although this unit typically yields only small supplies of marginal quality water, as demonstrated by the bore currently in use at the resort.

Potable water has been attained from both the Bitter Springs Limestone and the Heavitree Quartzite in the area (eg Orniston Gorge camp ground), but these supplies are small (< 2 L/s) and aquifers developed in these formations are not considered extensive enough for use at Glen Helen.

2.2 PRIOR WORK

Prior to this investigation, drilling for an Aboriginal Living Area was undertaken approximately 8 km directly along strike from Glen Helen in the same formations as those to be targeted for the resort complex, and as such, was directly relevant to this investigation. During this work program one bore was drilled into the Arumbera Sandstone (1 L/s, TDS = 1490 mg/L) and three into the Goyder Formation.

The bores into the Goyder Formation yielded from 0.7 - 2.5 L/s with TDS content of around 2000 mg/L. The strata encountered consisted of vertically dipping, soft, yellow and brown sandy clay and soft to firm yellow/brown and white, fine to medium grained sandstone. It appears that the firmer, cleaner, higher yielding sandstone occurs near the top of the formation. Drilling was terminated while still in aquifer material on all bores in the Goyder Formation. For full details of this program, see Matthews (1993), WRB Report Number 49/93A.

The Jay Creek Limestone was not seen in outcrop at this locality (contrary to the geological map) and was not encountered during the drilling.

Bore RN 6416 lies approximately 800 m south-east of the resort, penetrates the Jay Creek Limestone and yields 2 L/s with a TDS of 3000 mg/L. No limestone outcrop could be located more than 300 m west of RN 6416 and it is assumed that the limestone wedges out against the Goyder Formation and is not present for some substantial distance east of this point - at least the 8 km to the outstation mentioned previously.

The resort is currently served by Bore RN 12021 which is drilled into red/purple sandstone of the Arumbera Sandstone and yields 0.4 L/s of marginally unpotable water.

2.3 INVESTIGATION STRATEGY - TARGET SELECTION

From the drilling at the Living Area approximately 8 km east of Glen Helen, and the results from bores RN 6146 and RN 12021, it was hypothesised that no potable groundwater was present north of the ridgeline which runs in an east-west direction immediately south of the resort.

It was decided to drill four investigation bores - one into each of the Goyder Formation, Jay Creek Limestone and the Arumbera Sandstone west of the Finke River (where the beds had not been drilled previously), and a further bore into the Goyder Formation on the eastern side of the Finke River. It was expected that the water would have a TDS of at least 2000 mg/L from all three units and that the Goyder Formation would have the highest yield and best water quality.

The Parks and Wildlife Commission has a set of 1:14000 scale colour airphotographs over the relevant area.

3.0 DRILLING

Bore RN 16364 was drilled into the Jay Creek Limestone approximately 100 m west of the Finke River (see Figure 4 for a bore location map). Clay and sandy clay was encountered to 24 m and dark grey sandy limestone thereafter. A supply of 2 L/s was struck from 24 - 35 m and the TDS was approximately 5000 mg/L. The bore was constructed with 50 mm PVC for future monitoring use.

Bore RN 16368 targetted the Goyder Formation approximately 1 km east of the Finke River. The bore encountered grey/brown and yellow, firm to hard, periodically fractured sandstone and airlifted 8 L/s of water with a TDS of 2000 mg/L from 150 m. Drilling was terminated due to the high yield although aquifer material was still being drilled. Surface casing only was left in the hole so as to allow for construction as either a production or monitoring bore at a later date.

Bore RN 16370 was drilled in the Goyder Formation on the western side of the Finke River. The bore encountered soft, yellow brown and white slightly clayey sandstone and yielded only seepage (TDS = 2900 mg/L). The bore was cased with 50 mm PVC.

The last bore in the program (RN 16371) targetted the Arumbera Sandstone and 0.2 L/s of water with a TDS of 2400 mg/L was attained. Soft, dark brown to purple clay and sandstone was encountered. The bore was cased with 50 mm PVC.

Site work was terminated at this stage as land tenure had yet to be finalised. As such, no test pumping was undertaken and therefore aquifer characteristics are not known.

4.0 DISCUSSION

4.1 BORE SITE SELECTION

The Goyder Formation should be tapped to provide the long term water needs at Glen Helen. The formation extends many kilometres both east and west of Glen Helen and outcrop width is usually from 400 - 500 m wide. The vertically dipping sandstones of this unit contain the best quality water in the area and can supply large yields. Two production bores each capable of 6 L/s would be necessary to supply the forecast needs of the resort.

The production bores should be sited to target the high-yielding, white, firm to hard, fine grained sandstone found in the upper part of the formation rather than the softer yellow/brown clayey sandstone found lower in the sequence. The high yielding bore (RN 16368) is approximately 190 m from the Goyder Formation/Pacoota Sandstone contact while the low yielding RN 16370 is over 400 m from the same contact. As such the production bores should be sited at least within 200 m of the base of the Pacoota Sandstone. See Figure 4 for a suggested borefield plan.

The 2 production bores should be constructed with inert casing and will probably be from 140 - 180 m deep. ABS casing should be used to stop any possible corrosion problems with the brackish water and give long term, reliable service. (PVC casing should not be used as the depth of the bores exceeds manufacturers specifications.) A short step and a 48 hour constant rate test pump should be undertaken on at least one of the bores to ascertain aquifer properties so as to allow for calculations of storage and sustainable yield. An 8 hour constant rate test will probably suffice for the second production bore as aquifer properties should be similar.

Bore RN 16368 and 2 other bores should be constructed with 50 mm PVC and monitored on a regular, three monthly basis. See Figure 4 for a suggested borefield layout. Monitoring Bore RN 16368 is placed between Production Bore 2 and the Glen Helen Gorge and any pumping-induced decline in the groundwater levels down-gradient of the borefield would be evident in this bore. If large declines were noted, close monitoring of the waterhole would be warranted to ascertain any flow-on effects.

The water will be unpotable (approximately 2000 mg/L) and no development should occur within 500 m of the borefield area or east of Monitoring Bore 1 (see Figure 5).

The final development phase needs to include professional assessment of the extent of the resource and its potential for providing the necessary yield in a sustainable manner, and suggest long-term monitoring strategies.

The estimated cost to drill and construct the production and monitoring bores, test pump the production bores, assess the resource and issue a final report is shown at Appendix A.

4.2 GROUNDWATER FLOW

Groundwater characteristics for the Amadeus Basin region have been reviewed by Lau and Jacobsen (1991) and they suggest that groundwater movement is generally eastward, particularly in the northern part of the basin. Warren and Shaw (1995) state that groundwater moves east across HERMANNSBURG.

The SWL of a number of bores and the surface water level at Glen Helen Gorge were reduced to

mAHD. A section through bores RN's 16351, 16368 and 16370 (all penetrate the Goyder Formation) and the Glen Helen Gorge waterhole has been constructed and is presented in Figure 5. It can be seen that, in the Goyder Formation at least, the groundwater gradients slope towards the waterhole, from both the west and east. The siting and design of the resort infrastructure should recognise that the Finke River is the lowest point in the system, is a discharge zone and acts as a sink in the local area.

4.3 GROUND/SURFACE WATER RELATIONSHIPS

There are several permanent and semi-permanent 'independent' waterholes along the Glen Helen stretch of the Finke River. The four closest to Glen Helen are marked on Figure 7 as A - D with A being the furthest upstream. The four waterholes are located above/within 4 different formations. The 4 waterholes were sampled in August 1994 and the following results were attained:

WATERHOLE	UNIT	TDS (mg/l)
A	Bitter Springs Limestone	11000
B	Goyder Formation	5070
C	Pacoota Sandstone	3780
D	Mereenie Sandstone	1350

(Full analyses are available in Table 1).

Although it is difficult to draw conclusions from one data set of a constantly changing system (the hydrochemistry will depend on rainfall, streamflow and evaporation regimes as well as the underlying geology) some points are of interest. The Bitter Springs Limestone is a regionally saline aquifer while the Goyder Formation usually ranges from 2000 - 3000 TDS. The Pacoota and Mereenie Sandstone usually contain good quality water. This pattern was reflected in the waterhole samples.

Disregarding the results for fluoride, nitrate and iron, 8 of the 11 remaining parameters had a decreasing ion concentration pattern from waterhole A - D. The bicarbonate variance between the waterholes was less than 40% (while variance in TDS was over 800%). The highest potassium concentration was attained from waterhole B which overlies the Goyder Formation. This unit

contains much more clay - which has a high potassium concentration - than either the Pacoota or Mereenie Sandstones. The Bitter Springs Limestone would also be expected to have low potassium levels.

From the hydrochemistry of the different waterholes and from the water levels of the Goyder Formation (Figure 5) it appears that the surface water in the Glen Helen area is, to some degree at least dependent on, and connected with, the groundwater contained in the aquifers of the different formations.

It is beyond the scope of this report to undertake further comment on the relationship between the groundwater and surface water apart from stating that there is a connection. Large drawdowns due to abstraction from the Goyder Formations may impact on waterhole B (and perhaps C) and an estimate of the sustainable yield of the unit should be calculated after the production bores are pump tested. Regular checks of Monitoring Bores 1 - 3 and waterholes B and C should be undertaken once the bores have been constructed and estimates of the sustainable yield refined as more data becomes available.

4.4 RESOURCE MANAGEMENT

There are a number of water management scenarios which could be implemented to reduce the impact on the natural regime at Glen Helen and they are examined briefly below. Tighter delineation of the different management possibilities should be considered before the next planning/construction phase.

POTABLE REQUIREMENTS

Although peak total demand may be up to 5 L/s (432 kL/day), it is reasonable to assume that daily potable use - drinking, cooking and showers only - may be no more than 60 kL/day. This allows for 300 people using 200 L/day of potable water and would require a continuous supply of 0.7 L/s from the desalination plant.

NON-POTABLE REQUIREMENTS

The main non-potable water use would be irrigation. With careful management and selection of appropriate plant species it is possible to successfully irrigate with water containing salt levels up to the 2000 mg/L (which is available from the Goyder Formation). The Ayers Rock Resort is a well-known example where irrigation is undertaken with brackish water.

The 'grey' water (kitchen and bathroom wastewater) should be viewed as a valuable resource. This water would have a low TDS (>500 mg/L) and could be blended with straight borewater to lower the TDS of the irrigation water. A 1:5 blend ratio for example would result in a TDS of about 1750 mg/L.

BRINE DISPOSAL

A commonly used figure for desalination plants is that brine production amounts to approximately one quarter of the process water. Using that figure for Glen Helen, it is expected that 22 kL of brine would be produced per day and this water would have a TDS of 6500 mg/L.

When last tested, Waterhole A had a TDS of 11000mg/L. Given that this waterhole has an area of 50 x 100 m and the average evaporation rate is 7 mm day, approximately 35 kL of water would evaporate from the surface per day. It is thought that the addition of the desalination plant wastewater (only two-thirds the volume of that evaporated daily and of significantly better quality than the naturally ponded water) to the waterhole would have negligible effect.

SURFACE WATER

Potential exists to use surface water from intermittent flows of the Finke River. Good quality water from flows in the Finke River could be artificially recharged into the Goyder Formation aquifer. The start and finish of each individual flow event - and small flows - in the Finke River are saline, but the middle part of medium to large flow events are of low TDS water. Assuming that the Finke River flows with potable water for 5 days a year, pumping from the river at 75 L/s into a holding/settling pond (200 m x 100 m x 2 m) would provide 32 000 kL of water (a 1 L/s continuous supply) which could then be pumped into the aquifer over the next 30 days at 10 L/s.

Artificial recharge with water from intermittently flowing rivers has not previously been undertaken in central Australia. Artificial recharge using stormwater has recently been conducted in and around Adelaide and has been notably successful.

Alternatively, the small creek north of Bore RN 16368 could be dammed and direct use made of this water.

5.0 RECOMMENDATION

Two production bores each with a minimum yield of 6 L/s should be constructed to the east of Glen Helen Resort. They should be constructed with ABS casing and will probably be between 140 - 180 m deep. Bore RN 16368 should be converted to monitoring use and a further two monitoring bores installed.

The production bores should be drilled into the upper parts of the Goyder Formation (within 200 m of the Poooota Sandstone outcrop) where the sandstone is cleaner and firmer, with concomitant higher yields.

The two production bores should be test pumped and professional assessment of the aquifer properties, long-term sustainable yield and monitoring strategies included.

The water will be unpotable with a TDS of around 2000 mg/L and treatment will be required for domestic use. Irrigation needs can be met by either untreated bore water or a blend of treated wastewater and untreated bore water. Brine and sewerage waste need to be disposed of so as to minimise impact on the local environment.

No development should be undertaken within 500 m of the borefield area or east of Monitoring Bore 1.

6.0 REFERENCES

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WATER QUALITY DATA

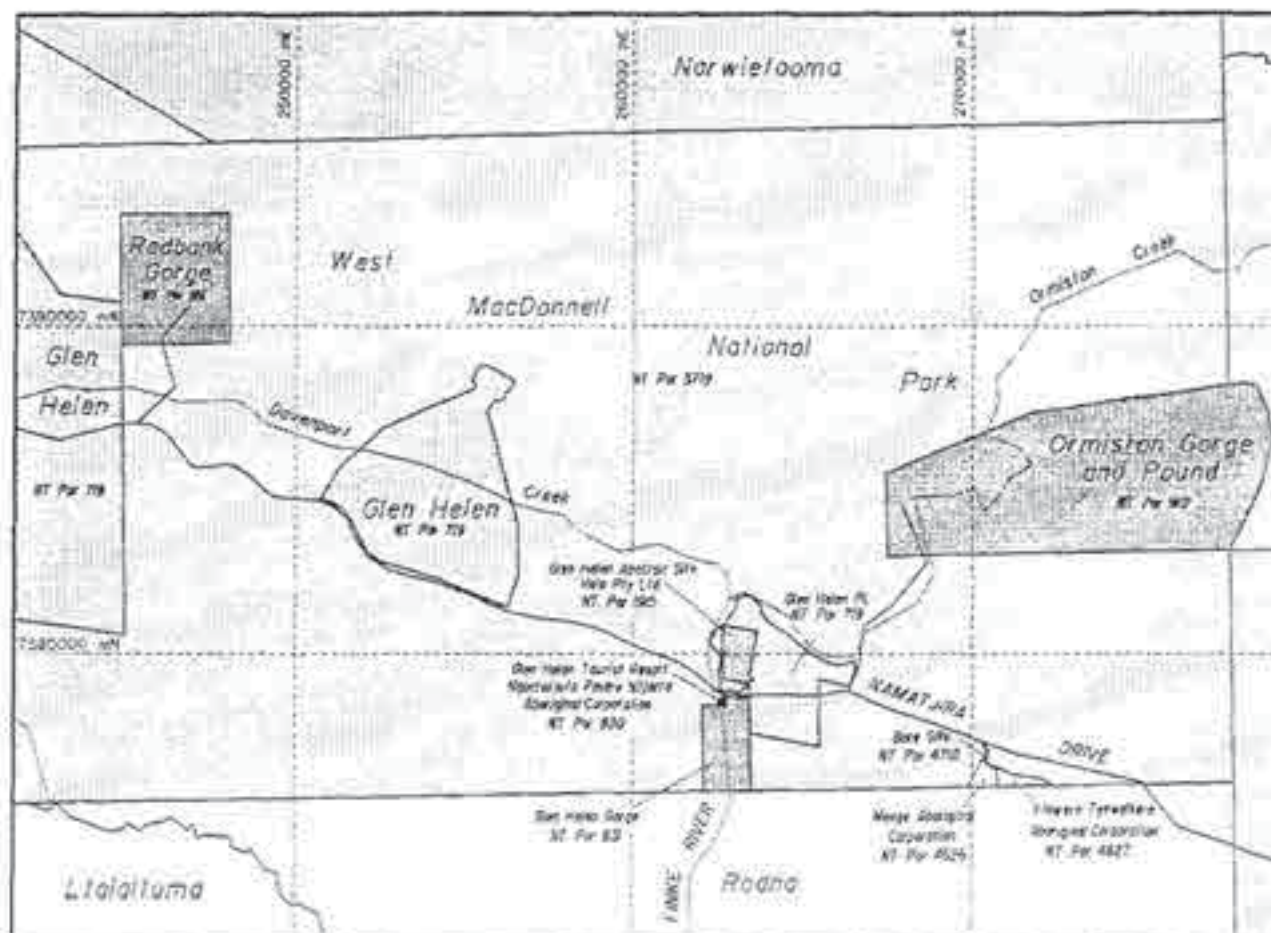
BORE REGISTERED NUMBER	DATE OF SAMPLING	SPECIFIC CONDUCTANCE	TOTAL DISSOLVED SOLIDS	SODIUM	POTASSIUM	CALCIUM	MAGNESIUM	IRON (TOTAL)	TOTAL HARDNESS	TOTAL ALKALINITY	SILICA	CHLORIDE	SULPHATE	NITRATE	BICARBONATE	FLUORIDE	(CALC FROM CHLORIDE)	COMMENTS
RW		µS/cm	TD/S	Na	K	Ca	Mg	Fe	CaCO ₃	CaCO ₃	SiO ₂	Cl	SO ₄	NO ₃	HCO ₃	F	NaCl	
6146	30/08/98	5200	3201	950	53	238	87	0.3	930	418	24	1480	410	1	255	0.9	512	
16364	15/06/94	7370																
16368	09/08/94	5110	3090	800	63	212	50	u/s	768	212	16	1360	360	1	259	0.8	2240	
16370	11/08/94	4860	2970	767	67	166	86	U/S	769	239	13	1250	482	1	282	1.1	2060	
16371	17/08/94	3310	2420	949	24	268	124	U/S	1180	208	15	440	1080	3	254	1.3	725	
Finke R.	11/08/94	15400	11000	2740	47	852	258	0.7	3190	258	19	4450	2450	2	314	0.5	7330	'Bitter Springs' WH
Finke R.	11/08/94	7780	5070	1240	81	339	139	0.2	1420	244	24	2100	900	1	297	0.3	3460	'Goyder Farm' WH
Finke R.	11/08/94	3780	2250	516	23	175	59	0.3	680	253	11	910	354	2	309	0.4	1500	'Pacoota S'st.' WH
Finke R.	11/08/94	2330	1350	322	17	104	44	0.3	441	181	13	477	242	1	221	0.4	786	'Merconia S'st.' WH
NHMRC GUIDELINES →			1500					0.3		500		400	400	100		1.7		Maxima except pH range

Figures



LOCATION MAP
GLEN HELEN RESORT

FIGURE 1



LEGEND

- West MacDonnell National Park Conservation Land Corporation
- Nature Parks now part of West MacDonnell National Park
- Pastoral Lease
- Aboriginal Land Trust
- Aboriginal Living Areas
- Crown Lease in Perpetuity
- Glen Helen Resort



LAND TENURE MAP GLEN HELEN AREA

FIGURE 2



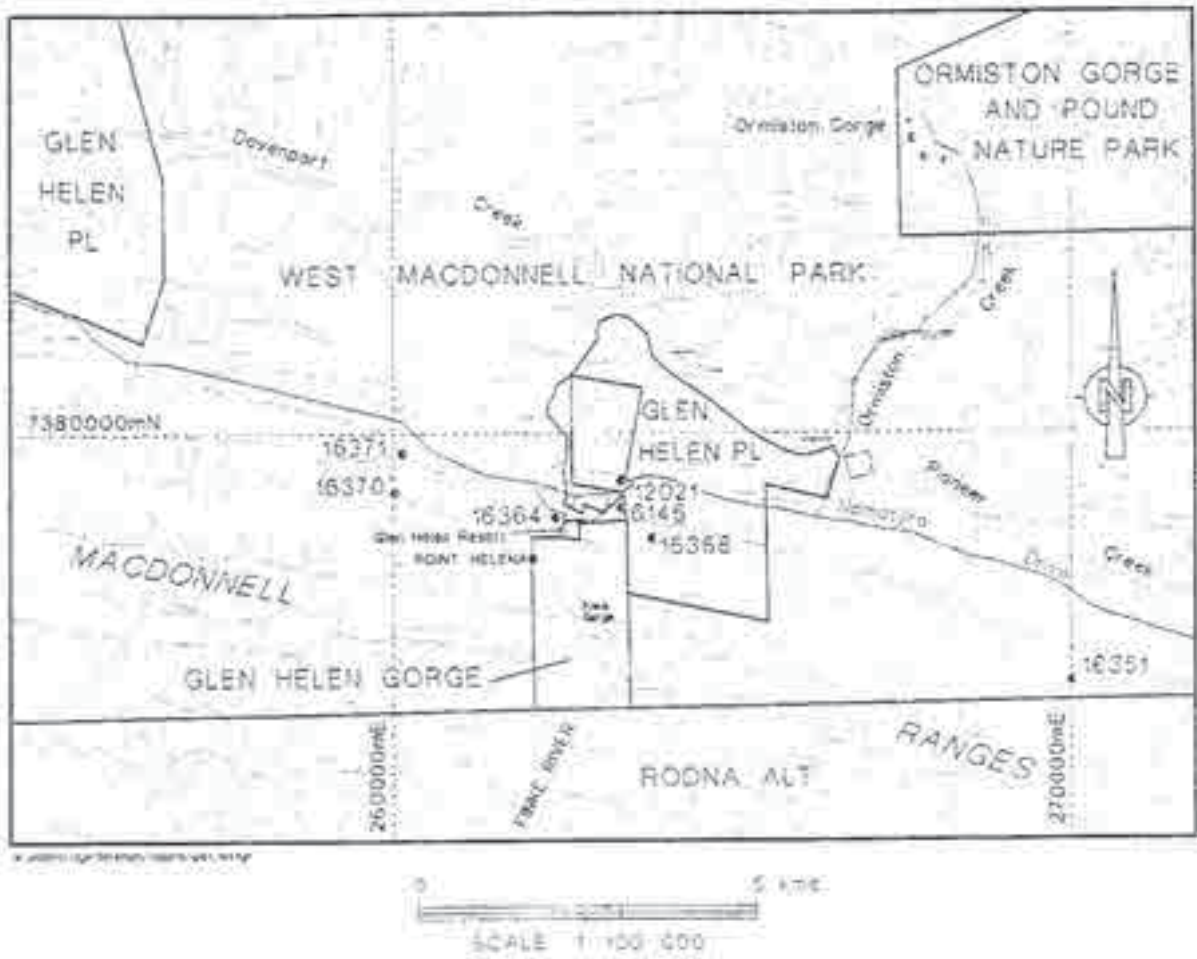
Scale 1:100,000

Qa	Alluvium			
Qs	Aeolian sand			
Czo	Conglomerate, scree			Cenozoic
Tla	Laterite			
Ts	Sandstone, sandy clay			
Pzu	Green, brown sandstone	Undandita Member		
Pzb	Conglomerate, minor sandstone	Brewer Conglomerate	Petrina Group	Devonian to Carboniferous
Pze	Cross bedded silty sandstone	Liltera Member		
Pzr	Brown cross bedded sandstone	Hermannsburg Sandstone		
Pzd	Red/brown siltstone	Dare Siltstone Member		
Pzj	Lithic sandstone	Parke Siltstone		
Pzm	Cross bedded sandstone	Mereenie Sandstone		Silurian to Devonian
Oc	Brown sandstone, minor siltstone	Carmichael Sandstone		
Ot	Siltstone, shale, limestone	Stokes Siltstone	Larpinta Group	Cambrian to Ordovician
Os	Fossiliferous sandstone	Stairway Sandstone		
Oh	Siltstone, limestone, sandstone	Horn Valley Sandstone		
C-Op	Fossiliferous sandstone	Pacoota Sandstone		
Og	Sandstone, limestone, siltstone	Goyder Formation		
Ol	Dolomitic limestone and shale	Jay Creek Limestone	Pentacosta Group	Cambrian
Oh	Shale, limestone, siltstone	Hugh River Shale		
P-Ca	Red/brown silty sandstone	Arumbera Sandstone		
Pup	Siltstone, sandstone, limestone	Pentatataka Formation		
Pus	Calcareous sandstone, siltstone	Areyonga Formation		Proterozoic
Pub	Dolomitic limestone, shale	Bitter Springs Formation		
Puh	Quartzite and orthoquartzite	Heavitree Quartzite		

WEST MACDONNELLS PARK LIVING AREA

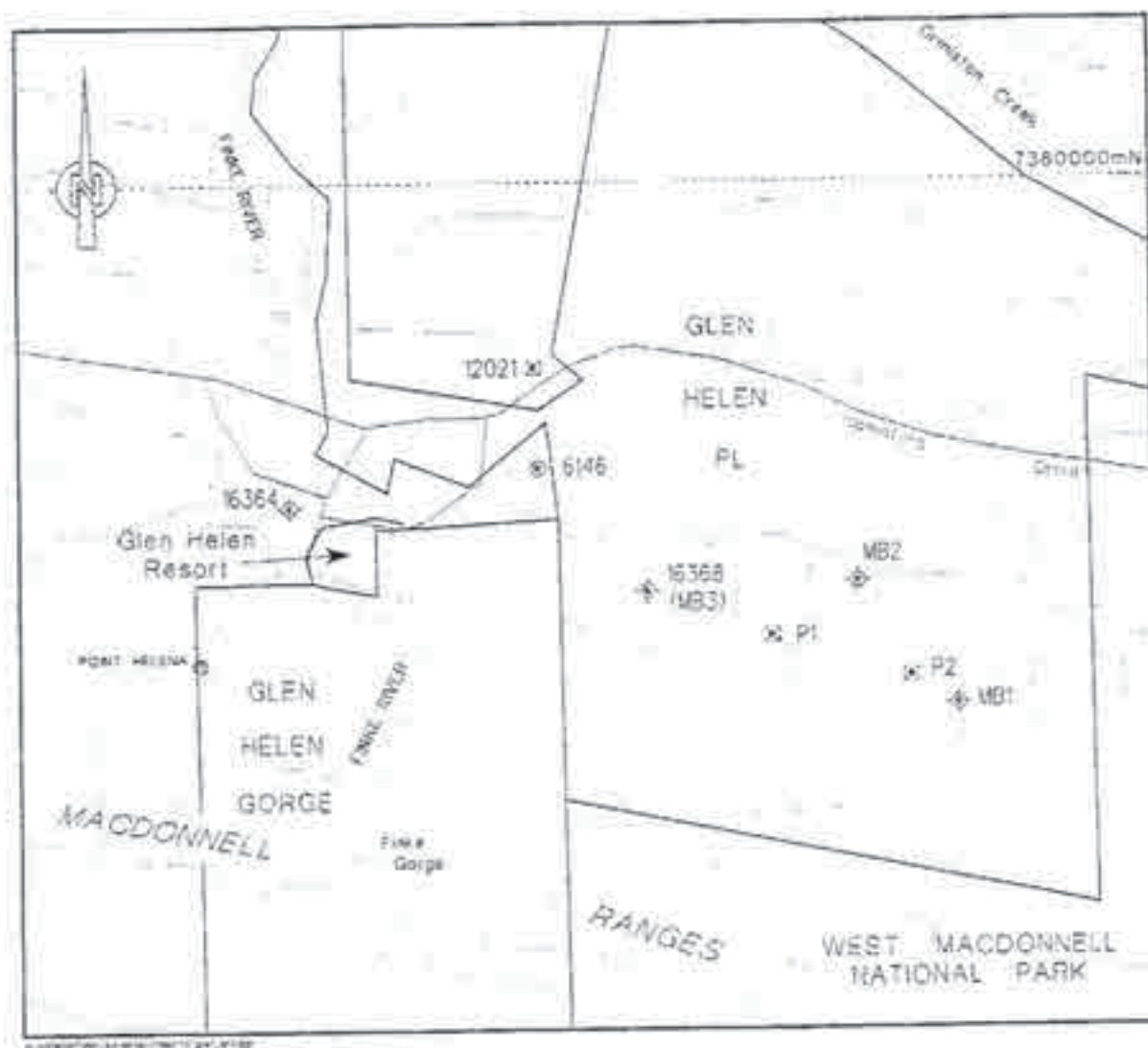
GEOLOGY MAP

FIGURE 3



GLEN HELEN RESORT
BORE LOCATION MAP

FIGURE 4



LEGEND

- ⊕ Closed Bore
- ⊙ Monitoring Bore
- ⊗ Production Bore

GLEN HELEN RESORT PROPOSED BOREFIELD MAP

FIGURE 5

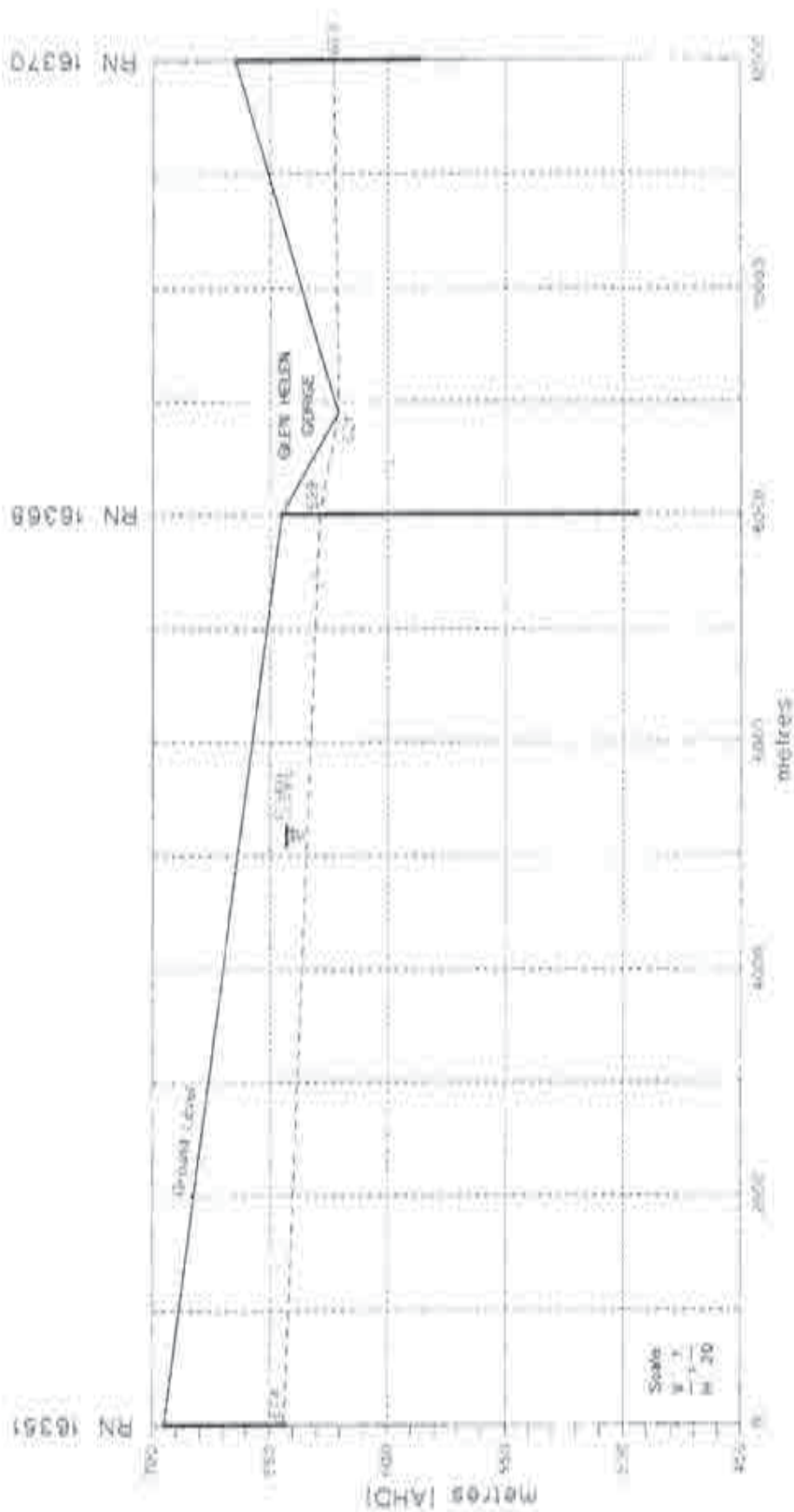


FIGURE 6

FIGURE 6



Aerial Photo NTC 3015 Run 7 008-135

Scale 1:50 000

GLEN HELEN AREA GEOLOGY / WATERHOLE MAP

FIGURE 7

Appendices

60.47.1.

PROJECT BRIEF
GLEN HELEN RESORT GROUNDWATER INVESTIGATION

1.0 INTRODUCTION

Proposed developments at Glen Helen are part of the Conservation Commission's (CCNT) West MacDonnells Park Strategy. This includes a 100 - 200 room motel, a hostel and caravan park. Water Resources is to investigate groundwater supplies for the CCNT development plan. The project manager is the Department of Transport and Works.

A review of potential groundwater sources for the proposed development was conducted by Australian Groundwater Consultants (AGC) in July, 1988. Six drill sites were pegged in the valley east of Glen Helen. Progress has until recently been halted by land tenure problems.

Water supplies for the existing Glen Helen Lodge are obtained from a single bore which has limited capacity (0.4 L/s) and produces water of marginal quality (1500 mg/L). Surface water holes and alluvium of the Finke River and Ormiston Creek contain brackish to saline water.

It is planned that this development be the only visitor accommodation in the western MacDonnells with an image of isolated comfort. Peak visitor numbers of 400 persons is expected. Water use of 1200 L/c/d would require a continuous supply of 5.5 L/s. This is an estimate only - accurate visitor numbers are difficult to predict.

The Kings Canyon Resort has an average monthly water usage ranging from 9000 kL (June 1993) to 24 000 kL (November 1992). While water use is higher in summer than winter, visitor numbers are substantially higher in winter. This suggests that the majority of the water is used for irrigation. In June 1993, visitor numbers were estimated at 10 000 person days, which equates to 900 L/c/d.

2. TECHNICAL BACKGROUND

The proposed development is located on the northern margin of the Amadeus Basin on the Finke River immediately north of the MacDonnell Ranges. The more prospective aquifers of the basin sequence, including the Mereenie Sandstone and Pacoota Sandstone, lie south of the entrance to Glen Helen Gorge. Outcrop of these units are in rugged terrain and access for drill rigs is limited. The Mereenie and Pacoota sandstones will not be targetted if potable water is obtained east or west of the proposed resort.

On the basis of previous drilling results the most prospective accessible targets for potable water supplies are the Jay Creek Limestone and the Goyder Formation. The target formations dip steeply to the south east of Glen Helen, and steeply to overturned to the west. Due to the steep dips and subsequent narrow surface expression at least six holes should be drilled to determine aquifer potential.

The Jay Creek Limestone consists of limestone, dolomite and siltstone with a few thin interbeds of calcareous sandstone. Geological mapping for the 1:250 000 Hermannsburg map sheet (Majoribanks, 1974) shows the Jay Creek Limestone to be absent west of Glen Helen and as isolated lenses east of the Finke River. The 6 sites selected by AGC (1988) attempted to target this formation.

As part of a groundwater investigation for an aboriginal living area approximately 8 km east of Glen Helen site 6 of the AGC investigation was recently drilled. This yielded brackish water from brown and red siltstone (probable Hugh River Shale). A second bore further south produced marginally unpotable water from a yellow fine to medium grained sandstone, thought to be part of the Goyder Formation.

No limestone or dolomite was encountered in either drilling or outcrop and it is considered that the Jay Creek Limestone is not present in the study area.

Further drilling of the Goyder Formation and Arumbera Sandstone is planned as part of the living area investigation and the results will be incorporated into the Glen Helen Resort investigation.

Drilling for the resort will initially be conducted within the Goyder Formation both east and west of Glen Helen. Depending on results, further drilling south of Glen Helen (targetting the Mereenie and Pacoota Sandstones) may be necessary, subject to client agreement, sacred site clearance, and access.

A further alternative may be desalinisation of brackish water. (Sufficient near-potable water should be available in the Goyder Formation). A dual reticulation system may also be feasible if only small quantities of potable water are available.

3. AIM

To develop an adequate sustainable potable water supply for the Glen Helen Resort and to identify potential impact on the groundwater and surface water regime.

4. OBJECTIVES

- Within access limitations, assess groundwater resources in the Glen Helen Gorge area for yield and quality.
- Identify the most cost effective sustainable potable water source for the proposed resort.
- Investigate any link between surface water in the Finke River and groundwater by determining flow gradients.
- Funds permitting, and subject to investigation results, construct and test production bores, and associated monitoring bore(s).

5. SCOPE OF WORK

Six investigation holes will be drilled. The initial three holes will be drilled along the main valley, east of the Finke River and target the Goyder Formation. If results are favourable

further drilling would occur to the east of the river. At least one hole is envisaged on the western side of the Finke River.

Investigation holes will be drilled using percussion drilling techniques. Measurement of salinity and yield during drilling will indicate the potential of the Formations for development as aquifers.

A nominal maximum depth of 125 m has been adopted. The depth and location of the drill holes may be adjusted as the programme proceeds.

The water level in the Finke River and local bores will be surveyed to the Australian Height Datum, allowing determination of flow gradients.

6. WORK PROGRAMME

Site selection and preparation of access tracks will occur immediately following the conclusion of the living area investigation 8 km east of Glen Helen. Drilling and testing with the WRB crew is programmed for October/November 1993.

7. COSTING

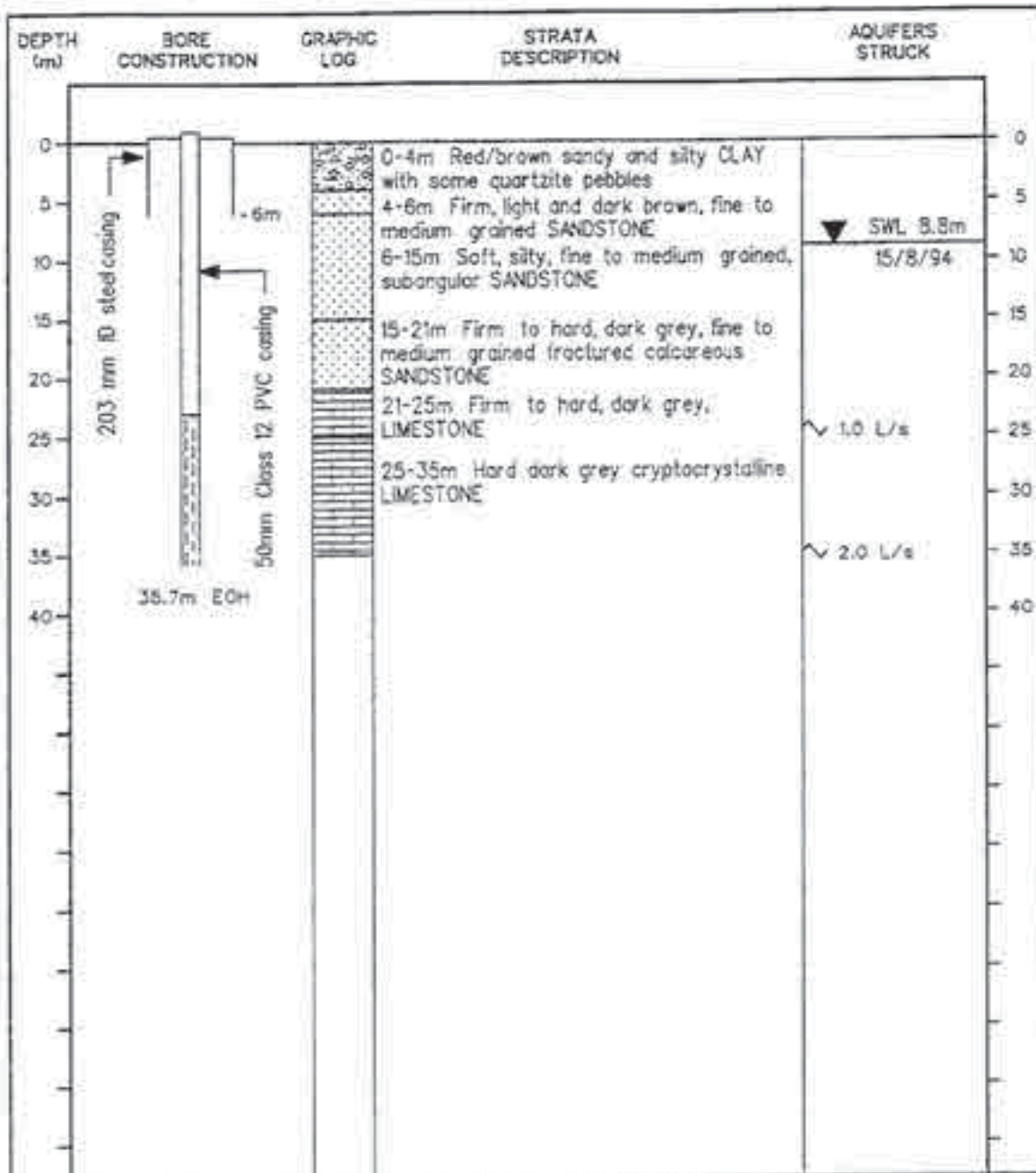
The estimated cost for the investigation is \$ 120 000. WRB has recieved funds to this amount. Actual costs may exceed this, subject to results, and provision of additional funding may need to be sought.

The attached initiation sheet shows a cost of \$78 000. This estimate allows for 6 investigation holes, with two bores being tested. Depending on the success of this stage, production bores will be constructed (if the water is potable or desalinisation/dual supply is proposed) or further drilling will be undertaken south of the gorge entrance. Additional costings will be calculated at this stage.

**POWER
AND
WATER
AUTHORITY**



WATER RESOURCES COMPOSITE LOG OF BORE



DATE DRILLED 15/8/94

GLEN HELEN RESORT

RN 16364

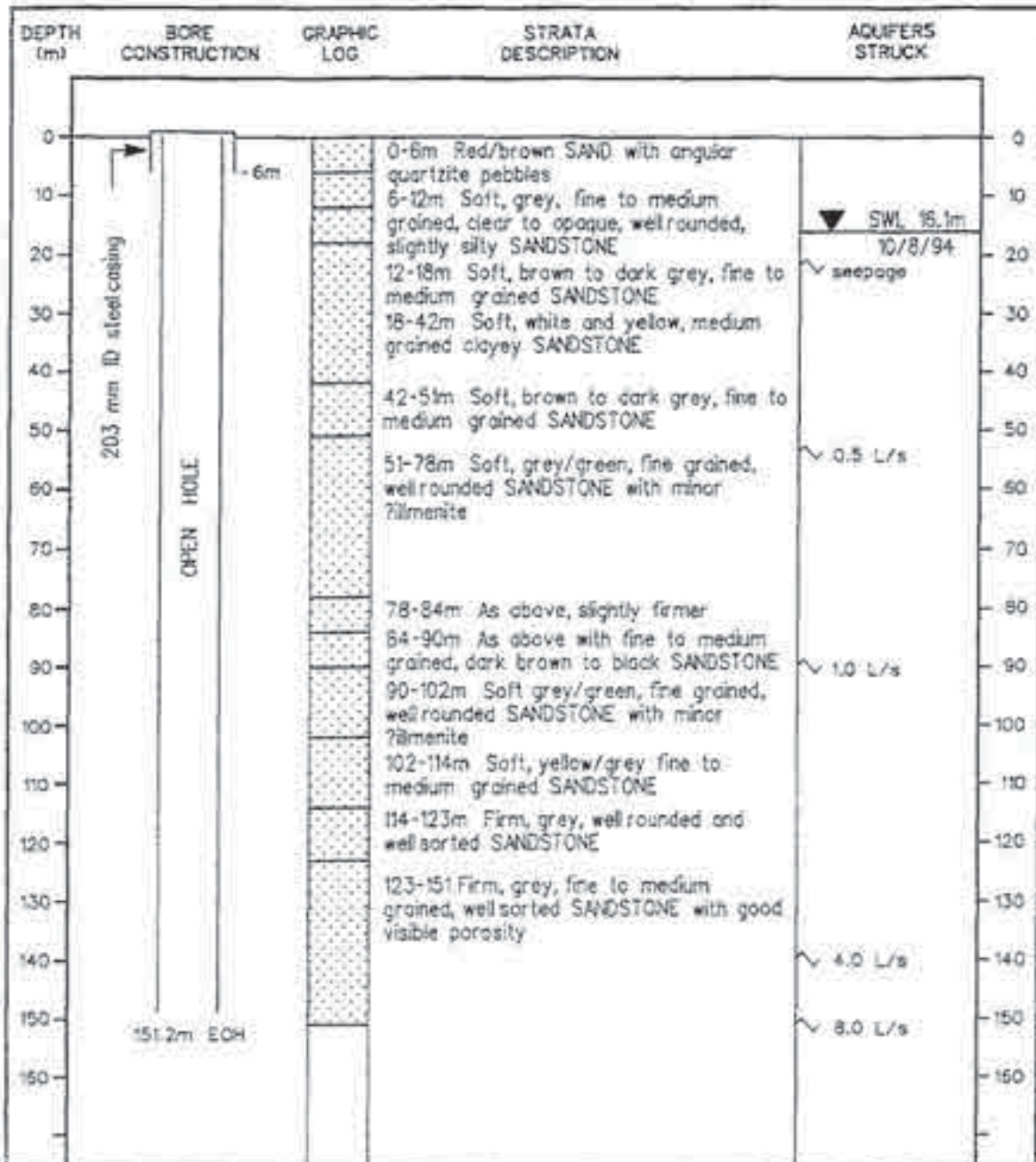
clog-013.dgn
Avia 28/5/96

APPENDIX B

**POWER
AND
WATER
AUTHORITY**



WATER RESOURCES COMPOSITE LOG OF BORE



DATE DRILLED 10/8/94

GLEN HELEN RESORT

RN 16368

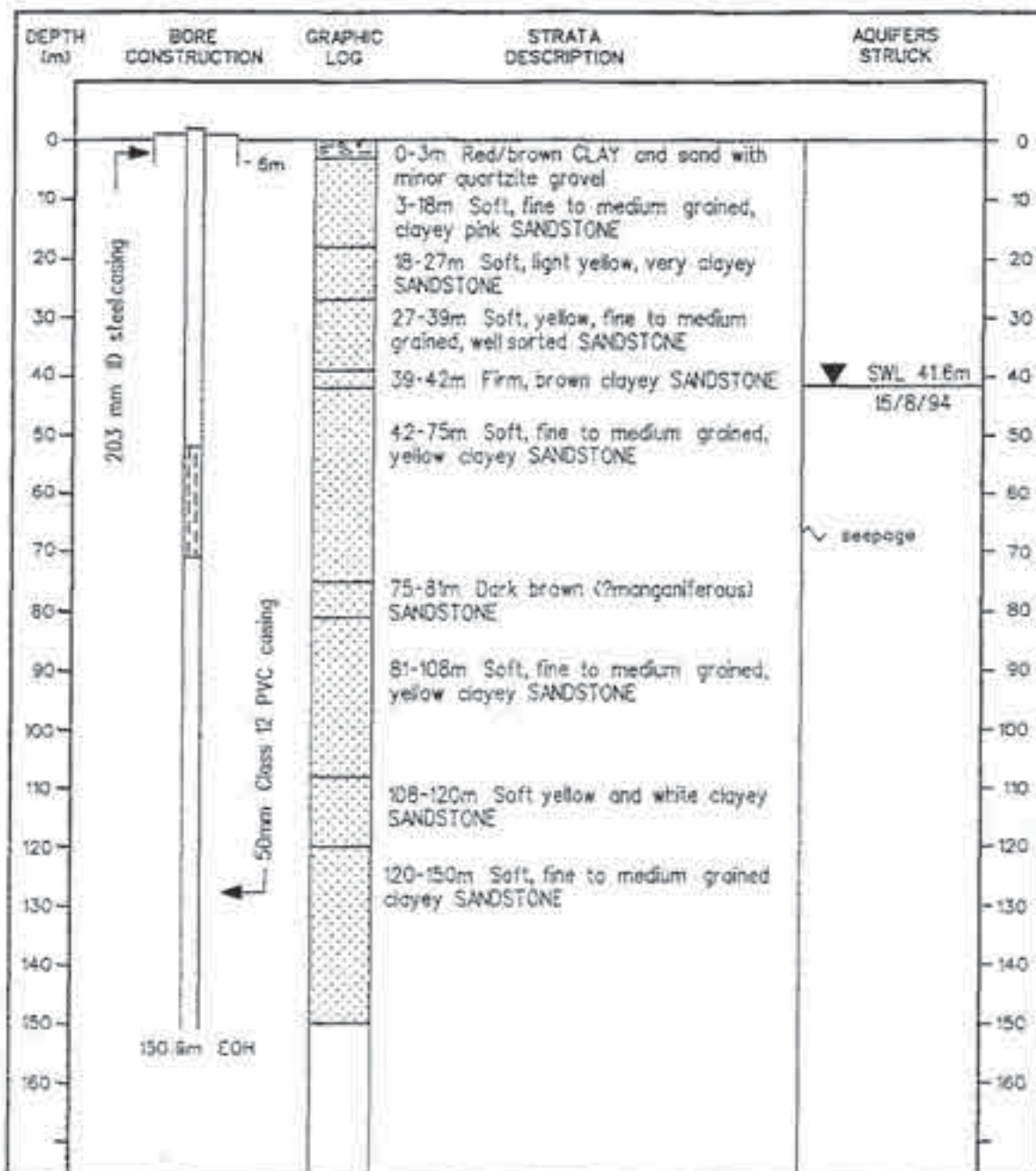
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APPENDIX C

**POWER
AND
WATER
AUTHORITY**



WATER RESOURCES COMPOSITE LOG OF BORE



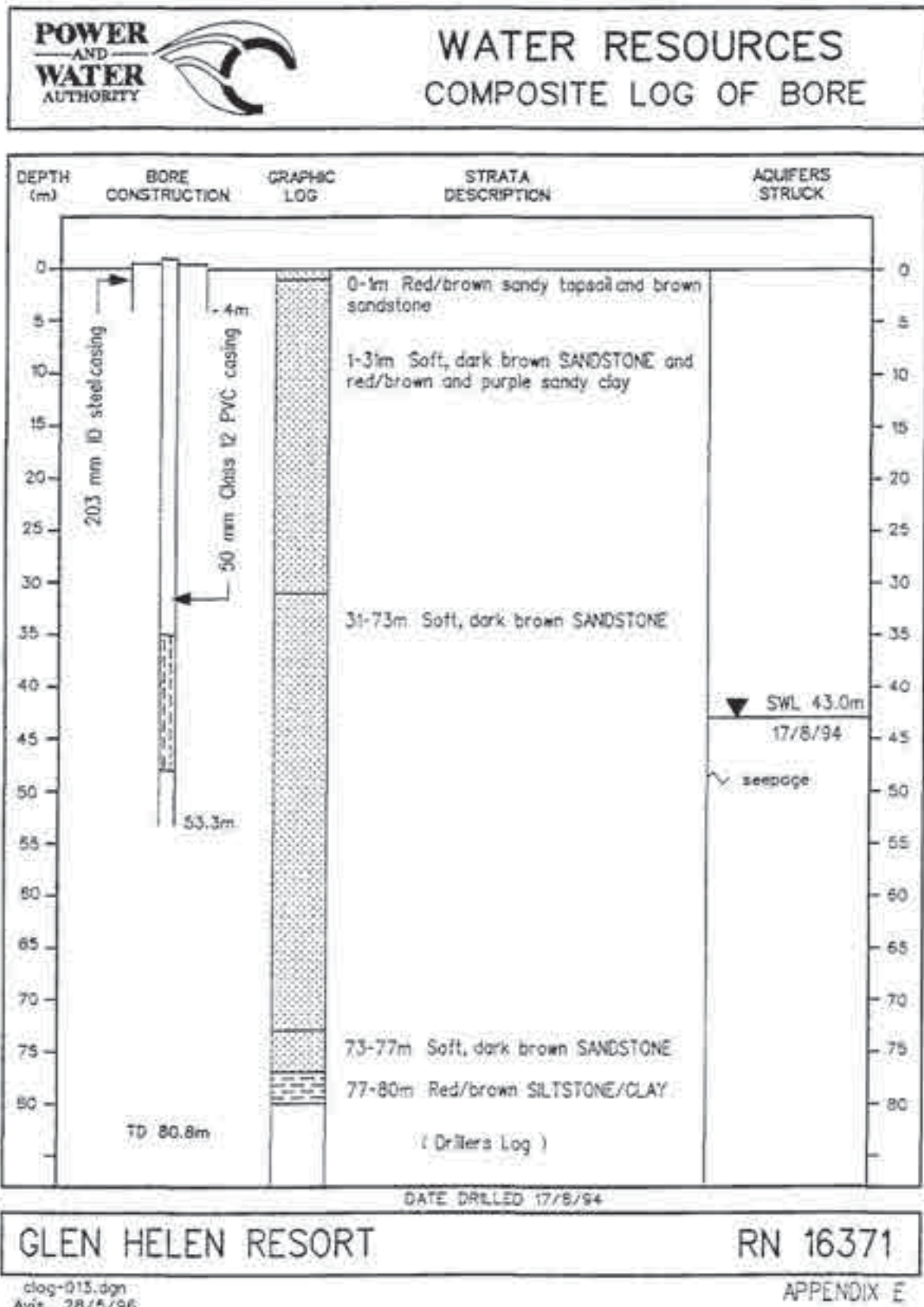
DATE DRILLED 15/8/94

GLEN HELEN RESORT

RN 16370

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APPENDIX D



APPENDIX D

Alice Springs Region Glen Helen Resort Potable Water Pipeline Feasibility Review (NT Department of Infrastructure, 2016)



Alice Springs Region Glen Helen Resort

Potable Water Pipeline Feasibility Review

March 2016

Prepared by:
Gunalan Sivachelvan/
Glen Auricht

NT Department of Infrastructure,
Alice Springs Region

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4. Existing Situation	2
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1. Background

The Northern Territory Department of Infrastructure, Alice Springs (DoI) has been requested by the Department of the Chief Minister (NT) to assist Ngurratjuta / Pmara Ntjarra Aboriginal Corporation investigate the feasibility of constructing a water supply system to convey potable water from existing water bores adjacent to the Glen Helen Resort.

2. Scope

This report provides a high level assessment of two options supplying water to the Resort; and provides preliminary advice on the feasibility of construction, order of costs and any applicable constraints/limitations.

DoI's assessment is based on the following:

- a desktop review of available historical information on previous ground water investigations;
- bore hole logs;
- site visit along the proposed route (undertaken on 9 March 2016);
- Google Maps™ information on the route terrain; to the west and east of the Resort.
- available historical cost data for similar scale of works

3. Site Location

Glen Helen Resort is located on the bank of the Finke River on the northern side of the Glen Helen Gorge, in the Western MacDonnell Ranges Park. Access is via the sealed Namatjira Drive, 130km west of Alice Springs.

It is a long established and popular tourist destination, built on the original, historical Glen Helen station homestead.

There is potential for the site to be developed in to a Holiday park with accommodation cabins.

The site is expected to be developed to provide sufficient overnight accommodation for 100 visitors.

For the purposes of this assessment, a daily water demand of 150 litres/capita/day has been assumed for the site development. The total daily demand is therefore assumed to be 150,000 litres per day.

Figure 1 shows an aerial view of the Glen Helen Resort in its current configuration.



Figure 1: Site Location – Glen Helen Resort

4. Existing Situation

Glen Helen Resort currently operates as a homestead lodge and offers a range of accommodation options ranging from fully furnished motel rooms to powered and unpowered camp sites.

Water supply to the lodge is limited; and is currently through a piped bore (RN 16943) (located approximately 2km east of the Resort), and various low level header tanks situated around the premises. The current storage volume is estimated to be around 30,000 litres. The bore supplies 0.5 l/s and the water quality is poor. The current supply is very low pressure and causes excessive scaling due to high mineral content.

Glen Helen Resort applied for, and was granted a lease for the use of Bore RN 18280; located 17 km to the west of the Resort. The bore is capable of supplying up to 8 l/s at a depth of 90m. The water produced from this bore was transferred via tanker to supplement the Resort's water supply as and when required. The water quality is far superior when compared to other supply sources in the vicinity of the Resort.

At the time of inspection, the bore was not operational, as the submersible pump from the bore had been pulled out for repairs.

From review of desktop information; it appears that various exploratory bores have been drilled in the past around the Resort area, in three distinct geological formations, to find a source of acceptable quality water close to the site. Most have returned poor water quality results and have been abandoned without use.

5. Selection Criteria for Water Supply Systems

The selection of the appropriate water supply system is dependent on various factors and requires evaluation of the following:

- Demand Estimate
- Bore Depth and Flow Rate
- Pump Selection
- Power Supply requirements
- Pipeline Length
- Terrain
- Pipe Size and Material
- Head loss in system
- Minimum Head required for reticulation
- Storage requirements
- Telemetry (Communication System)

In general, an increase in length of supply implies higher system construction costs. This is due to the increased head loss experienced in the system; which in turn requires larger pipe sizes (and associated fittings) to limit losses; higher pump rating and proportionately higher power supply requirements; and increased telemetry costs.

A typical water supply system will include a bore equipped with a submersible pump; suitable power supply; telemetry (to allow remote operation and fault detection); supply pipeline (rising main conveying pumped water), header tank and gravity pipeline feed to the internal reticulated system.

The options assessed in this report are based on provision of a typical water supply system as stated above.

6. Options Assessment

6.1. Option 1 – Water Supply System from Bore RN 18280

This option is based on installation of a new pipeline route and header tank system from existing bore RN 18280 to the Resort.

Existing Northern Territory Government (NTG) Roads bore RN18280 was drilled in 2006 for the construction of the sealed Namatjira Drive west of Glen Helen Resort. This bore is located 17km west of Glen Helen Resort adjacent to the road. This bore was drilled to a depth of 90m and produces 8L/sec. Water quality is acceptable with a conductivity of 1334, and can be considered to be potable. This bore supplies the best quality water of the two options currently being assessed.

GPS recorded a fall in elevation of 40 metres from this bore to Glen Helen Resort. The terrain is undulating with many rocky hill crests and steep creek crossings in valleys; and a direct gravity feed is not viable.

To construct a pipe line to the Resort from this location along the road reserve, would be at considerable cost, and require detailed design. A pipe line route further to the south may offer an alternative to avoid

the peaks and dips, and provide a simpler engineering solution. Aboriginal Areas Protection Authority (AAPA) certificate would however be required.

The proposed equipment, indicative costing, constraints and considerations for Option 1 are summarised in Table 1 below. Photographs 1 to 4 show typical views of the site for Option 1 and bore location.

Table 1 – Estimated Costs: Option 1 – Water Supply System from Bore RN 18280				
Item No.	Item	Indicative Costing	Constraints /Limitations	Considerations
1	Pump system with solar power and back-up generator supply	\$ 50,000	• Long pumping distance; increased power consumption – such a system is estimated to have a power demand of 10kW • Possibility of vandalism	Due to the long distance involved, a specialised pump system is required to meet the duty point (required head and discharge). Lorentz Pumps are specialist pump manufacturers capable of delivering customised solutions and can supply a pump system to meet the system requirements. Being specialised units; any spares may require long lead times, which need to be factored in post construction. Solar Power supply has been included to reduce operating costs.
2	Pipeline – OD 110mm PE PN 12.5 - 17km length @ \$ 80.00/ linear metre	\$ 1,360,000	• Trenching in rocky ground • Pipe Bedding and Embedment material may require to be imported • Sacred sites within pipeline route • Undulating terrain requires many additional fittings – air valves and flushing points • Long distance requires larger pipe size • PE pipes have been known to have issues in freezing temperatures – due to expansion of water during freezing, leading to pipe bursts.	Long length PE PN 12.5 pressure pipes have been considered as most appropriate for the install situation; as these are available in 100m coils, so less jointing; and offer greater flexibility.
3	Header Tank	\$ 30,000	• Naturally level platform providing required head of 12m may be difficult to locate close to Resort. • Additional costs if steel support structure for tank is to be provided	150,000 litre steel panel header tank on a naturally elevated platform and level gravel base with associated fittings to connect to existing reticulation.



Table 1 – Estimated Costs: Option 1 – Water Supply System from Bore RN 18280				
Item No.	Item	Indicative Costing	Constraints /Limitations	Considerations
4	Telemetry	\$ 30,000	- Regular monitoring required by personnel; however some systems have mobile apps or text messaging capabilities - System needs to be compatible with pump system specified	Costs based on a Lorentz pump compatible system.
5	Detailed Design and Route Survey	\$ 100,000		Due to the lengths involved, detailed design by an engineer, including topographic survey of the route and pipeline modelling is recommended.
Estimated Total Costs – Option 1				\$ 1,520,000



PHOTOGRAPH 1: VIEW OF THE NTG ROADS BORE RN18280, LOCATED ADJACENT TO NAMATJIRA DRIVE, 17KM WEST OF GLEN HELEN RESORT (E 247626, N 7384092)



PHOTOGRAPH 2: NAMATJIRA DRIVE CHAINAGE (CH.) 85.7. VIEW OF THE FINKE RIVER CROSSING. THIS RIVER PROVIDES A SUBSTANTIAL OBSTACLE FOR THE CONSTRUCTION OF A PIPE LINE UNDER THE RIVER BED. ANY WORK WOULD REQUIRE AN AAPA AUTHORITY CERTIFICATE BECAUSE OF KNOWN SACRED SITES NEARBY.



PHOTOGRAPH 3: NAMATJIRA DRIVE CH. 88.03. VIEW TO THE SOUTH OF A TYPICAL CREEK CROSSING. THERE ARE MORE THAN 10 OF THESE CREEKS THAT WOULD NEED TO BE TRENCHED FOR A PIPE LINE.



PHOTOGRAPH 4: NAMATJIRA DRIVE CH. 94. TYPICAL VIEW OF TABLE DRAIN AND VERGE. CONSTRUCTING A PIPE LINE ALONG THE ROAD WOULD REQUIRE TRENCHING IN VERY ROCKY SOIL. IMPORTED BEDDING AND PIPE EMBEDMENT MATERIAL WILL BE REQUIRED.



PHOTOGRAPH 5: NAMATJIRA DRIVE CH. 97.98. VIEW OF A LISTED AAPA SACRED SITE ADJACENT TO THE ROAD ON THE SOUTH SIDE.

6.2. Option 2 – Water Supply System from Bore RN 16354

This option is based on installation of a new pipeline route and header tank system from existing bore RN 16354 to the Resort. The bore location is approximately 7km east of the Glen Helen Resort.

The bore site is accessed through a dirt track located at Ch.77.25km, Namatjira Drive, at the western end of a floodway (E 270565, N 7377394). Bore RN16354 is located in the creek bed of the gap, approximately 650m from the start of the dirt track (E 270567, N 7376978).

The bore data sheet states the bore was drilled to a depth of 45m with a supply rate of 1.6 L/sec. Previous bore data indicates a likelihood of 3 to 6 L/sec if this bore site is re-drilled to 120m depth. Conductivity of 2000 is reported in the water from RN16354, which is border line quality, but suitable for Resort irrigation

and ablution. It is to be noted that the water quality from this bore is similar to the currently operational bore supply to the Resort. Desalination of the water through reverse osmosis plant specially developed for small community supplies in remote regions could be considered as a means of improving quality.

Pipeline construction from this bore location would require an AAPA authority certificate, but is proposed to follow the valley floor direct to the Resort, at an estimated distance of 7km. GPS elevation readings indicate a fall in elevation of 40m between the bore site and the Resort. A header tank of similar capacity to Option 1 (150,000 litres), located on a naturally elevated platform close to the Resort, has been considered for gravity feeding the Resort.

The proposed equipment, indicative costing, constraints and considerations for Option 2 are summarised in Table 2 below. Photographs 6 to 8 show typical views of the site for Option 2 and bore location.

Table 2 – Estimated Costs: Option 2 – Water Supply System from Bore RN 16354				
Item No.	Item	Indicative Costing	Constraints /Limitations	Considerations
1	Drill and case new water bore 120m depth including track clearance	\$ 50,000	Current bore RN 16354 screened at a lower depth and its current condition is unknown.	
2	Pump system with solar power and back-up generator supply	\$ 50,000	- Increased bore depth compared to Option 1; similar power demand to Option 1 (10 kW). - Possibility of vandalism - Increased TDS in bore water may reduce equipment life.	As the proposed bore depth for meeting the required flow rate is 120 m; the overall pump duty point for this system is still in a similar range to that of option 1. As such, a specialised pump system is still required to meet the duty point (required head and discharge). Lorentz Pumps are specialist pump manufacturers capable of delivering customised solutions and can supply a pump system to meet the system requirements. Being specialised units; any spares may require long lead times, which need to be factored in post construction.
3	Pipeline – OD 90mm PE PN 12.5 - 7km length @ \$ 68.00/ linear metre	\$ 476,000	- Sacred sites within pipeline route will need to be checked. - Laying pipes in creek bed may lead to pipes being submerged in flood waters. There is a possibility of contamination through any faulty joints or burst pipe, in a negative pressure situation. - PE pipes have been known to have issues in freezing temperatures – due to expansion of water during freezing, leading to pipe bursts.	Long length PE PN 12.5 pressure pipes have been considered as most appropriate for the install situation; as these are available in 100m coils, so less jointing; and offer greater flexibility.

Table 2 – Estimated Costs: Option 2 – Water Supply System from Bore RN 16354				
Item No.	Item	Indicative Costing	Constraints /Limitations	Considerations
4	Header Tank	\$ 30,000	- Naturally level platform providing required head of 12m may be difficult to locate close to Resort. - Additional costs if steel support structure for tank is to be provided	150,000 litre steel panel header tank on a naturally elevated platform and level gravel base with associated fittings to connect to existing reticulation.
5	Telemetry	\$ 30,000	- Regular monitoring required by personnel; however some systems have mobile apps or text messaging capabilities - System needs to be compatible with pump system specified	Costs based on a Lorentz pump compatible system.
6	Desalination Plant	\$ 200,000	- Disposal of Brine Water may require an environmental discharge permit prior to disposal - Ongoing operation and maintenance costs need to be factored in if such a system is installed. - Three phase power supply required to operate plant	This cost is based on a reverse osmosis package plant including brine tanks supplied by Veolia water technologies. All equipment is fitted in to 2 transportable 20ft containers (lockable). This unit is suitable for small community water supplies and relatively easy to install. The system specified is capable of treating water with TDS values of up to 2000 mg/l.
7	Detailed Design and Route Survey	\$ 60,000		A preliminary route assessment / topographical survey including environmental clearance checks will be required. While detailed modelling may not be required; a design check by a competent hydraulics engineer is still recommended.
Estimated Total Costs – Option 2				\$ 896,000



PHOTOGRAPH 6: VIEW OF BORE RN16354 LOCATED IN THE CREEK BED. IT WOULD BE PREFERABLE TO CLEAR A SITE ON THE BANK NEAR THE VEHICLE AND DRILL A NEW BORE TO 120M DEPTH.



PHOTOGRAPH 7: VIEW OF THE TRACK INTO BORE RN16354



PHOTOGRAPH 8: VIEW OF THE TYPICAL TERRAIN AND SOIL TYPE FOR PROPOSED PIPE LINE ROUTE FROM BORE 16354

7. Recommendations

Both options considered are feasible to construct. Option 2, however, is considered to be the more cost effective solution and is recommended for further consideration.

It is to be noted that the current water supply to the Resort is similar to the untreated water quality expected from Bore 16354. If desalination costs are excluded, the order of costs for construction of Option 2 will be \$ 696,000.

The installation of option 2 could be staged to initially construct the water supply system without desalination; and incorporate desalination at a later date.

APPENDIX E

Glen Helen Resort High-Level Environmental Due Diligence Inspection (LES, 2020)





Glen Helen Resort High-Level Environmental Due Diligence Inspection

18/11/2020

Report prepared by

Low Ecological Services P/L
PO Box 3130, Alice Springs, NT 0871
Ph: (08) 89 555 222 Fax: (08) 89 555 722
Email: lowecol@lowecol.com.au
Web: www.lowecol.com.au



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DISCLAIMER

This document has been prepared by Low Ecological Services (LES) for Discovery Parks. LES has prepared this document using the skill and care expected from professional scientists to provide factual and technical information and practicable solutions to identified risks. It does not constitute legal advice.

ACKNOWLEDGEMENTS

Low Ecological acknowledges the following people for information used in this report.

Amy McArdle (Ngurratjuta Aboriginal Corporation), Scott Murdoch (Territory Electrical and Maintenance), Jason Hansen (Pump and Power Alice Springs), and Sherwin Owen (Bullet Plumbing Alice Springs).

DOCUMENT REVISION DETAILS

Date	Revision	Reviewer	Comments
18/11/2020	V0 (DRAFT)	Kristen Grant – Low Ecological Services (LES)	Initial document

EXECUTIVE SUMMARY

Low Ecological Services was engaged by Discovery Parks to do a high-level due diligence environmental inspection of the Glen Helen Lodge site. The site was inspected on 27th October 2020 which included on-site discussions with Amy McArdle, a representative from Ngurratjuta Aboriginal Corporation.

Key areas inspected were:

- Pub and guest/staff accommodation area (including fuel station, grease trap, pool, and wastewater pump station).
- Utilities/maintenance/storage area (including Wastewater treatment system, diesel generators, fuel/chemical storage, and water supply tanks and pump).
- Landfill area.
- Helicopter pad and re-fueling area.
- Effluent irrigation area.
- Groundwater extraction bore area.
- Campground area.

No significant contamination or environmental risks were identified during the site inspection.

Further investigation of some items is required, and several recommendations are included in this report for improvements for ongoing management of the lodge site.

Key items that require further investigation are:

- Investigate condition and integrity of diesel and unleaded underground fuel tanks and pipework. This could also involve auger sampling of soil around the diesel tank.
- Obtain fuel volume accounting records and review/analysis from Ngurratjuta Aboriginal Corporation and review to confirm if any fuel loss has been recorded over time from systems.
- Confirm that the additional vent and old plinth adjacent to the unleaded bowser is not associated with an old decommissioned underground fuel tank.
- Confirm WWTP has adequate capacity for peak sewage load/flows to effectively treat sewage and not overflow to the environment.
- Test cement sheeting cladding on walls in maintenance shed, and sample pieces from landfill for presence of asbestos.

1. INTRODUCTION

Low Ecological Services was engaged by Discovery Parks to do a high-level due diligence environmental inspection of the Glen Helen Lodge site. Discovery Parks are considering purchasing/leasing the Lodge. The purpose of the investigation was to determine what environmental risks are present on the site, to allow Discovery Parks to consider these when making decisions about possible purchase/lease of the lodge.

The site was inspected on 27th October 2020 by environmental consultants Bill Low and Kristen Grant. Amy McArdle, a representative from Ngurratjuta Aboriginal Corporation, acted as a guide and provided information during the site inspection.

1.1. BACKGROUND

The Glen Helen Lodge is located 130 km from Alice Springs, off Namatjira Drive, Alice Springs, NT, within the Tjoritja / West MacDonnell National Park. Glen Helen was a cattle station established in the early 1900s. Several homesteads were built over the years, with the third homestead built on the current site of the Glen Helen Lodge. There was a fire in the 1980s which burnt most of the old homestead/lodge building. The lodge was purchased by the Ngurratjuta Aboriginal Corporation in 1992 and run as camping and fuel and beverages. It was leased out from 1999 to 2006 and then from 2006 to 2018. Ngurratjuta Aboriginal Corporation took back ownership/management of the lodge in 2018 and has run it to the present day. The tenure type of the land parcel (NT Portion 830) which the lodge is on is Freehold. This parcel was created in 1963.

1.2. SCOPE

High level due diligence environmental inspection and report of the Glen Helen Lodge site, including:

- Pub and guest/staff accommodation area (including fuel station, grease trap, pool, and wastewater pump station).
- Utilities/maintenance/storage area (including Wastewater treatment system, diesel generators, fuel/chemical storage, and water supply tanks and pump).
- Landfill area.
- Helicopter pad and re-fueling area.
- Effluent irrigation area.
- Groundwater extraction bore area.
- Campground area.

The above items included in the scope are shown on the labelled location map and site map below.

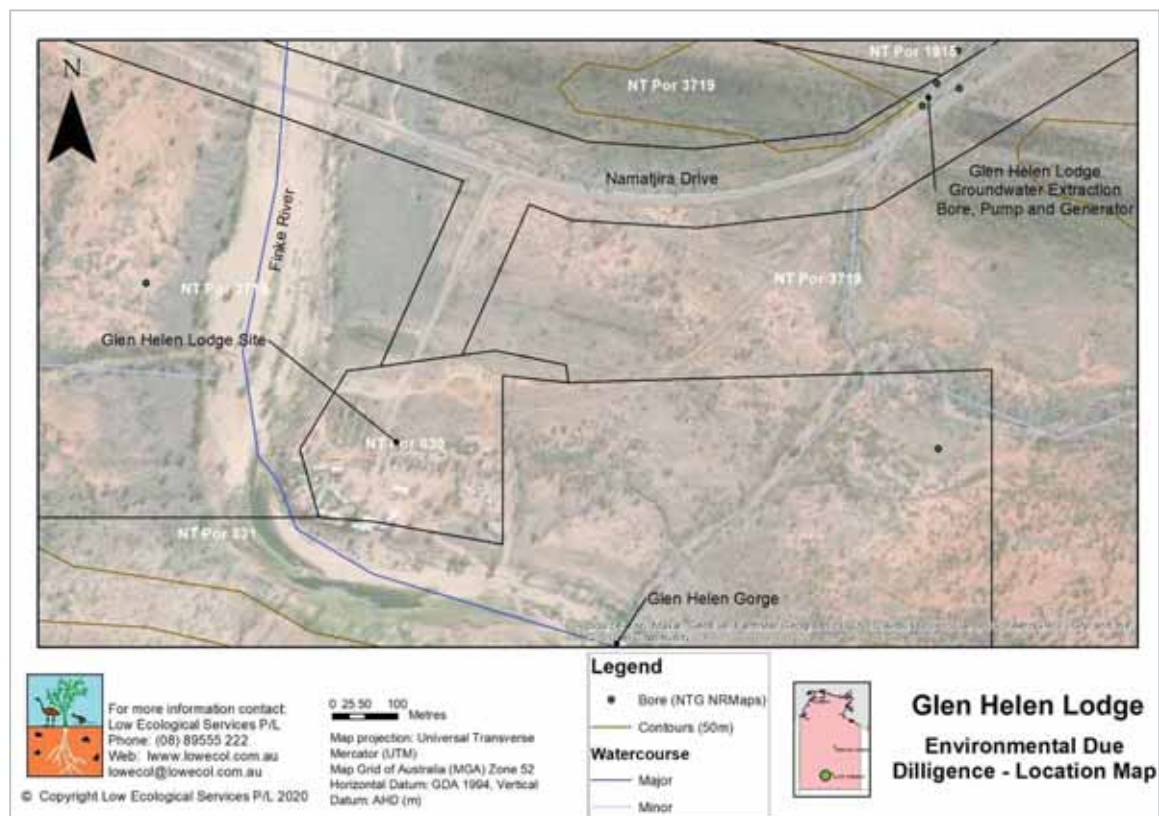


Figure 1: Location Map

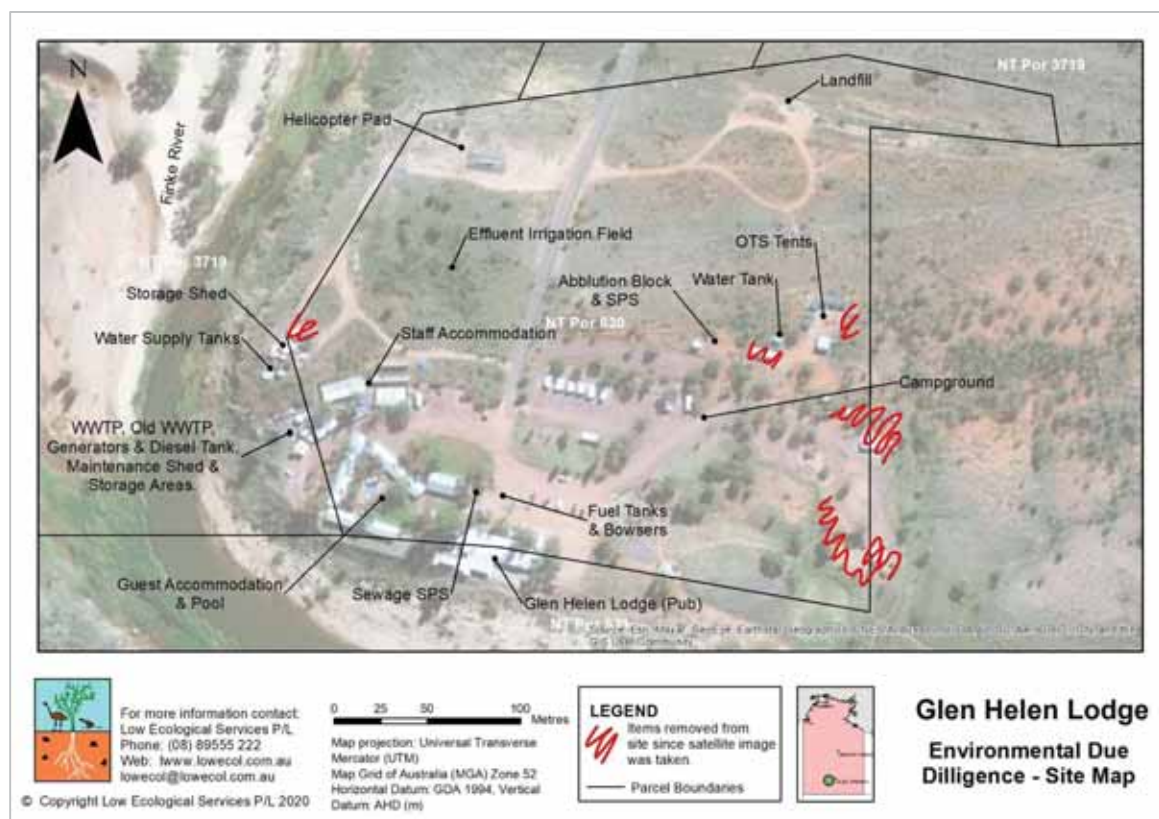


Figure 2: Site Map.

2. METHOD

Limited information was provided by Discovery Parks prior to the site inspection. A desktop review was undertaken to determine history of the site and possible contaminating activities which may have occurred on the site. This involved review of Google Earth satellite images of the site over time, and review of NT Gov NR Maps to understand the topography, geology, parcel boundaries, and bores.

The site inspection was undertaken over one day. Amy McArdle, a representative from Ngurratjuta Aboriginal Corporation, accompanied us during the site inspection, guiding us around the site and providing explanation, information, and history of each area. The site inspection was a visual inspection only.

Following the site inspection, phone discussions were had with Scott Murdoch of Territory Electrical (the fuel station maintenance contractors), Jason Hansen of Pump and Power (diesel generators and pumps maintenance contractors), and Sherwin Owen of Bullet Plumbing (general plumbing, sewage system and local wastewater system maintenance).

3. FINDINGS

Fuel Station

The fuel station consists of two (2) underground fuel storage tanks, two (2) fuel bowzers located on the edge of the gravel carpark. One of the tanks contains diesel and one contains unleaded (Opal) fuel. The diesel tank was thought to be 7000 L, the volume and age of the unleaded tank is unknown and should be confirmed with Amy. Fill points and vents are adjacent to each tank. The unleaded bowser has a small canopy/shade structure over it. The diesel tank age is unknown, however it was in place when Ngurratjuta bought the Lodge in 1992.

No significant contamination was observed from either bowser, tank or fill points. Fuel staining is present on the concrete and soil around the diesel bowser, and no staining was present around fill/dip points. There is likely minor fuel contamination of soil under the bowzers from small customer spillages. There were no other signs of leakage or spillage of fuel observed.

Amy said she was not aware of any leaks or significant spills or issues in the past at this site. Amy said there has been no issues/discrepancies with fuel volume accounting that she is aware of. When fuel sales were occurring the site manager did tank dips and kept records including fuel delivery and sales. Fuel sales and records are all manual, there is no electronic console. Amy said a water test strip/paste kit has been used on site to test for water in fuel tanks, and no issues are known to her.

Recommend that fuel volume accounting records and review/analysis, and water test results are obtained from Ngurratjuta and reviewed.

The fuel system maintenance contractor (Territory Electrical) recalled previous work on the system as follows:

- Diesel – Approximately 15 years ago the pump suction line corroded through, they replaced all the pipework and cleaned out diesel tank. They removed 4-5 inches of sludge from inside the tank which can be an indicator of internal corrosion. External surface corrosion was observed on the top of the tank when they excavating to replace pipework.
- The unleaded pump has been replaced twice, once in 2002, and again in 2012 due to corrosion of the pump frame from irrigation water hitting the pump. Condition of the tank and pipework is unknown, however it is possible buried pipework has also been effected by corrosion from irrigation water in the past.

The diesel tank is old (pre 1992) and is likely in fair/poor condition due to age. Review of fuel volume accounting records may show no major underground leaks have been identified. The diesel tank is a risk due to age and lack of integrity testing, and the proximity to the waterhole and Glen Helen Gorge. Auger sampling could confirm whether fuel contamination exists in the ground here. Replacement with modern tank should be considered to avoid leaks in future. Any new system should consider the flood level, as the current system is below flood level.

Two vents stacks were observed and a possible old fill point in the concrete plinth adjacent to the unleaded tank. Recommend confirming that this additional vent and old plinth is not associated with an old decommissioned underground fuel tank.

Recommend reviewing condition of unleaded pipework in ground.



Photo: Fuel station on edge of gravel carpark.



Photo: Diesel bowser, underground tank, fill and dip points, and vent – Note diesel staining on concrete around bowser.



Photo: Unleaded bowser, fill/dip point, vent, and small canopy – Note two vent pipes and unknown filled opening adjacent to bowser.

Wastewater Treatment System

Wastewater from the site is pumped from two sewage pump stations to a package wastewater treatment plant (WWTP) on the south-west corner of the site. This is a batch process aerated activated sludge treatment plant. Treated effluent is filtered and chlorinated before being pumped to the effluent irrigation area. Waste activated Sludge (WAS) from the plant is stored and removed off-site periodically (3 monthly during normal operation) by JJ Richards.

The two sewage pump stations (SPS) on site appeared in good condition and plumber confirmed they are in good condition internally. One was installed recently and the other re-furbished. Unable to lift the lid of either one during inspection. Both SPSs were pumped out in 2018 when the new WWTP was installed. Large SPS is ~4m deep concrete structure with fiberglass or epoxy lining and sound according to the plumber. The main pump station has heavy duty gatic lids and a tall pipe/stack for ventilation. Both SPSs have local level alarm/light. No contamination or environmental risks identified with these.

A new packaged WWTP was designed and installed in 2018 by MBR Technologies (a division of AKS), adjacent to the old WWTP. This WWTP was not operating during the site inspection as the lodge is currently not operating. No odours were observed from the WWTP. Evidence of past overflows from the WWTP onto the ground and into the control room were observed. Overflows appeared to have originated from the aeration tank and buffer tank, and leakage from the inlet flowmeter. A manually operated submersible pump and pipe is sometimes used to avoid overflows from the system by pumping to another nearby tank. The plumber confirmed that there has been overflows from the WWTP with 2-3 inches of wastewater in the control room on one occasion. The plumber advised that there have been operational problems and some reliability issues with the system and some components. During normal operation of the WWTP he would typically respond to issues including equipment blockages every two weeks. The plumber advised there have been issues with the chlorine dosing system, and during our site inspection it looked as though chlorine was being dosed manually into the filtered effluent tank from a ladder. This is an OHS risk, and also relies on human intervention to ensure correct disinfection of irrigation water. The plumber is of the opinion that some components of the WWTP do not cope with peak sewage flows. Due to the proximity of the WWTP to the Finke River waterhole, significant overflows from the WWTP, if left unchecked, could impact on the waterhole causing temporary contamination. Operation/maintenance is required to ensure this does not happen.

Stockpiled chemicals in 20L containers were stored/stacked inside the control/dosing room rather than in specific bunded storage area.

Downslope from the new WWTP there is a plastic-lined turkey nest dam that was used in the past with the old WWTP as a sludge overflow/storage dam. Dry dark odourless composted biosolids are present in the bottom. This is close to the river/waterhole, however is not a risk now that it is disused. It currently still acts as a drainage/overflow capture for the new WWTP and should be retained for this function.

The effluent irrigation field is located to the north of the WWTP and staff accommodation area. No issues were mentioned about function/performance of the irrigation area. This area is fenced and has good signage. It was not operating at the time of the inspection.

The old redundant WWTP still on the site adjacent to the new one. Refer section of this report on redundant equipment on site.

The following is recommended:

- Confirm WWTP has adequate capacity for peak sewage load/flows to effectively treat sewage and not overflow to the environment. This should include confirmation that system components such as buffer tank are appropriately sized, and system operating levels and alarm levels are appropriate.
- Ongoing operational/maintenance issues with the WWTP are resolved including repair/replacement of the automated chlorine dosing system.
- Stockpiled chemicals should be stored in a specific bunded area.
- The old WWTP should be dismantled and removed from site to unclutter and avoid confusion between old and new equipment, and avoid hazards developing as it deteriorates.

If the treatment system is designed/sized adequately, and is operated/maintained correctly, the risk of wastewater contamination of the Finke River waterholes from wastewater overflows should be low.



Photo: Wastewater Treatment System – Note stormwater diversion drain upslope, and Finke River waterhole behind.



Photo: Inlet pipe and screen into wastewater treatment plant – Note evidence of leakage from inlet flowmeter.



Photo: Old sludge/overflow/storage turkey nest dam – Note thin black plastic liner deteriorated/disintegrating at top of banks. Dry dark odourless composted biosolids present in bottom.



Photo: Evidence of overflow from effluent buffer tank into control/dosing room.



Photo: Chemical storage/stacking in control/dosing room.



Photo: Evidence of effluent overflow onto ground from door of control/dosing room.



Photo: Evidence of effluent overflow onto ground from side of control/dosing room.	Photo: Buffer tank overflow pipe into wheelie bin.
	
Photo: Evidence of wastewater overflow from top of aeration tank.	Photo: Effluent irrigation field – note fenced and signage.

Diesel Powered Generators and Diesel Storage Tank

There are two large generators on site with a ~4,000 L above ground diesel fuel storage tank. Generators are located in a dedicated building with sound insulated doors. The age of the diesel tank is unknown, the current generators were installed in 2018 to replace the existing generators. Both generators appeared in good general condition. The diesel tank was in good condition with no corrosion observed. The building ceiling is cement sheets with plastic joiners and is likely modern cement sheeting rather than asbestos cement sheeting, but this was not confirmed.

Oil/Fuel contaminated soil was observed around the back of the generator building and underneath the above ground diesel tank. Small diesel spillages have obviously occurred in the past during filling of the diesel tank. A catch bucket and temporary IBC bund was under the tank as an attempt to catch spills, but rainfall collects in these. This diesel stained soil under the tank does not extend far on the ground/horizontally, however would have to auger to confirm depth of diesel contamination in soil under diesel tank. Crank case breather hoses currently run onto the ground out the back of the building dripping oil onto the ground. Oil staining is minor and is unlikely to penetrate far into ground.

There is no bunding underneath generators and the building floor drains direct to ground outside. A diesel leak from generator fuel hoses etc could result in a leak onto the ground outside the building.

Waste oil drums/containers, 44-gallon drums, used fuel/oil filters etc from generator maintenance are currently stored out in the weather and are on un-bunded on wooden pallets. Risk of spills, some minor staining of soil here.

The following is recommended:

- Review bunding arrangement for generator building and diesel storage tank to prevent spills/leaks to soil.
- Review filling procedure for diesel storage tank to reduce spills.
- Redirect crank case breather hoses into oil collection containers to collect oil drips.
- Store waste oil and materials from generator maintenance in weatherproof bunded area to reduce risk of spill/leak to soil.
- Redirect and extend generator exhausts to avoid soot deposits on WWTP.



Photo: Above ground diesel storage tank – note stained soil under tank.



Photo: Back of generator building – note small patches of oil stained soil from crank case breather hoses, and 44 gallon drums stored on ground adjacent to building.



Photo: Waste oil, filters, drums etc stored on ground/pallets adjacent to building.



Photo: Catch bucket and bund under diesel tank – note diesel stained soil under.



Photo: Generator building floor drains direct to ground/soil outside.



Photo: Soot from generator exhausts deposited on nearby WWTP.

Landfill

The small informal landfill site is located to the east of the lodge access road, with no fence or locked gate or formal fire break. The landfill has primarily been used for stockpile and/or disposal of hard waste from renovations/building works etc. No significant environmental risks were observed at the landfill site during the inspection.

The landfill utilizes part of an old trench dug out in this area years ago for possible extraction of clean fill for lodge area. Renovation waste mainly in this trench – not a significant quantity. There is a small quantity of cement sheeting in the renovation waste which may be asbestos sheeting, however tests would be required to confirm this. The area adjacent to the current section of the open trench looks to be previously filled and covered, not an extensive area and no odours were observed in this area.

A small square pit was excavated in 2018 into clean undisturbed native soil for use as a rubbish pit. There is mostly scrap metal in this pit and stockpiled around it. All general garbage was transported off-site for disposal at the Ormiston Landfill up until July 2020 when the disposal agreement with NT Parks expired. As a temporary measure, general garbage has since been disposed in the landfill area on site and burnt in this pit. Cans and bottles etc are taken to Alice Springs for recycling. Waste oil etc is taken to Alice Springs for recycling/disposal.

17 tyres were visible at the landfill, and it is likely there are an additional 10 or so tyres buried under the renovation rubble. There is a mix of truck/bus and car tyres.

Ngurratjuta Aboriginal Corporation plan for all the material stockpiled at the landfill to be carted and disposed in Alice Springs. Recommend test cement sheeting and manage appropriately.

Recommend that if this landfill is continued to be used into the future it should be formalized and a management plan implemented to ensure good practice operation/management.



Photo: 2018 pit used for hard rubbish and more recently general garbage placed in here and burnt.



Photo: Current part of trench – note tyres under renovation rubble. Small quantity of pieces of cement sheet (possible ACM).



Photo: Current part of trench in foreground and previously filled/covered small area behind. This is mostly tiles and concrete rubble.



Photo: 2018 pit used for hard rubbish and more recently general garbage placed in here and burnt. Mostly scrap metal remains.



Photo: Scrap metal stockpiled on the site.



Photo: 2018 pit used for hard rubbish and more recently general garbage placed in here and burnt.

Maintenance areas and chemical storage

No contamination was identified in maintenance areas. The main maintenance shed has internal wall cladding which is likely Asbestos Cement Sheetting, which is broken in several areas. Broken ceiling cladding was more modern and unlikely to be asbestos cement sheetting. Chemicals and fuel stored in this shed are in un-bunded area on porous floor and not in cabinets. Recommend general review of chemical storage. Recommend test wall cladding and manage accordingly.



Photo: Main storage shed – wall cladding likely asbestos cement sheetting.



Photo: Broken/damaged wall cladding.



Photo: Chemical/flammables stored in maintenance shed on floor and shelf.

Photo: Material storage area – note 44-gallon drum of fuel/oil and 20 L drum of waste oil.

Water Supply bores(s)

No significant contamination or issues identified. Diesel powered generator powers electric submersible bore pump in one bore (RN 016944). Generator is located on a concrete plinth with a corrugated iron roof over, within a security fence and locked gate compound. A new diesel motor was recently installed and a larger fuel tank (~80L). Localised contamination of soil from oil/diesel spillages is present around the generator plinth, however staining doesn't extend far from plinth. This is likely from maintenance activities (oil changes) and small spillage from re-fuelling the diesel tank. Soil contamination is unlikely to extend far, but would need to auger to confirm depth. A container of waste oil is stored on the ground inside the compound. 80L diesel tank and generator are not bunded

and are located adjacent to an ephemeral creek. Recommend avoid storage of waste oil here and a review of bunding in case of diesel leak/spills.

The production bore is located ~50m NW of generator shelter, within a covered pit on the side of the road. The top of the bore casing is under the pit lid, and the pit looks to be in a minor surface water drainage ditch. To avoid ingress of surface water into the bore casing (and possible contaminants) it is good practice to have the top of casing 0.5m above ground level. The arrangement of the bore casing under the lid was not inspected. Recommend review of arrangement under pit lid to ensure risk of contaminant entry is acceptable, and amend arrangement as appropriate.

A dud/capped bore is located immediately adjacent to the generator plinth in the area of oil stained soil, recommend checking that this bore is adequately sealed to avoid contamination entry. Electrical cable from generator to pump appears to be direct buried rather than in a conduit – not to standard.



Photo: Bore pump diesel generator in locked enclosure.



Photo: Production bore in pit adjacent to road upslope from generator (Photo-Google)



Photo: Generator plinth and diesel tank – note localised oil/diesel staining on and around plinth.



Photo: Dud/capped bore.

Water Supply System

No significant contamination or environmental issues identified. Bore water is stored in three tanks on the site and distributed via pressure pumps through a pipe network around the site. Bore water is not treated. Bacteriological samples are sent off for analysis periodically. It was noted that there are many pipes around the site and both a water supply system and recycled water (effluent) system.

Some of the recycled water pipes are coloured purple or have some purple spray paint on them. If colours and labels are not clear, there is a risk of mistakes and possible cross connections between the two systems in the future. Recommend pipes are all properly coloured and labelled and site plans are maintained of pipe networks to reduce this risk.

Swimming Pool - Chemical storage and backflush

No contamination or significant issues identified. Chemical storage is untidy and on flat concrete floor slab in small filter shed, not stored in bunded area or cabinet. Some evidence of water leakage from filter at some stage. Backflush goes into small poly-tank adjacent and flows from hose directly onto nearby garden bed. Recommend review pool chemical storage arrangement and backflush arrangement.

Decommissioned/Redundant equipment

Two Items were noted on the site. Concrete infilled lid openings from what is likely an old septic tank located west of the grease trap between the pub and the southernmost guest accommodation wing. The old redundant wastewater treatment system located adjacent to the current operating wastewater treatment system. This redundant system contributes to congestion and may cause confusion between new and old system. Recommend that the redundant wastewater treatment system is dismantled and disposed off-site, and is checked and monitored until it is removed from site to ensure it doesn't become a hazard as it deteriorates.



Photo: Concrete filled lid openings, possible old septic tank.



Photo: Old wastewater treatment system. Also several tanks.



Photo: Old wastewater treatment system - Note liquid still in chemical dosing tank.

Grease Traps

No issues identified. Grease trap is present on discharge of lodge where commercial kitchen is located. Was pumped out recently ~2 months ago by JJ Richards. The grease trap was installed/replaced 6-7 years ago and according to plumber is in good condition. The cover was not lifted, and internals not inspected during this site inspection as no lid lifter was available.

An area of grease/oil stained rocks/building rubble was observed near the back of the pub. This is where cleaners have thrown dirty kitchen floor mop water with cooking oil residue. Not a contamination issue but suggest change this practice.



Photo: Grease trap cover.



Photo: Cooking oil residue staining on rocks.

Helicopter pad and re-fueling area

No contamination was observed in this area. The area is clean and consists of a crushed rock pad and small tin shed for storage. No fuel or oil was present at the time of the inspection. There is no permanently installed bunded area for fuel or oil storage. Fuel drums are currently stored on the

ground and wheeled out to re-fuel helicopter. Recommend review of process and possible bunded tank or drum area in future.



Photo: Helicopter pad area.



Photo: Small storage shed and wind sock.

Weeds

No significant infestations of weeds were observed. Buffel grass is present and should continue to be managed to reduce fire risk around campground and buildings.

4. CONCLUSIONS

No significant contamination or environmental risks were identified during the site inspection. Further investigation of some items is required, and several recommendations are included in this report for improvements for ongoing management of the lodge site.

Key items that require further investigation are:

- Investigate condition and integrity of diesel and unleaded underground fuel tanks and pipework. This could also involve auger sampling of soil around the diesel tank.
- Obtain fuel volume accounting records and review/analysis from Ngurratjuta Aboriginal Corporation and review to confirm if any fuel loss has been recorded over time from systems.
- Confirm that the additional vent and old plinth adjacent to the unleaded bowser is not associated with an old decommissioned underground fuel tank.
- Confirm WWTP has adequate capacity for peak sewage load/flows to effectively treat sewage and not overflow to the environment.

5. REFERENCES

Google Earth Pro, Imagery accessed 20/10/2020.

Northern Territory Government (2020), NR Maps, Department of Environment and Natural Resources: Northern Territory, Australia. Accessed online 20/10/2020, <https://nrmaps.nt.gov.au/nrmaps.html>

APPENDIX F

Alice Springs Town Council Soil Classification Analysis for General Fill Disposal Report (LES, September 2021)





Alice Springs Town Council Soil Classification Analysis for General Fill Disposal Report

28/09/2021

Report prepared by Low Ecological Services P/L

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DISCLAIMER

This document has been prepared by Low Ecological Services (LES) for Ngurratjuta/Pmara Ntjarra Aboriginal Corporation (Ngurratjuta) to be presented to Alice Springs Town Council. LES has prepared this document using the skill and care expected from professional scientists to provide factual and technical information and reasonable solutions to identified risks. It does not constitute legal advice.

DOCUMENT REVISION DETAILS

Date	Revision	Reviewer	Comments
13/09/2021	Draft_01	Katelyn Douglass (Author)	Initial Document (Author)

1. INTRODUCTION

Low Ecological Services (LES) was engaged by Territory Electrical on behalf of Ngurratjuta to undertake sampling and testing of the soil located in storage pods at the Alice Springs Indervon Petroleum storage yard. The soil originates from Glen Helen Lodge where a fuel leak occurred. Ngurratjuta would like to dispose of the low level contaminated/exposed soil at Alice Springs Regional Waste Management Facility. The soil was sampled and tested as directed by the *Alice Springs Town Council Landfill General Fill Classification and Disposal Method* document prepared by Tierra Environment.

1.1. SCOPE OF WORK

To investigate the excavated soil originating from Glen Helen that is currently awaiting disposal to determine if it meets the criteria to be classified as general fill.

- Collect soil samples at various depths from each storage pod.
- Test all soil samples on-site for the presence of fuel vapours using a portable photo ionisation detector (PID);
- Select representative soil samples based on having low PID vapour concentrations and low fuel contamination history. This includes, 5 homogenous soil samples from the petrol pit soil storage pods and another 7 homogenous soil samples from the diesel pit soil storage pods.
- Have the representative soil samples analysed by ALS laboratories.
- Analyse two representative samples for Suite 1 (VIC EPA 448.3), one from the diesel soil and one from the petrol soil as outlined in Tierra's General Fill Classification document and the rest for (Contaminants of concern (COC)) as agreed upon by a ASTC representative.
- Collect Intra and Inter Laboratory duplicates of a sample and analyse them for Suite 1 analytes.
- Compare results to the proposed "acceptable threshold" criteria
- Assess quality assurance and quality control results

*Note Suite 2 was not used as it is not relevant to these samples. Rather the known contaminants of concern where focused upon, this includes TRH/TPH, BTEXN, Heavy metals and PAH for two representative diesel samples.

2. SAMPLING DETAILS

Sample collection and preservation was completed in accordance to the method outlined by Tierra Environment. There was 15m³ of stockpiled homogenous soil from the diesel pit where 7 samples were taken. And there was 7.5m³ of stockpiled homogenous soil from the petrol pit where 5 samples were taken. Furthermore, sampling was undertaken based on the requirements of AS4482.1 Parts 1 and 2 ensuring that volatile contaminants are retained within the sample for laboratory analysis.

Table 1 - Methods of Investigation

Media Sampled	Soil samples from the storage IBC's and pods at depth from homogenous soil.
Field Observations	- Odour, colour, and consistency of each sample. - Photographs of the site and sample material.
Transport & Storage	Samples were placed in clean and Teflon sealed jars. Samples were chilled, transported to Alice Springs and sent via courier to ALS Sydney/Melbourne and Eurofins Sydney, all within recommended holding times.
Analytical Methods	- All soil samples were tested on-site for the presence of fuel vapours using a portable PID instrument. - Samples were analysed for Suite 1 (Full VIC EPA general fill Suite) and Suite 2 Contaminants of Concern (COC) including TRH/TPH, BTEXN, PAH, Heavy metals by ALS Laboratory and Eurofins Laboratory.

3. RESULTS VS CRITERIA

Alice Springs Town Council Landfill General Fill Classification guidelines prepared by Tierra Environment of the “acceptable threshold” criteria based on SA EPA and EPA Victoria documents is presented in the table below.

Table 2 – General Fill “Acceptable Threshold” Criteria

Chemical Species	Max Dry Weight Chemical Concentration (mg/kg)	Chemical Species	Max Dry Weight Chemical Concentration (mg/kg)
Inorganic Species		Organic Species	
Arsenic	20	Phenols (halogenated)	1
Barium	300	Phenols (non- halogenated)	60
Beryllium	20	Benzene	1
Cadmium	3	Ethylbenzene	3.1
Chromium III	400	Toluene	1.4
Chromium VI	1	Xylene	14
Cobalt	170	PAH	5
Copper	60	Benzo(a)pyrene	1
Lead	300	C5-C9 petroleum hydrocarbon	65
Manganese	500	>C9 petroleum hydrocarbon	1,000
Mercury	1	PCB	2
Molybdenum	40	Chlorinated Hydrocarbons	1
Nickel	60	Aldrin + Dieldrin	2
Tin	50	Heptachlor	2
Selenium	10	Chlordane	2
Silver	10	DDT	2
Zinc	200		
Fluoride	450		
Cyanide	50		

The above table contains proposed “acceptable threshold” criteria. The table should be referred to the NT EPA for final consideration and acceptance of chemical substances and criteria.

3.1. SUMMARY TABLES OF OBTAINED RESULTS COMPARED AGAINST RELEVANT CRITERIA

Suite 1 was analysed under the ALS analysis suite IWRG621 (previously known as VIC EPA 448.3) – Soil Hazard Categorisation & Management (including Ultra Trace organics to meet low level ‘fill criteria’).

The acceptable threshold criteria is outlined in the orange shaded column. The Green samples represent the homogenous samples obtained from the Glen Helen petrol fuel pit. Red samples represent the diesel samples obtained from the Glen Helen diesel fuel pit

Table 3 - Summary laboratory analysis results table for Suite 1

Analyte grouping /Analyte	Unit	LOR	Acceptable Threshold	Sample ID			
				Petrol: P5 (6+10)	Diesel: B10 +B3 +B9	INTRA – LAB QC01	INTER – LAB QC02
Average PID Reading	ppm	0.1	-	4.3	6.8	-	-
Moisture Content	%	1	-	3.8	4.8	3.9	2.7
pH	pH Unit	0.1	-	7.9	7.9	8.0	7.7
Arsenic	mg/kg	5	20	<5	<5	<5	2.1
Cadmium	mg/kg	1	3	<1	<1	<1	< 0.4
Chromium	mg/kg	2	400	----	----	----	18
Copper	mg/kg	5	60	11	11	13	12
Lead	mg/kg	5	300	12	18	13	14
Molybdenum	mg/kg	2	40	<2	<2	<2	< 5
Nickel	mg/kg	2	60	9	9	10	10
Selenium	mg/kg	5	10	<5	<5	<5	< 2
Silver	mg/kg	2	10	<2	<2	<2	< 2
Tin	mg/kg	5	50	<5	<5	<5	< 10
Zinc	mg/kg	5	200	30	29	32	34
Mercury	mg/kg	0.1	1	<0.1	<0.1	<0.1	< 0.1
Hexavalent Chromium	mg/kg	0.5	1	<0.5	<0.5	<0.5	< 1
Total Cyanide	mg/kg	1	50	<1	<1	<1	< 1
Fluoride	mg/kg	40	450	320	310	320	120
C6 - C9 Fraction	mg/kg	10	65	<10	<10	<10	< 20
C10 - C14 Fraction	mg/kg	50	1000	<50	<50	<50	< 20
C15 - C28 Fraction	mg/kg	100	1000	<100	720	<100	< 50
C29 - C36 Fraction	mg/kg	100	1000	<100	<100	<100	< 50
C10 - C36 Fraction (sum)	mg/kg	50	1000	<50	720	<50	< 50
C6 - C10 Fraction	mg/kg	10	65	-	-	-	< 20
C6 - C10 Fraction minus BTEX (F1)	mg/kg	10	65	<10	<10	<10	< 20
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50	1000	<50	180	<50	< 50
>C16 - C34 Fraction (F3)	mg/kg	100	1000	<100	570	<100	< 100
>C34 - C40 Fraction (F4)	mg/kg	100	1000	<100	<100	<100	< 100

Analyte grouping /Analyte	Unit	LOR	Acceptable Threshold	Sample ID			
				Petrol: P5 (6+10)	Diesel: B10 +B3 +B9	INTRA – LAB QC01	INTER – LAB QC02
>C10 - C40 Fraction (sum)	mg/kg	50	1000	<50	750	<50	< 100
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50	1000	<50	180	<50	< 50
Benzene	mg/kg	0.2	1	<0.2	<0.2	<0.2	< 0.1
Toluene	mg/kg	0.5	1.4	<0.5	<0.5	<0.5	< 0.1
Ethylbenzene	mg/kg	0.5	3.1	<0.5	<0.5	<0.5	< 0.1
meta- & para-Xylene	mg/kg	0.5	-	<0.5	<0.5	<0.5	< 0.2
Styrene	mg/kg	0.5	-	<0.5	<0.5	<0.5	< 0.5
ortho-Xylene	mg/kg	0.5	-	<0.5	<0.5	<0.5	< 0.1
Total Xylenes	mg/kg	0.5	14	<0.2	<0.2	<0.2	< 0.3
Sum of monocyclic aromatic hydrocarbons	mg/kg	0.2	-	<0.5	<0.5	<0.5	< 0.5
Naphthalene	mg/kg	1	-	<1	<1	<1	< 0.5
Sum of organochlorine pesticides	mg/kg	0.03	-	<0.03	<0.03	<0.03	< 0.1
Sum of Aldrin + Dieldrin	mg/kg	0.03	2	<0.03	<0.03	<0.03	< 0.05
Sum of DDD + DDE + DDT	mg/kg	0.05	2	<0.05	<0.05	<0.05	< 0.05
Chlordane	mg/kg	0.03	2	<0.03	<0.03	<0.03	< 0.1
Sum of other organochlorine pesticides	mg/kg	0.03	-	<0.03	<0.03	<0.03	< 0.1
Sum of polycyclic aromatic hydrocarbons	mg/kg	0.5	5	<0.5	<0.5	<0.5	<0.5
Sum of Phenols (halogenated)	mg/kg	0.03	1	<0.03	<0.03	<0.03	< 1
Sum of Phenols (non-halogenated)	mg/kg	1	60	<1	<1	<1	< 20
Sum of volatile chlorinated hydrocarbons	mg/kg	0.01	1	<0.01	<0.01	<0.01	< 0.5
Sum of other chlorinated hydrocarbons	mg/kg	0.01	1	<0.01	<0.01	<0.01	< 0.5
Total Polychlorinated biphenyls (PCB)	mg/kg	0.1	2	<0.1	<0.1	<0.1	< 0.1

Suite 2 was not analysed as it was not applicable to these samples. Rather, the contaminants of concern were focused upon which included TRH/TPH, BTEXN, PAH and heavy metals analysis. This method adjustment was agreed upon by an Alice Springs Town Council Representative.

Table 4 - Summary laboratory analysis results table for Contaminants of Concern (TRH/TPH, BTEXN, PAH and heavy metals).

Analyte grouping /Analyte	Unit	LOR	Acceptable Threshold	Sample ID									
				P5 (2+7)	P5 (1+5)	P5 (9+4)	P5 (3+8)	B11 +B8	B4 + B7	B1 + B5	B2 + B6	D5 + D2	D7 + D8
PID Reading (Non-Lab Field Measurement)													
PID Vapour Reading	ppm	0.1	-	2.9	2.1	2.6	4.1	8.6	4.9	10	8.5	7.6	13.3
Moisture Content	%	1	-	3.4	3.2	3.0	3.5	----	2.9	4.2	3.3	----	3.5
Arsenic	mg/kg	5	20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cadmium	mg/kg	1	3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium	mg/kg	2	400	16	16	17	16	13	13	17	16	16	17
Copper	mg/kg	5	60	12	12	13	13	10	10	13	31	11	13
Lead	mg/kg	5	300	17	11	7	8	13	13	10	12	12	9
Nickel	mg/kg	2	60	9	9	10	11	8	8	10	10	9	10
Zinc	mg/kg	5	200	30	31	26	28	25	24	28	26	27	28
Mercury	mg/kg	0.1	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C6 - C10 Fraction	mg/kg	10	65	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
C6 - C10 Fraction minus BTEX (F1)	mg/kg	10	65	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50	1000	<50	<50	<50	<50	220	<50	130	150	110	50
>C16 - C34 Fraction (F3)	mg/kg	100	1000	<100	<100	<100	<100	830	<100	480	640	520	230
>C34 - C40 Fraction (F4)	mg/kg	100	1000	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100

Soil Classification Analysis for General Fill Disposal

Analyte grouping /Analyte	Unit	LOR	Acceptable Threshold	Sample ID									
				P5 (2+7)	P5 (1+5)	P5 (9+4)	P5 (3+8)	B11 +B8	B4 + B7	B1 + B5	B2 + B6	D5 + D2	D7 + D8
>C10 - C40 Fraction (sum)	mg/kg	50	1000	<50	<50	<50	<50	1050	<50	610	790	630	280
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50	1000	<50	<50	<50	<50	220	<50	130	150	110	50
Benzene	mg/kg	0.2	1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	0.5	1.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	0.5	3.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	mg/kg	0.5	14	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	mg/kg	0.5	14	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Xylenes	mg/kg	0.5	14	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sum of BTEX	mg/kg	0.2	19.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	mg/kg	1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum of PAH	mg/kg	0.5	5	-	-	-	-	<0.5	-	-	-	<0.5	-

The yellow highlighted result of 1050mg/kg for TRH >C10 - C40 Fraction (sum) in diesel sample **B11 + B8** is the only value to exceed the “acceptable threshold” criteria.

The ALS certificates of analysis for the soil samples is provided in Appendix B.

3.2. ASSESSMENT METHOD

Below is the primary sample results as presented in Section 2.8.1 for the TRH results for the diesel homogenous samples. All other results above LOR were well below the acceptable threshold criteria and relatively consistent.

- The mean result of the diesel samples TRH >C10 - C40 Fraction (sum) is 587.14 mg/kg
- The 95% Confidence Level is 587 ± 238 mg/kg. With 95% confidence the population mean is between 349 mg/kg and 825 mg/kg based on only 7 samples. The 95% UCL estimation of the mean (825mg/kg) does not exceed the maximum total dry weight concentration Criteria of 1000mg/kg.
- The Standard Deviation of the diesel samples is 321.457, it is less than 50% of the maximum total dry weight concentration criteria of 1000.
- The maximum of the diesel samples is 1050, which is 105% of the maximum total dry weight concentration criteria. (This is less than 250% of the maximum total dry weight concentration criteria)

4. QUALITY ASSURANCE / QUALITY CONTROL

Table 5 and Table 6 present the relative percentage difference (RPD) for field duplicate samples. Overall, the quality control (QC) results were deemed to be acceptable

QC acceptance criteria are adopted from the acceptance criteria used by Tierra environment are as follows:

- Results <10 times the LOR: RPD must lie between 0 – 80%
- Results between 10 – 30 times the LOR: RPD must lie between 0 – 50%
- Results >30 times the LOR: RPD must lie between 0 – 30%

4.1. SUMMARY TABLE OF OBTAINED QUALITY DATA WITH ASSESSMENT

Table 5 - Intra-Laboratory Duplicate Results:

Analyte grouping/Analyte	Units	LOR	P5 (6+10)	QC01	RPD (%)	Acceptance Criteria
Moisture Content	%	1	3.8	3.9	2.60	Pass
pH	pH Unit	0.1	7.9	8	1.26	Pass
Arsenic	mg/kg	5	<5	<5	-	Pass
Cadmium	mg/kg	1	<1	<1	-	Pass
Chromium	mg/kg	2	----	----	-	Pass
Copper	mg/kg	5	11	13	16.67	Pass
Lead	mg/kg	5	12	13	8.00	Pass
Molybdenum	mg/kg	2	<2	<2	-	Pass
Nickel	mg/kg	2	9	10	10.53	Pass
Selenium	mg/kg	5	<5	<5	-	Pass
Silver	mg/kg	2	<2	<2	-	Pass
Tin	mg/kg	5	<5	<5	-	Pass
Zinc	mg/kg	5	30	32	6.45	Pass
Mercury	mg/kg	0.1	<0.1	<0.1	-	Pass
Hexavalent Chromium	mg/kg	0.5	<0.5	<0.5	-	Pass
Total Cyanide	mg/kg	1	<1	<1	-	Pass
Fluoride	mg/kg	40	320	320	0	Pass

The relative percentage difference of the duplicate results analysed within the ALS laboratory are all <10 times the LOR and lie between 0 – 80%. This passes the quality control acceptance criteria.

Table 6 - Inter-Laboratory Duplicate Results:

Analyte grouping/Analyte	Units	ALS LOR	P5 (6+10)	Eurofins LOR	QC02	RPD (%)	Acceptance Criteria
Moisture Content	%	1	3.8	1	2.7	33.8	Pass
pH	pH Unit	0.1	7.9	0.1	7.7	2.6	Pass
Arsenic	mg/kg	5	<5	2	2.1	-	Pass
Cadmium	mg/kg	1	<1	< 0.4	< 0.4	-	Pass
Chromium	mg/kg	2	----	5	18	-	Pass
Copper	mg/kg	5	11	5	12	8.7	Pass
Lead	mg/kg	5	12	5	14	15.4	Pass
Molybdenum	mg/kg	2	<2	< 5	< 5	-	Pass
Nickel	mg/kg	2	9	5	10	10.5	Pass
Selenium	mg/kg	5	<5	< 2	< 2	-	Pass
Silver	mg/kg	2	<2	< 2	< 2	-	Pass
Tin	mg/kg	5	<5	< 10	< 10	-	Pass
Zinc	mg/kg	5	30	5	34	12.5	Pass
Mercury	mg/kg	0.1	<0.1	< 0.1	< 0.1	-	Pass
Hexavalent Chromium	mg/kg	0.5	<0.5	< 1	< 1	-	Pass
Total Cyanide	mg/kg	1	<1	< 1	< 1	-	Pass
Fluoride	mg/kg	40	320	100	120	90	Fail

The relative percentage difference of the duplicate results analysed across two different laboratories are all <10 times the LOR. All but one of the RPD results lie between 0 – 80%. Fluoride was found to have a RPD of 90%. However considering the low levels of fluoride contaminant when compared to acceptable threshold values from the Victorian guidelines the RPD results can still be deemed acceptable.

Refer Appendix B and C for the ALS and Eurofins respective Environmental Certificates of Analysis

5. CONCLUSION

Samples were collected as per the requirements and were analysed for VIC EPA 448.3 Suite 1 and for contaminants of concern at the correct rates. The results indicate that the samples are within the acceptable threshold and meet the quality control criteria.

6. APPENDICES

Appendix A – Completed Pro Forma

Details of Company Requesting Disposal of Materials

Business Name	Ngurratjuta/Pmara Ntjarra Aboriginal Corporation	Contact Person	Amy Driver
Address	PO Box 8573 ALICE SPRINGS NT 0871	Phone Number	08 8951 1911
		Fax Number	
ABN	79 602 462 309	Email	amyd@ngur.com.au

Materials Details

Name of the site where materials originate from	Glen Helen Lodge
Approximate volume of material requiring disposal	22,500L, 22.5m ³
Description of the type of material to be disposed of	Silty clay soils
Date materials were sent or are proposed to be sent to landfill	ASAP

Please answer all of the below questions	Yes/No	If No Apply Step
Is the materials free of asbestos?	Yes	1
Do all materials originate from the same site?	Yes	2
Were samples collected across the insitu or stockpiled materials including at depth?	Yes	3
Were samples collected as per the requirements of AS4482.1 Parts 1 and 2	Yes	3
Were intra-laboratory duplicates and inter-laboratory duplicates collected at the rate detailed in the Method?	Yes	3
Were samples analysed for the suite 1 and suite 2 analytes at the rates detailed in the Method?	Yes	3
Have all analytes listed in the Method been analysed and reported?	Yes	3
Has a summary of all laboratory testing compared against relevant criteria been prepared and attached to this document?	Yes	4
Do results comply with the assessment rules presented in Section 2.8.1 of the Method?	Yes	5
Do QA/QC sample results comply with the assessment rules presented in Section 2.8.2 of the Method?	Yes	6
Have all the required documents as detailed in Section 3 of the Method been provided with this document?	Yes	7

ALICE SPRINGS TOWN COUNCIL LANDFILL

Disposal Request Agreement and Declaration for the Assessment and Disposal of Materials

The "Method" referred to above is "Alice Springs Town Council Landfill General Fill Classification and Disposal Method", prepared by Tierra Environment for Alice Springs Town Council and dated 6 May 2015

Steps to follow if answer is no to any of the above

- 1 Seek advice from ASTC Landfill staff. Material may still be able to be accepted but will need to be disposed of elsewhere at the landfill and there may be additional costs associated with disposal.
- 2 Keep materials separate and sample, analyse, assess, classify and document as two separate batches. If this is not possible additional samples should be collected and analysed for the full list of analytes in the method.
- 3 Re-sample materials from across and throughout the profile or stockpile at the required density and analyse samples for suite 1 and suite 2 analytes as detailed in the method.
- 4 Prepare a summary of all laboratory testing compared against relevant criteria.
- 5 Materials cannot be disposed of at the Alice Springs Town Council Landfill without specific approval from the NT EPA. Disposee to accept all costs associated with obtaining such approval if granted at all.
- 6 If an acceptable explanation to Council can be provided no further actions are required. If an acceptable explanation to Council cannot be provided then additional testing may be required.
- 7 Provide all required documentation.

Agreement and Declaration

An authorised person of the company detailed above acknowledges ownership of the materials until Alice Springs Town Council (Council) is satisfied the materials meet the requirements of the sampling and analytical method and all relevant fees have been paid in full and Council disposes of the materials. Furthermore the company detailed above acknowledges it will remove materials from the Alice Springs Town Council Landfill as and when directed by Council. The company also acknowledges all information is true and correct and the sampling and analytical method has been adhered to in undertaking the materials assessment and preparing this document. Council may at its discretion have the information provided reviewed by their environmental consultant for consistency with the method.

Date

28/09/2021

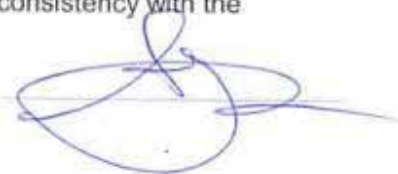
Signature of
authorised
person



Name of
authorised
person

CAMERON MILLER,
CEO

Signature of
witness



Name of
witness

AMY DRIVER

Appendix B - ALS Environmental Certificate of Analysis



CERTIFICATE OF ANALYSIS

Work Order
: **ES2132828**

Client
: **LOW ECOLOGICAL SERVICES**

Contact
: **MR BILL LOW**

Address
: **PO BOX 3130
ALICE SPRINGS NT, AUSTRALIA 0871**

Telephone
: **+61 08 89 555 222**

Project
: **Glen Helen - Soil Testing**

Order number
: **----**

C-O-C number
: **----**

Sampler
: **----**

Site
: **----**

Quote number
: **EN/333**

No. of samples received
: **13**

No. of samples analysed
: **13**

Page
: **1 of 24**

Laboratory
: **Environmental Division Sydney**

Contact
: **Customer Services ES**

Address
: **277-288 Woodpark Road Smithfield NSW Australia 2164**

Telephone
: **+61-2-8784 8555**

Date Samples Received
: **10-Sep-2021 07:00**

Date Analysis Commenced
: **15-Sep-2021**

Issue Date
: **21-Sep-2021 18:22**



Accreditation No. 183
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: **Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.**

Signatories
This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signature	Position	Accreditation Category
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Jarvis Nheu	Non-Metals Team Leader	Melbourne Inorganics, Springvale, VIC
Sanjeshni Jyoti	Senior Chemist Volatiles	Sydney Inorganics, Smithfield, NSW
Xing Lin	Senior Organic Chemist	Melbourne Inorganics, Springvale, VIC

RIGHT SOLUTIONS | RIGHT PARTNER

Page : 2 of 24
 Work Order : ES2132828
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen - Soil Testing



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extractions/dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

A = This result is computed from individual analyte detections at or above the level of reporting

g = ALS is not NATA accredited for these tests

~ = Indicates an estimated value.

- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benzo(a)anthracene (0.1), Chrysene (0.01), Benzo(b)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1,2,3-cd)pyrene (0.1), Dibenzo(a,h)anthracene (1.0), Benzo(g,h,i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m,p-Xylene and o-Xylene at or above the LOR.
- EP074-UT: Where reported, Total Xylenes is the sum of the reported concentrations of m,p-Xylene and o-Xylene at or above the LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- EP074-WF: Where reported, Sum of trichlorobenzenes is the sum of the reported concentrations of 1,2,3-Trichlorobenzene and 1,2,4-Trichlorobenzene at or above the LOR.

Soil Classification Analysis for General Fill Disposal

Page : 3 of 24
 Work Order : ES2132828
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen - Soil Testing



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Compound	CAS Number		LOR	Sampling date / time		Sample ID					
EA001: pH in soil using 0.01M CaCl extract											
pH (CaCl2)	---	0.1	pH Unit			7.9	---	---	---	---	---
EA055: Moisture Content											
Moisture Content	---	1.0	%			---	3.4	3.2	3.0	3.5	
EA055: Moisture Content (Dried @ 105-110°C)											
Moisture Content	---	1.0	%			3.8	---	---	---	---	
EG005(ED093)T: Total Metals by ICP-AES											
Molybdenum	7439-98-7	2	mg/kg			<2	---	---	---	---	---
Selenium	7782-49-2	5	mg/kg			<5	---	---	---	---	---
Silver	7440-22-4	2	mg/kg			<2	---	---	---	---	---
Tin	7440-31-5	5	mg/kg			<5	---	---	---	---	---
Arsenic	7440-38-2	5	mg/kg			<5	<5	<5	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg			<1	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg			---	16	16	17	16	16
Copper	7440-50-8	5	mg/kg			11	12	12	13	13	13
Lead	7439-92-1	5	mg/kg			12	17	11	7	8	8
Nickel	7440-02-0	2	mg/kg			9	9	9	10	11	11
Zinc	7440-66-6	5	mg/kg			30	30	31	26	28	28
EG035T: Total Recoverable Mercury by FILMS											
Mercury	7439-97-6	0.1	mg/kg			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG048: Hexavalent Chromium (Alkaline Digest)											
Hexavalent Chromium	18540-29-9	0.5	mg/kg			<0.5	---	---	---	---	---
EK026SF: Total CN by Segmented Flow Analyzer											
Total Cyanide	57-12-5	1	mg/kg			<1	---	---	---	---	---
EK040T: Fluoride Total											
Fluoride	16984-48-8	40	mg/kg			320	---	---	---	---	---
EP066: Polychlorinated Biphenyls (PCB)											
Total Polychlorinated biphenyls	---	0.1	mg/kg			<0.1	---	---	---	---	---
EP074A: Monocyclic Aromatic Hydrocarbons											
Benzene	71-43-2	0.2	mg/kg			<0.2	---	---	---	---	---
Toluene	108-88-3	0.5	mg/kg			<0.5	---	---	---	---	---
Ethylbenzene	100-41-4	0.5	mg/kg			<0.5	---	---	---	---	---
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg			<0.5	---	---	---	---	---
Styrene	100-42-5	0.5	mg/kg			<0.5	---	---	---	---	---
ortho-Xylene	95-47-6	0.5	mg/kg			<0.5	---	---	---	---	---

Soil Classification Analysis for General Fill Disposal

Page : 4 of 24
 Work Order : ES2132828
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen - Soil Testing



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		P5 (6+10)		P5 (2+7)		P5 (1+5)		P5 (9+4)		P5 (3+8)	
Compound	CAS Number	LOI	Unit	Sampling date / time	Result	Sampling date / time	Result	Sampling date / time	Result	Sampling date / time	Result	Sampling date / time	Result
EP074A: Monocyclic Aromatic Hydrocarbons - Continued													
Sum of monocyclic aromatic hydrocarbons	---	0.2	mg/kg		<0.2		---		---		---		---
Sum of Total Xylenes	---	0.5	mg/kg		<0.5		---		---		---		---
EP074H: Naphthalene													
Naphthalene	91-20-3	1	mg/kg		<1		---		---		---		---
EP074I: Volatile Halogenated Compounds													
Vinyl chloride	75-01-4	0.02	mg/kg		<0.02		---		---		---		---
1,1-Dichloroethene	75-35-4	0.01	mg/kg		<0.01		---		---		---		---
Methylene chloride	75-09-2	0.4	mg/kg		<0.4		---		---		---		---
trans-1,2-Dichloroethene	156-60-5	0.02	mg/kg		<0.02		---		---		---		---
cis-1,2-Dichloroethene	156-59-2	0.01	mg/kg		<0.01		---		---		---		---
Chloroform	67-66-3	0.02	mg/kg		<0.02		---		---		---		---
1,1,1-Trichloroethane	71-55-6	0.01	mg/kg		<0.01		---		---		---		---
Carbon Tetrachloride	56-23-5	0.01	mg/kg		<0.01		---		---		---		---
1,2-Dichloroethane	107-06-2	0.02	mg/kg		<0.02		---		---		---		---
Trichloroethene	79-01-6	0.02	mg/kg		<0.02		---		---		---		---
1,1,2-Trichloroethane	79-00-5	0.04	mg/kg		<0.04		---		---		---		---
Tetrachloroethene	127-18-4	0.02	mg/kg		<0.02		---		---		---		---
1,1,1,2-Tetrachloroethane	630-20-6	0.01	mg/kg		<0.01		---		---		---		---
1,1,2,2-Tetrachloroethane	79-34-5	0.02	mg/kg		<0.02		---		---		---		---
Hexachlorobutadiene	87-68-3	0.02	mg/kg		<0.02		---		---		---		---
Chlorobenzene	108-90-7	0.02	mg/kg		<0.02		---		---		---		---
1,4-Dichlorobenzene	106-46-7	0.02	mg/kg		<0.02		---		---		---		---
1,2-Dichlorobenzene	95-50-1	0.02	mg/kg		<0.02		---		---		---		---
1,2,4-Trichlorobenzene	120-82-1	0.01	mg/kg		<0.01		---		---		---		---
Sum of volatile chlorinated hydrocarbons	---	0.01	mg/kg		<0.01		---		---		---		---
Sum of other chlorinated hydrocarbons	---	0.01	mg/kg		<0.01		---		---		---		---
EP075A: Phenolic Compounds (Halogenated)													
2-Chlorophenol	95-67-8	0.03	mg/kg		<0.03		---		---		---		---
2,4-Dichlorophenol	120-83-2	0.03	mg/kg		<0.03		---		---		---		---
2,6-Dichlorophenol	87-65-0	0.03	mg/kg		<0.03		---		---		---		---
4-Chloro-3-methylphenol	59-50-7	0.03	mg/kg		<0.03		---		---		---		---
2,4,6-Trichlorophenol	95-95-4	0.05	mg/kg		<0.05		---		---		---		---
2,4,6-Trichlorophenol	88-06-2	0.05	mg/kg		<0.05		---		---		---		---

Soil Classification Analysis for General Fill Disposal

Page : 5 of 24
 Work Order : ES2132828
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen - Soil Testing



Analytical Results

Substrate: SOIL
 Matrix: SOIL

Compound	CAS Number	LOR	Sampling date / time	Unit	P5 (6+10)	P5 (2+7)	P5 (1+5)	P5 (9+4)	P5 (3+8)
					Result	Result	Result	Result	Result
EP075A: Phenolic Compounds (Halogenated) - Continuent									
2,3,5,6-Tetrachlorophenol	935-95-5	0.03		mg/kg	<0.03	----	----	----	----
2,3,4,5-Tetrachlorophenol	4901-51-3	0.05		mg/kg	<0.05	----	----	----	----
2,3,4,6-Tetrachlorophenol									
Pentachlorophenol	87-86-5	0.2		mg/kg	<0.2	----	----	----	----
* Sum of Phenols (halogenated)	----	0.03		mg/kg	<0.03	----	----	----	----
EP075A: Phenolic Compounds (Non-halogenated)									
Phenol	108-95-2	1		mg/kg	<1	----	----	----	----
2-Methylphenol	95-48-7	1		mg/kg	<1	----	----	----	----
3- & 4-Methylphenol	1319-77-3	1		mg/kg	<1	----	----	----	----
2-Nitrophenol	88-75-5	1		mg/kg	<1	----	----	----	----
2,4-Dimethylphenol	105-67-9	1		mg/kg	<1	----	----	----	----
2,4-Dinitrophenol	51-28-5	5		mg/kg	<5	----	----	----	----
4-Nitrophenol	100-02-7	5		mg/kg	<5	----	----	----	----
2-Methyl-4,6-dinitrophenol	8071-51-0	5		mg/kg	<5	----	----	----	----
Dinoseb	88-85-7	5		mg/kg	<5	----	----	----	----
2-Cyclohexyl-4,6-dinitrophenol	131-89-5	5		mg/kg	<5	----	----	----	----
* Sum of Phenols (non-halogenated)	----	1		mg/kg	<1	----	----	----	----
EP075B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5		mg/kg	<0.5	----	----	----	----
Acenaphthene	83-32-9	0.5		mg/kg	<0.5	----	----	----	----
Acenaphthylene	208-96-8	0.5		mg/kg	<0.5	----	----	----	----
Fluorene	86-73-7	0.5		mg/kg	<0.5	----	----	----	----
Phenanthrene	85-01-6	0.5		mg/kg	<0.5	----	----	----	----
Anthracene	120-12-7	0.5		mg/kg	<0.5	----	----	----	----
Fluoranthene	206-44-0	0.5		mg/kg	<0.5	----	----	----	----
Pyrene	129-00-0	0.5		mg/kg	<0.5	----	----	----	----
Benz(a)anthracene	56-55-3	0.5		mg/kg	<0.5	----	----	----	----
Chrysene	218-01-9	0.5		mg/kg	<0.5	----	----	----	----
Benzo(b+I) & Benzo(k)fluoranthene	205-99-2	1.0		mg/kg	<1.0	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5		mg/kg	<0.5	----	----	----	----
Indeno(1,2,3-cd)pyrene	193-39-5	0.5		mg/kg	<0.5	----	----	----	----
Dibenz(a,h)anthracene	53-70-3	0.5		mg/kg	<0.5	----	----	----	----
Benzo(g,h,i)perylene	191-24-2	0.5		mg/kg	<0.5	----	----	----	----
* Sum of polycyclic aromatic hydrocarbons	----	0.5		mg/kg	<0.5	----	----	----	----

Soil Classification Analysis for General Fill Disposal

Page : 6 of 24
 Work Order : ES2132828
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen - Soil Testing



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		Sampling date / time		P5 (6+10)		P5 (2+7)		P5 (1+5)		P5 (9+4)		P5 (3+8)	
Compound	CAS Number	LOR	Unit	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
EP075B: Polynuclear Aromatic Hydrocarbons - Continued															
* Benzo(a)pyrene TEQ (zero)	—	0.5	mg/kg	<0.5	—	—	—	—	—	—	—	—	—	—	—
* Benzo(a)pyrene TEQ (half LOR)	—	0.5	mg/kg	0.6	—	—	—	—	—	—	—	—	—	—	—
* Benzo(a)pyrene TEQ (LOR)	—	0.5	mg/kg	1.2	—	—	—	—	—	—	—	—	—	—	—
EP075I: Organochlorine Pesticides															
alpha-BHC	319-84-6	0.03	mg/kg	<0.03	—	—	—	—	—	—	—	—	—	—	—
Hexachlorobenzene (HCB)	118-74-1	0.03	mg/kg	<0.03	—	—	—	—	—	—	—	—	—	—	—
beta-BHC	319-85-7	0.03	mg/kg	<0.03	—	—	—	—	—	—	—	—	—	—	—
gamma-BHC	58-89-9	0.03	mg/kg	<0.03	—	—	—	—	—	—	—	—	—	—	—
delta-BHC	319-86-8	0.03	mg/kg	<0.03	—	—	—	—	—	—	—	—	—	—	—
Heptachlor	76-44-8	0.03	mg/kg	<0.03	—	—	—	—	—	—	—	—	—	—	—
Aldrin	309-00-2	0.03	mg/kg	<0.03	—	—	—	—	—	—	—	—	—	—	—
Heptachlor epoxide	1024-57-3	0.03	mg/kg	<0.03	—	—	—	—	—	—	—	—	—	—	—
cis-Chlordane	5103-71-9	0.03	mg/kg	<0.03	—	—	—	—	—	—	—	—	—	—	—
trans-Chlordane	5103-74-2	0.03	mg/kg	<0.03	—	—	—	—	—	—	—	—	—	—	—
Endosulfan 1	959-98-8	0.03	mg/kg	<0.03	—	—	—	—	—	—	—	—	—	—	—
4,4'-DDE	72-55-9	0.05	mg/kg	<0.05	—	—	—	—	—	—	—	—	—	—	—
Dieldrin	60-57-1	0.03	mg/kg	<0.03	—	—	—	—	—	—	—	—	—	—	—
Endrin aldehyde	7421-93-4	0.03	mg/kg	<0.03	—	—	—	—	—	—	—	—	—	—	—
Endrin	72-20-8	0.03	mg/kg	<0.03	—	—	—	—	—	—	—	—	—	—	—
Endosulfan 2	33213-65-9	0.03	mg/kg	<0.03	—	—	—	—	—	—	—	—	—	—	—
4,4'-DDD	72-54-8	0.05	mg/kg	<0.05	—	—	—	—	—	—	—	—	—	—	—
Endosulfan sulfate	1031-07-8	0.03	mg/kg	<0.03	—	—	—	—	—	—	—	—	—	—	—
4,4'-DDT	50-29-3	0.05	mg/kg	<0.05	—	—	—	—	—	—	—	—	—	—	—
Methoxychlor	72-43-5	0.03	mg/kg	<0.03	—	—	—	—	—	—	—	—	—	—	—
* Sum of organochlorine pesticides	—	0.03	mg/kg	<0.03	—	—	—	—	—	—	—	—	—	—	—
* Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.03	mg/kg	<0.03	—	—	—	—	—	—	—	—	—	—	—
* Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-29-3	0.05	mg/kg	<0.05	—	—	—	—	—	—	—	—	—	—	—
* Chlordane	57-74-9	0.03	mg/kg	<0.03	—	—	—	—	—	—	—	—	—	—	—
* Sum of other organochlorine pesticides	—	0.03	mg/kg	<0.03	—	—	—	—	—	—	—	—	—	—	—
EP080/071: Total Petroleum Hydrocarbons															
C6 - C9 Fraction	—	10	mg/kg	—	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
C6 - C9 Fraction	—	10	mg/kg	<10	—	—	—	—	—	—	—	—	—	—	—
C10 - C14 Fraction	—	50	mg/kg	—	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
C10 - C14 Fraction	—	50	mg/kg	<50	—	—	—	—	—	—	—	—	—	—	—

Soil Classification Analysis for General Fill Disposal



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 Work Order ES2132828
 Client LOW ECOLOGICAL SERVICES
 Project Glen Helen - Soil Testing

Analytical Results

Substrate: SOIL (Matrix: SOIL)		Sample ID		P5 (6+10)		P5 (2+7)		P5 (1+5)		P5 (9+4)		P5 (3+8)	
Compound	CAS Number	LOR	Unit	Sampling date / time	Result	Sampling date / time	Result	Sampling date / time	Result	Sampling date / time	Result	Sampling date / time	Result
EP080/071: Total Petroleum Hydrocarbons - Continued													
C6 - C10 Fraction	C6_C10	10	mg/kg		<10		---		---		---		---
C15 - C28 Fraction	---	100	mg/kg		---		<100		<100		<100		<100
C15 - C28 Fraction	---	100	mg/kg		<100		---		---		---		---
C29 - C36 Fraction	---	100	mg/kg		---		<100		<100		<100		<100
C29 - C36 Fraction	---	100	mg/kg		<100		---		---		---		---
C10 - C36 Fraction (sum)	---	50	mg/kg		---		<50		<50		<50		<50
C10 - C36 Fraction (sum)	---	50	mg/kg		<50		---		---		---		---
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions													
C6 - C10 Fraction	C6_C10	10	mg/kg		<10		<10		<10		<10		<10
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		---		<10		<10		<10		<10
>C10 - C16 Fraction	---	50	mg/kg		---		<50		<50		<50		<50
>C10 - C16 Fraction	---	50	mg/kg		<50		---		---		---		---
>C16 - C34 Fraction	---	100	mg/kg		---		<100		<100		<100		<100
>C16 - C34 Fraction	---	100	mg/kg		<100		---		---		---		---
>C34 - C40 Fraction	---	100	mg/kg		---		<100		<100		<100		<100
>C34 - C40 Fraction	---	100	mg/kg		<100		---		---		---		---
>C10 - C40 Fraction (sum)	---	50	mg/kg		---		<50		<50		<50		<50
>C10 - C40 Fraction (sum)	---	50	mg/kg		<50		---		---		---		---
>C10 - C16 Fraction minus Naphthalene (F2)	---	50	mg/kg		---		<50		<50		<50		<50
>C10 - C16 Fraction minus Naphthalene (F2)	---	50	mg/kg		<50		---		---		---		---
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10		---		---		---		---
EP060: BTEXN													
Benzene	71-43-2	0.2	mg/kg		---		<0.2		<0.2		<0.2		<0.2
Toluene	108-88-3	0.5	mg/kg		---		<0.5		<0.5		<0.5		<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		---		<0.5		<0.5		<0.5		<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		---		<0.5		<0.5		<0.5		<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		---		<0.5		<0.5		<0.5		<0.5
Sum of BTEX	---	0.2	mg/kg		---		<0.2		<0.2		<0.2		<0.2
Total Xylenes	---	0.5	mg/kg		---		<0.5		<0.5		<0.5		<0.5
Naphthalene	91-20-3	1	mg/kg		---		<1		<1		<1		<1
EP066S: PCB Surrogate													

Soil Classification Analysis for General Fill Disposal

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 Client : LOW ECOLOGICAL SERVICES
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Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sub-Matrix: SOIL (Matrix: SOIL)	Sample ID		P5 (8+10)	P5 (2+7)	P5 (1+5)	P5(9+4)	P5(3+8)
	Sampling date / time	Unit					
	CAS Number	LOR					
Compound			Result	Result	Result	Result	Result
EP066S: PCB Surrogate - Continued							
Decachlorobiphenyl	2051-24-3	0.1	%	87.2	----	----	----
EP074S: VOC Surrogates (Ultra-Trace)							
1,2-Dichloroethane-D4	17060-07-0	0.1	%	109	----	----	----
Toluene-D8	2037-26-5	0.1	%	101	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%	101	----	----	----
EP075S: Acid Extractable Surrogates (Waste Classification)							
Phenol-d6	13127-86-3	0.025	%	86.5	----	----	----
2-Chlorophenol-D4	93951-73-6	0.025	%	77.6	----	----	----
2,4,6-Tribromophenol	118-79-6	0.025	%	82.7	----	----	----
EP075T: Base/Neutral Extractable Surrogates (Waste Classification)							
Nitrobenzene-D5	4165-60-0	0.025	%	80.2	----	----	----
1,2-Dichlorobenzene-D4	2199-69-1	0.025	%	77.2	----	----	----
2-Fluorobiphenyl	321-60-6	0.025	%	84.6	----	----	----
Anthracene-d10	1719-06-8	0.025	%	86.5	----	----	----
4-Terphenyl-d14	1718-51-0	0.025	%	89.5	----	----	----
EP080S: TPH(V)/BTEX Surrogates							
1,2-Dichloroethane-D4	17060-07-0	0.2	%	110	115	115	124
Toluene-D8	2037-26-5	0.2	%	89.6	96.2	97.4	103
4-Bromofluorobenzene	460-00-4	0.2	%	104	101	102	106



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Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		B10+B3+B9		B11 + B8		B4+ B7		B1 +B3		B2 + B6	
Compound	CAS Number	Sampling date / time		B10+B3+B9		B11 + B8		B4+ B7		B1 +B3		B2 + B6	
		LOI	Unit	Result	Result	Result	Result	Result	Result	Result	Result		
EA001: pH in soil using 0.01M CaCl extract													
pH (CaCl2)	---	0.1	pH Unit	7.9	---	---	---	---	---	---	---	---	---
EA055: Moisture Content													
Moisture Content	---	1.0	%	---	---	---	---	2.9	4.2	---	---	3.3	---
EA055: Moisture Content (Dried @ 105-110°C)													
Moisture Content	---	1.0	%	4.8	---	4.9	---	---	---	---	---	---	---
EG005(ED053)T: Total Metals by ICP-AES													
Molybdenum	7439-98-7	2	mg/kg	<2	---	---	---	---	---	---	---	---	---
Selenium	7782-49-2	5	mg/kg	<5	---	---	---	---	---	---	---	---	---
Silver	7440-22-4	2	mg/kg	<2	---	---	---	---	---	---	---	---	---
Tin	7440-31-5	5	mg/kg	<5	---	---	---	---	---	---	---	---	---
Arsenic	7440-38-2	5	mg/kg	<5	---	<5	---	<5	<5	<5	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	---	<1	---	<1	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	---	---	13	---	13	17	13	17	16	---
Copper	7440-50-8	5	mg/kg	11	---	10	---	10	13	10	13	31	---
Lead	7439-92-1	5	mg/kg	18	---	13	---	13	13	10	10	12	---
Nickel	7440-02-0	2	mg/kg	9	---	8	---	8	8	10	10	10	---
Zinc	7440-66-6	5	mg/kg	29	---	25	---	24	28	20	28	26	---
EG035T: Total Recoverable Mercury by FIMS													
Mercury	7439-97-6	0.1	mg/kg	<0.1	---	<0.1	---	<0.1	<0.1	<0.1	<0.1	<0.1	---
EG048: Hexavalent Chromium (Alkaline Digest)													
Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	---	---	---	---	---	---	---	---	---
EK026SF: Total CN by Segmented Flow Analyzer													
Total Cyanide	57-12-5	1	mg/kg	<1	---	---	---	---	---	---	---	---	---
EK040T: Fluoride Total													
Fluoride	16984-48-8	40	mg/kg	310	---	---	---	---	---	---	---	---	---
EP066: Polychlorinated Biphenyls (PCB)													
Total Polychlorinated biphenyls	---	0.1	mg/kg	<0.1	---	---	---	---	---	---	---	---	---
EP074A: Monocyclic Aromatic Hydrocarbons													
Benzene	71-43-2	0.2	mg/kg	<0.2	---	---	---	---	---	---	---	---	---
Toluene	108-88-3	0.5	mg/kg	<0.5	---	---	---	---	---	---	---	---	---
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	---	---	---	---	---	---	---	---	---
meta- & para-Xylene	108-38-3	0.5	mg/kg	<0.5	---	---	---	---	---	---	---	---	---
Styrene	100-42-5	0.5	mg/kg	<0.5	---	---	---	---	---	---	---	---	---
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	---	---	---	---	---	---	---	---	---

Soil Classification Analysis for General Fill Disposal

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Analytical Results

Substrate: SOIL
 (Matrix: SOIL)

Compound	CAS Number	Sampling date / time	Sample ID	B10+B3+B9	B11 + B8	B4+ B7	B1 +B5	B2 + B6
		Unit		Result	Result	Result	Result	Result
EP074A: Monocyclic Aromatic Hydrocarbons - Continued								
^ Sum of monocyclic aromatic hydrocarbons	---	mg/kg		<0.2	---	---	---	---
^ Total Xylenes	---	mg/kg		<0.5	---	---	---	---
EP074H: Naphthalene								
Naphthalene	91-20-3	mg/kg	1	<1	---	---	---	---
EP074I: Volatile Halogenated Compounds								
Vinyl chloride	75-01-4	mg/kg	0.02	<0.02	---	---	---	---
1,1-Dichloroethene	75-35-4	mg/kg	0.01	<0.01	---	---	---	---
Methylene chloride	75-09-2	mg/kg	0.4	<0.4	---	---	---	---
trans-1,2-Dichloroethene	156-60-5	mg/kg	0.02	<0.02	---	---	---	---
cis-1,2-Dichloroethene	156-59-2	mg/kg	0.01	<0.01	---	---	---	---
Chloroform	67-66-3	mg/kg	0.02	<0.02	---	---	---	---
1,1,1-Trichloroethane	71-55-6	mg/kg	0.01	<0.01	---	---	---	---
Carbon Tetrachloride	56-23-5	mg/kg	0.01	<0.01	---	---	---	---
1,2-Dichloroethane	107-06-2	mg/kg	0.02	<0.02	---	---	---	---
Trichloroethene	79-01-6	mg/kg	0.02	<0.02	---	---	---	---
1,1,2-Trichloroethane	79-00-5	mg/kg	0.04	<0.04	---	---	---	---
Tetrachloroethene	127-18-4	mg/kg	0.02	<0.02	---	---	---	---
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg	0.01	<0.01	---	---	---	---
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg	0.02	<0.02	---	---	---	---
Hexachlorobutadiene	67-66-3	mg/kg	0.02	<0.02	---	---	---	---
Chlorobenzene	108-90-7	mg/kg	0.02	<0.02	---	---	---	---
1,4-Dichlorobenzene	106-46-7	mg/kg	0.02	<0.02	---	---	---	---
1,2-Dichlorobenzene	95-50-1	mg/kg	0.02	<0.02	---	---	---	---
1,2,4-Trichlorobenzene	120-82-1	mg/kg	0.01	<0.01	---	---	---	---
^ Sum of volatile chlorinated hydrocarbons	---	mg/kg	0.01	<0.01	---	---	---	---
^ Sum of other chlorinated hydrocarbons	---	mg/kg	0.01	<0.01	---	---	---	---
EP075(SIM): Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	mg/kg	0.5	---	<0.5	---	---	---
Acenaphthylene	208-96-8	mg/kg	0.5	---	<0.5	---	---	---
Acenaphthene	83-32-9	mg/kg	0.5	---	<0.5	---	---	---
Fluorene	86-73-7	mg/kg	0.5	---	<0.5	---	---	---
Phenanthrene	85-01-8	mg/kg	0.5	---	<0.5	---	---	---
Anthracene	120-12-7	mg/kg	0.5	---	<0.5	---	---	---

Soil Classification Analysis for General Fill Disposal



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Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		Sampling date / time		Unit		
Compound	CAS Number	LOR	Unit	B10+B3+B9	B11 + B8	B4+ B7	B1 +B5	B2 + B6
				06-Sep-2021 17:35	06-Sep-2021 17:35	06-Sep-2021 17:30	06-Sep-2021 17:30	06-Sep-2021 17:30
				ES2132828-006	ES2132828-007	ES2132828-008	ES2132828-009	ES2132828-010
				Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continuent								
Fluoranthene	206-44-0	0.5	mg/kg	----	<0.5	----	----	----
Pyrene	129-00-0	0.5	mg/kg	----	<0.5	----	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	----	<0.5	----	----	----
Chrysene	218-01-9	0.5	mg/kg	----	<0.5	----	----	----
Benzo(b+h)fluoranthene	206-99-2	0.5	mg/kg	----	<0.5	----	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	----	<0.5	----	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	----	<0.5	----	----	----
Indeno(1,2,3-cd)pyrene	193-39-5	0.5	mg/kg	----	<0.5	----	----	----
Dibenz(a,h)anthracene	53-70-3	0.5	mg/kg	----	<0.5	----	----	----
Benzol(g,h,i)perylene	191-24-2	0.5	mg/kg	----	<0.5	----	----	----
^ Sum of polycyclic aromatic hydrocarbons				----	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (zero)				----	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (half LOR)				----	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (LOR)				----	0.6	----	----	----
				----	1.2	----	----	----
EP075A: Phenolic Compounds (Halogenated)								
2-Chlorophenol	95-57-8	0.03	mg/kg	<0.03	----	----	----	----
2,4-Dichlorophenol	120-83-2	0.03	mg/kg	<0.03	----	----	----	----
2,6-Dichlorophenol	87-65-0	0.03	mg/kg	<0.03	----	----	----	----
4-Chloro-3-methylphenol	59-50-7	0.03	mg/kg	<0.03	----	----	----	----
2,4,6-Trichlorophenol	95-95-4	0.05	mg/kg	<0.05	----	----	----	----
2,4,6-Trichlorophenol	88-06-2	0.05	mg/kg	<0.05	----	----	----	----
2,3,5,6-Tetrachlorophenol	935-95-5	0.03	mg/kg	<0.03	----	----	----	----
2,3,4,5 & 2,3,4,6-Tetrachlorophenol	4901-51-3	0.05	mg/kg	<0.05	----	----	----	----
Pentachlorophenol	87-86-5	0.2	mg/kg	<0.2	----	----	----	----
^ Sum of Phenols (halogenated)				<0.03	----	----	----	----
EP075A: Phenolic Compounds (Non-halogenated)								
Phenol	108-95-2	1	mg/kg	<1	----	----	----	----
2-Methylphenol	95-48-7	1	mg/kg	<1	----	----	----	----
3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	----	----	----	----
2-Nitrophenol	88-75-5	1	mg/kg	<1	----	----	----	----
2,4-Dimethylphenol	105-67-9	1	mg/kg	<1	----	----	----	----
2,4-Dinitrophenol	51-28-5	5	mg/kg	<5	----	----	----	----
4-Nitrophenol	100-02-7	5	mg/kg	<5	----	----	----	----
2-Methyl-4,6-dinitrophenol	8071-51-0	5	mg/kg	<5	----	----	----	----

Soil Classification Analysis for General Fill Disposal

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Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Compound	CAS Number	LOR	Sampling date / time	Unit	B10+B3+B9	B11 + B8	B4+ B7	B1 +B5	B2 + B6
EP075A: Phenolic Compounds (Non-halogenated) - Continued									
Dinoseb	88-85-7	5		mg/kg	<5	---	---	---	---
2-Cyclohexyl-4,6-Dinitrophenol	131-89-5	5		mg/kg	<5	---	---	---	---
* Sum of Phenols (non-halogenated)	---	1		mg/kg	<1	---	---	---	---
EP075B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5		mg/kg	<0.5	---	---	---	---
Acenaphthene	83-32-9	0.5		mg/kg	<0.5	---	---	---	---
Acenaphthylene	208-06-8	0.5		mg/kg	<0.5	---	---	---	---
Fluorene	86-73-7	0.5		mg/kg	<0.5	---	---	---	---
Phenanthrene	85-01-8	0.5		mg/kg	<0.5	---	---	---	---
Anthracene	120-12-7	0.5		mg/kg	<0.5	---	---	---	---
Fluoranthene	206-44-0	0.5		mg/kg	<0.5	---	---	---	---
Pyrene	129-00-0	0.5		mg/kg	<0.5	---	---	---	---
Benz[a]anthracene	56-55-3	0.5		mg/kg	<0.5	---	---	---	---
Chrysene	218-01-9	0.5		mg/kg	<0.5	---	---	---	---
Benzo[b+J] & Benzo[k]fluoranthene	205-99-2 207-08-9	1.0		mg/kg	<1.0	---	---	---	---
Benzo[a]pyrene	50-32-6	0.5		mg/kg	<0.5	---	---	---	---
Indeno[1,2,3-cd]pyrene	193-39-6	0.5		mg/kg	<0.5	---	---	---	---
Dibenz[a,h]anthracene	53-70-3	0.5		mg/kg	<0.5	---	---	---	---
Benzo[g,h,i]perylene	191-24-2	0.5		mg/kg	<0.5	---	---	---	---
* Sum of polycyclic aromatic hydrocarbons	---	0.5		mg/kg	<0.5	---	---	---	---
* Benzo[a]pyrene TEQ (zero)	---	0.5		mg/kg	<0.5	---	---	---	---
* Benzo[a]pyrene TEQ (half LOR)	---	0.5		mg/kg	0.6	---	---	---	---
* Benzo[a]pyrene TEQ (LOR)	---	0.5		mg/kg	1.2	---	---	---	---
EP075I: Organochlorine Pesticides									
alpha-BHC	319-84-6	0.03		mg/kg	<0.03	---	---	---	---
Hexachlorobenzene (HCB)	118-74-1	0.03		mg/kg	<0.03	---	---	---	---
beta-BHC	319-85-7	0.03		mg/kg	<0.03	---	---	---	---
gamma-BHC	58-89-9	0.03		mg/kg	<0.03	---	---	---	---
delta-BHC	319-86-8	0.03		mg/kg	<0.03	---	---	---	---
Heptachlor	76-44-8	0.03		mg/kg	<0.03	---	---	---	---
Aldrin	309-00-2	0.03		mg/kg	<0.03	---	---	---	---
Heptachlor epoxide	1024-87-3	0.03		mg/kg	<0.03	---	---	---	---
cis-Chlordane	5103-71-9	0.03		mg/kg	<0.03	---	---	---	---

Soil Classification Analysis for General Fill Disposal

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Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		Sampling date / time		Unit		Result		Result		Result		Result	
Compound	CAS Number	LOR	Unit	B10+B3+B9	B11 + B8	B4+ B7	B1 +B5	B2 + B6							
06-Sep-2021 17:35															
ES2132828-006															
06-Sep-2021 17:35															
ES2132828-007															
06-Sep-2021 17:30															
ES2132828-008															
06-Sep-2021 17:30															
ES2132828-009															
06-Sep-2021 17:30															
ES2132828-010															
EP0751: Organochlorine Pesticides - Continued															
trans-Chlordane	5103-74-2	0.03	mg/kg	<0.03	----	----	----	----							
Endosulfan 1	959-98-8	0.03	mg/kg	<0.03	----	----	----	----							
4,4'-DDE	72-55-9	0.05	mg/kg	<0.05	----	----	----	----							
Dieldrin	60-57-1	0.03	mg/kg	<0.03	----	----	----	----							
Endrin aldehyde	7421-93-4	0.03	mg/kg	<0.03	----	----	----	----							
Endrin	72-20-8	0.03	mg/kg	<0.03	----	----	----	----							
Endosulfan 2	33213-65-9	0.03	mg/kg	<0.03	----	----	----	----							
4,4'-DDD	72-54-8	0.05	mg/kg	<0.05	----	----	----	----							
Endosulfan sulfate	1031-07-8	0.03	mg/kg	<0.03	----	----	----	----							
4,4'-DDT	50-29-3	0.05	mg/kg	<0.05	----	----	----	----							
Methoxychlor	72-43-5	0.03	mg/kg	<0.03	----	----	----	----							
^ Sum of organochlorine pesticides															
^ Sum of Aldrin + Dieldrin															
^ Sum of DDD + DDE + DDT															
0-2															
Chlordane	57-74-9	0.03	mg/kg	<0.03	----	----	----	----							
^ Sum of other organochlorine pesticides															
EP080071: Total Petroleum Hydrocarbons															
C6 - C9 Fraction	----	10	mg/kg	----	<10	<10	<10	<10							
C6 - C9 Fraction	----	10	mg/kg	<10	----	----	----	----							
C10 - C14 Fraction	----	50	mg/kg	----	<50	<50	<50	<50							
C10 - C14 Fraction	----	50	mg/kg	<50	----	----	----	----							
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	----	----	----	----							
C15 - C28 Fraction	----	100	mg/kg	----	980	<100	570	740							
C15 - C28 Fraction	----	100	mg/kg	720	----	----	----	----							
C29 - C36 Fraction	----	100	mg/kg	----	<100	<100	<100	<100							
C29 - C36 Fraction	----	100	mg/kg	<100	----	----	----	----							
C10 - C36 Fraction (sum)	----	50	mg/kg	----	980	<50	570	740							
C10 - C36 Fraction (sum)	----	50	mg/kg	720	----	----	----	----							
EP080071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions															
C6 - C10 Fraction	C6_C10	10	mg/kg	----	<10	<10	<10	<10							
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	----	<10	<10	<10	<10							
>C10 - C16 Fraction	----	50	mg/kg	----	220	<50	130	150							
>C10 - C16 Fraction	----	50	mg/kg	180	----	----	----	----							

Soil Classification Analysis for General Fill Disposal

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Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		Sampling date / time		B10+B3+B9		B11 + B8		B4+ B7		B1 +B5		B2 + B6	
Compound	CAS Number	LOH	Unit	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
EP080-071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued:															
>C16 - C34 Fraction	---	100	mg/kg	---	---	---	---	830	---	<100	---	480	---	640	---
>C16 - C34 Fraction	---	100	mg/kg	---	---	570	---	---	---	---	---	---	---	---	---
>C34 - C40 Fraction	---	100	mg/kg	---	---	---	---	<100	---	<100	---	<100	---	<100	---
>C34 - C40 Fraction	---	100	mg/kg	---	---	<100	---	---	---	---	---	---	---	---	---
^ >C10 - C40 Fraction (sum)	---	50	mg/kg	---	---	---	---	1050	---	<50	---	610	---	790	---
^ >C10 - C40 Fraction (sum)	---	50	mg/kg	---	---	750	---	---	---	---	---	---	---	---	---
^ >C10 - C16 Fraction minus Naphthalene (F2)	---	50	mg/kg	---	---	---	---	220	---	<50	---	130	---	150	---
>C10 - C16 Fraction minus Naphthalene (F2)	---	50	mg/kg	---	---	180	---	---	---	---	---	---	---	---	---
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	---	---	<10	---	---	---	---	---	---	---	---	---
EP080: BTEXN															
Benzene	71-43-2	0.2	mg/kg	---	---	---	---	<0.2	---	<0.2	---	<0.2	---	<0.2	---
Toluene	108-88-3	0.5	mg/kg	---	---	---	---	<0.5	---	<0.5	---	<0.5	---	<0.5	---
Ethylbenzene	100-41-4	0.5	mg/kg	---	---	---	---	<0.5	---	<0.5	---	<0.5	---	<0.5	---
meta- & para-Xylene	100-38-3 106-42-3	0.5	mg/kg	---	---	---	---	<0.5	---	<0.5	---	<0.5	---	<0.5	---
ortho-Xylene	95-47-6	0.5	mg/kg	---	---	---	---	<0.5	---	<0.5	---	<0.5	---	<0.5	---
^ Sum of BTEX	---	0.2	mg/kg	---	---	---	---	<0.2	---	<0.2	---	<0.2	---	<0.2	---
^ Total Xylenes	---	0.5	mg/kg	---	---	---	---	<0.5	---	<0.5	---	<0.5	---	<0.5	---
Naphthalene	91-20-3	1	mg/kg	---	---	---	---	<1	---	<1	---	<1	---	<1	---
EP065: PCB Surrogate															
Decachlorobiphenyl	2051-24-3	0.1	%	---	---	94.7	---	---	---	---	---	---	---	---	---
EP074S: VOC Surrogates (Ultra-Trace)															
1,2-Dichloroethane-D4	17060-07-0	0.1	%	---	---	96.3	---	---	---	---	---	---	---	---	---
Toluene-D8	2037-26-5	0.1	%	---	---	93.9	---	---	---	---	---	---	---	---	---
4-Bromofluorobenzene	460-00-4	0.1	%	---	---	91.6	---	---	---	---	---	---	---	---	---
EP075(SIM)S: Phenolic Compound Surrogates															
Phenol-d6	13127-88-3	0.5	%	---	---	---	---	93.2	---	---	---	---	---	---	---
2-Chlorophenol-D4	93951-73-6	0.5	%	---	---	---	---	92.1	---	---	---	---	---	---	---
2,4,6-Tribromophenol	118-79-6	0.5	%	---	---	---	---	71.0	---	---	---	---	---	---	---
EP075(SIM)T: PAH Surrogates															
2-Fluorobiphenyl	321-60-8	0.5	%	---	---	---	---	102	---	---	---	---	---	---	---
Anthracene-d10	1719-06-8	0.5	%	---	---	---	---	98.2	---	---	---	---	---	---	---

Soil Classification Analysis for General Fill Disposal

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Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Compound	CAS Number	Sampling date / time	Sample ID	B10+B3+B9	B11 + B8	B4+ B7	B1 +B5	B2 + B6
		LOR	Unit	Result	Result	Result	Result	Result
EP075(SIM): PAH Surrogates - Continued								
4-Terphenyl-d14	1718-51-0	0.5	%	---	81.7	---	---	---
EP075S: Acid Extractable Surrogates (Waste Classification)								
Phenol-d6	13127-88-3	0.025	%	89.9	---	---	---	---
2-Chlorophenol-D4	93851-73-6	0.025	%	81.1	---	---	---	---
2,4,6-Tribromophenol	118-79-6	0.025	%	88.7	---	---	---	---
EP075T: Base/Neutral Extractable Surrogates (Waste Classification)								
Nitrobenzene-D5	4165-90-0	0.025	%	82.7	---	---	---	---
1,2-Dichlorobenzene-D4	2199-69-1	0.025	%	80.4	---	---	---	---
2-Fluorobiphenyl	321-60-8	0.025	%	89.2	---	---	---	---
Anthracene-d10	1719-06-8	0.025	%	93.6	---	---	---	---
4-Terphenyl-d14	1718-51-0	0.025	%	95.0	---	---	---	---
EP080S: TPH(V)BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.2	%	---	106	115	123	112
Toluene-D8	2037-26-5	0.2	%	---	94.4	102	107	98.8
4-Bromofluorobenzene	460-00-4	0.2	%	---	94.7	104	107	100

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Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Compound	CAS Number	Sample ID		D5 + D2	D7 + D8	INTRA DUPLICATE	
		LOR	Unit				
EA001: pH in soil using 0.01M CaCl ₂ extract pH (CaCl ₂)	---	0.1	pH Unit	---	---	8.0	---
EA055: Moisture Content	---	1.0	%	---	---	---	---
EA055: Moisture Content (Dried @ 105-110°C)	---	1.0	%	---	---	3.9	---
EG005(ED053)T: Total Metals by ICP-AES							
Molybdenum	7439-98-7	2	mg/kg	---	---	<2	---
Selenium	7782-49-2	5	mg/kg	---	---	<5	---
Silver	7440-22-4	2	mg/kg	---	---	<2	---
Tin	7440-31-6	5	mg/kg	---	---	<5	---
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	---
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	---
Chromium	7440-47-3	2	mg/kg	16	17	---	---
Copper	7440-50-8	5	mg/kg	11	13	13	---
Lead	7439-92-1	5	mg/kg	12	9	13	---
Nickel	7440-02-0	2	mg/kg	9	10	10	---
Zinc	7440-66-6	5	mg/kg	27	28	32	---
EG035T: Total Recoverable Mercury by FIMS							
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	---
EG048: Hexavalent Chromium (Alkaline Digest)							
Hexavalent Chromium	18540-29-9	0.5	mg/kg	---	---	<0.5	---
EK0265F: Total CN by Segmented Flow Analyser							
Total Cyanide	57-12-5	1	mg/kg	---	---	<1	---
EK040T: Fluoride Total							
Fluoride	16984-48-8	40	mg/kg	---	---	320	---
EPC66: Polychlorinated Biphenyls (PCB)							
Total Polychlorinated biphenyls	---	0.1	mg/kg	---	---	<0.1	---
EP074A: Monocyclic Aromatic Hydrocarbons							
Benzene	71-43-2	0.2	mg/kg	---	---	<0.2	---
Toluene	108-88-3	0.5	mg/kg	---	---	<0.5	---
Ethylbenzene	100-41-4	0.5	mg/kg	---	---	<0.5	---
meta- & para-Xylene	106-38-3	0.5	mg/kg	---	---	<0.5	---
Styrene	100-42-5	0.5	mg/kg	---	---	<0.5	---
ortho-Xylene	95-47-6	0.5	mg/kg	---	---	<0.5	---

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Sub-Matrix: SOIL (Matrix: SOIL)	Sample ID		D5 + D2	D7 + DB	INTRA DUPLICATE	
	Sampling date / time	Unit				
Compound	CAS Number	LOR	Result	Result	Result	
EP074A: Monocyclic Aromatic Hydrocarbons - Continued						
^ Sum of monocyclic aromatic hydrocarbons	---	0.2	---	---	<0.2	---
^ Total Xylenes	---	0.5	---	---	<0.5	---
EP074H: Naphthalene						
Naphthalene	91-20-3	1	---	---	<1	---
EP074I: Volatile Halogenated Compounds						
Vinyl chloride	75-01-4	0.02	---	---	<0.02	---
1,1-Dichloroethane	75-30-4	0.01	---	---	<0.01	---
Methylene chloride	75-09-2	0.4	---	---	<0.4	---
trans-1,2-Dichloroethene	156-60-5	0.02	---	---	<0.02	---
cis-1,2-Dichloroethene	156-59-2	0.01	---	---	<0.01	---
Chloroform	67-66-3	0.02	---	---	<0.02	---
1,1,1-Trichloroethane	71-55-6	0.01	---	---	<0.01	---
Carbon Tetrachloride	56-23-5	0.01	---	---	<0.01	---
1,2-Dichloroethane	107-06-2	0.02	---	---	<0.02	---
Trichloroethene	79-01-8	0.02	---	---	<0.02	---
1,1,2-Trichloroethane	79-00-5	0.04	---	---	<0.04	---
Tetrachloroethene	127-18-4	0.02	---	---	<0.02	---
1,1,1,2-Tetrachloroethane	630-20-6	0.01	---	---	<0.01	---
1,1,2,2-Tetrachloroethane	79-34-5	0.02	---	---	<0.02	---
Hexachlorobutadiene	87-68-3	0.02	---	---	<0.02	---
Chlorobenzene	108-90-7	0.02	---	---	<0.02	---
1,4-Dichlorobenzene	106-46-7	0.02	---	---	<0.02	---
1,2-Dichlorobenzene	95-50-1	0.02	---	---	<0.02	---
1,2,4-Trichlorobenzene	120-82-1	0.01	---	---	<0.01	---
^ Sum of volatile chlorinated hydrocarbons	---	0.01	---	---	<0.01	---
^ Sum of other chlorinated hydrocarbons	---	0.01	---	---	<0.01	---
EP075(SIM): Polynuclear Aromatic Hydrocarbons						
Naphthalene	91-20-3	0.5	---	---	---	---
Acenaphthylene	208-96-8	0.5	---	---	---	---
Acenaphthene	83-32-9	0.5	---	---	---	---
Fluorene	86-73-7	0.5	---	---	---	---
Phenanthrene	85-01-8	0.5	---	---	---	---
Anthracene	120-12-7	0.5	---	---	---	---

Soil Classification Analysis for General Fill Disposal

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Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID							
Compound	CAS Number	LOR	Sampling date / time	Unit	D5 + D2	D7 + D8	INTRA DUPLICATE		
					06-Sep-2021 17:40 ES2132828-011	06-Sep-2021 17:40 ES2132828-012	06-Sep-2021 00:00 ES2132828-013	Result	Result
EP075(SIM): Polynuclear Aromatic Hydrocarbons - Continued									
Fluoranthene	206-44-0	0.5		mg/kg	<0.5	---	---	---	---
Pyrene	129-00-0	0.5		mg/kg	<0.5	---	---	---	---
Benz(a)anthracene	56-55-3	0.5		mg/kg	<0.5	---	---	---	---
Chrysene	218-01-9	0.5		mg/kg	<0.5	---	---	---	---
Benzof(b)fluoranthene	206-99-2	0.5		mg/kg	<0.5	---	---	---	---
Benzok(i)fluoranthene	207-04-9	0.5		mg/kg	<0.5	---	---	---	---
Benzof(e)pyrene	90-32-8	0.5		mg/kg	<0.5	---	---	---	---
Indeno(1,2,3-cd)pyrene	193-39-5	0.5		mg/kg	<0.5	---	---	---	---
Dibenz(a,h)anthracene	53-70-3	0.5		mg/kg	<0.5	---	---	---	---
Benzof(g,h,i)perylene	191-24-2	0.5		mg/kg	<0.5	---	---	---	---
* Sum of polycyclic aromatic hydrocarbons									
* Benzof(a)pyrene TEQ (zero)									
* Benzof(a)pyrene TEQ (half LOR)									
* Benzof(a)pyrene TEQ (LOR)									
EP075A: Phenolic Compounds (Halogenated)									
2-Chlorophenol	95-57-8	0.03		mg/kg	---	---	<0.03	---	---
2,4-Dichlorophenol	120-83-2	0.03		mg/kg	---	---	<0.03	---	---
2,6-Dichlorophenol	87-65-0	0.03		mg/kg	---	---	<0.03	---	---
4-Chloro-3-methylphenol	59-50-7	0.03		mg/kg	---	---	<0.03	---	---
2,4,6-Trichlorophenol	95-95-4	0.05		mg/kg	---	---	<0.05	---	---
2,4,6-Trichlorophenol	88-06-2	0.05		mg/kg	---	---	<0.05	---	---
2,3,5,6-Tetrachlorophenol	935-95-5	0.03		mg/kg	---	---	<0.03	---	---
2,3,4,5,6-Pentachlorophenol	4901-51-3	0.05		mg/kg	---	---	<0.05	---	---
* Sum of Phenols (halogenated)									
EP075A: Phenolic Compounds (Non-halogenated)									
Phenol	108-95-2	1		mg/kg	---	---	<1	---	---
2-Methylphenol	95-48-7	1		mg/kg	---	---	<1	---	---
3- & 4-Methylphenol	1319-77-3	1		mg/kg	---	---	<1	---	---
2-Nitrophenol	88-75-5	1		mg/kg	---	---	<1	---	---
2,4-Dimethylphenol	105-67-9	1		mg/kg	---	---	<1	---	---
2,4-Dinitrophenol	51-28-5	5		mg/kg	---	---	<5	---	---
4-Nitrophenol	100-02-7	5		mg/kg	---	---	<5	---	---
2-Methyl-4,6-dinitrophenol	8071-51-0	5		mg/kg	---	---	<5	---	---

Soil Classification Analysis for General Fill Disposal

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Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		D5 + D2		D7 + D8		INTRA DUPLICATE	
Compound	CAS Number	LOR	Unit	06-Sep-2021 17:40 ES2132628-011 Result	06-Sep-2021 17:40 ES2132628-012 Result	06-Sep-2021 17:40 ES2132628-013 Result	06-Sep-2021 17:40 ES2132628-014 Result	06-Sep-2021 17:40 ES2132628-015 Result	06-Sep-2021 17:40 ES2132628-016 Result
EP075A: Phenolic Compounds (Non-halogenated) - Continued									
Dinitrobenzyl	88-85-7	5	mg/kg	---	---	---	---	---	---
2-Cyclohexyl-4,6-Dinitrophenol	131-89-5	5	mg/kg	---	---	---	---	---	---
^ Sum of Phenols (non-halogenated)	---	1	mg/kg	---	---	---	---	---	---
EP075B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg	---	---	---	---	---	---
Acenaphthene	83-32-9	0.5	mg/kg	---	---	---	---	---	---
Acenaphthylene	208-96-8	0.5	mg/kg	---	---	---	---	---	---
Fluorene	86-73-7	0.5	mg/kg	---	---	---	---	---	---
Phenanthrene	85-01-8	0.5	mg/kg	---	---	---	---	---	---
Anthracene	120-12-7	0.5	mg/kg	---	---	---	---	---	---
Fluoranthene	206-44-0	0.5	mg/kg	---	---	---	---	---	---
Pyrene	129-00-0	0.5	mg/kg	---	---	---	---	---	---
Benzo[a]anthracene	56-55-3	0.5	mg/kg	---	---	---	---	---	---
Chrysene	218-01-9	0.5	mg/kg	---	---	---	---	---	---
Benzo[b]furanthene	205-99-2	1.0	mg/kg	---	---	---	---	---	---
Benzo[a]pyrene	50-32-8	0.5	mg/kg	---	---	---	---	---	---
Indeno[1,2,3-cd]pyrene	183-39-5	0.5	mg/kg	---	---	---	---	---	---
Dibenz[a,h]anthracene	53-70-3	0.5	mg/kg	---	---	---	---	---	---
Benzo[g,h,i]perylene	191-24-2	0.5	mg/kg	---	---	---	---	---	---
^ Sum of polycyclic aromatic hydrocarbons	---	0.5	mg/kg	---	---	---	---	---	---
^ Benzo[a]pyrene TEQ (zero)	---	0.5	mg/kg	---	---	---	---	---	---
^ Benzo[a]pyrene TEQ (half LOR)	---	0.5	mg/kg	---	---	---	---	---	---
^ Benzo[a]pyrene TEQ (LOR)	---	0.5	mg/kg	---	---	---	---	---	---
EP075I: Organochlorine Pesticides									
alpha-BHC	319-84-6	0.03	mg/kg	---	---	---	---	---	---
Hexachlorobenzene (HCB)	116-74-1	0.03	mg/kg	---	---	---	---	---	---
beta-BHC	319-85-7	0.03	mg/kg	---	---	---	---	---	---
gamma-BHC	58-80-9	0.03	mg/kg	---	---	---	---	---	---
delta-BHC	319-86-8	0.03	mg/kg	---	---	---	---	---	---
Heptachlor	76-44-8	0.03	mg/kg	---	---	---	---	---	---
Aldrin	309-00-2	0.03	mg/kg	---	---	---	---	---	---
Heptachlor epoxide	1024-57-3	0.03	mg/kg	---	---	---	---	---	---
cis-Chlordane	5103-71-9	0.03	mg/kg	---	---	---	---	---	---

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Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		Sampling date / time		D5 + D2		D7 + D8		INTRA DUPLICATE			
Compound	CAS Number	LOR	Unit	06-Sep-2021 17:40	06-Sep-2021 17:40	06-Sep-2021 17:40	06-Sep-2021 17:40	06-Sep-2021 17:40	06-Sep-2021 17:40	06-Sep-2021 00:00	06-Sep-2021 00:00	Result	Result
EP0751: Organochlorine Pesticides - Continued													
trans-Chlordane	5103-74-2	0.03	mg/kg	---	---	---	---	---	---	---	---	<0.03	---
Endosulfan 1	959-98-8	0.03	mg/kg	---	---	---	---	---	---	---	---	<0.03	---
4,4'-DDE	72-55-9	0.05	mg/kg	---	---	---	---	---	---	---	---	<0.05	---
Dieldrin	60-57-1	0.03	mg/kg	---	---	---	---	---	---	---	---	<0.03	---
Endrin aldehyde	7421-93-4	0.03	mg/kg	---	---	---	---	---	---	---	---	<0.03	---
Endrin	72-20-8	0.03	mg/kg	---	---	---	---	---	---	---	---	<0.03	---
Endosulfan 2	33213-65-9	0.03	mg/kg	---	---	---	---	---	---	---	---	<0.03	---
4,4'-DDD	72-54-8	0.05	mg/kg	---	---	---	---	---	---	---	---	<0.05	---
Endosulfan sulfate	1031-07-8	0.03	mg/kg	---	---	---	---	---	---	---	---	<0.03	---
4,4'-DDT	50-29-3	0.05	mg/kg	---	---	---	---	---	---	---	---	<0.05	---
Methoxychlor	72-43-5	0.03	mg/kg	---	---	---	---	---	---	---	---	<0.03	---
^ Sum of organochlorine pesticides													
^ Sum of Aldrin + Dieldrin													
^ Sum of DDD + DDE + DDT													
0.2													
Chlordane	57-74-9	0.03	mg/kg	---	---	---	---	---	---	---	---	<0.03	---
^ Sum of other organochlorine pesticides													
0.03													
EP080071: Total Petroleum Hydrocarbons													
C6 - C9 Fraction	---	10	mg/kg	---	<10	---	<10	---	<10	---	---	---	---
C6 - C9 Fraction	---	10	mg/kg	---	---	---	---	---	---	---	---	<10	---
C10 - C14 Fraction	---	50	mg/kg	---	<50	---	<50	---	<50	---	---	---	---
C10 - C14 Fraction	---	50	mg/kg	---	---	---	---	---	---	---	---	<50	---
C6 - C10 Fraction	C6_C10	10	mg/kg	---	---	---	---	---	---	---	---	<10	---
C15 - C28 Fraction	---	100	mg/kg	---	600	---	600	---	260	---	---	---	---
C15 - C28 Fraction	---	100	mg/kg	---	---	---	---	---	---	---	---	<100	---
C29 - C36 Fraction	---	100	mg/kg	---	<100	---	<100	---	<100	---	---	---	---
C29 - C36 Fraction	---	100	mg/kg	---	---	---	---	---	---	---	---	<100	---
C10 - C36 Fraction (sum)	---	50	mg/kg	---	600	---	600	---	260	---	---	---	---
C10 - C36 Fraction (sum)	---	50	mg/kg	---	---	---	---	---	---	---	---	<50	---
EP080071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions													
C6 - C10 Fraction	C6_C10	10	mg/kg	---	<10	---	<10	---	<10	---	---	---	---
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	---	<10	---	<10	---	<10	---	---	---	---
>C10 - C16 Fraction	---	50	mg/kg	---	110	---	110	---	50	---	---	---	---
>C10 - C16 Fraction	---	50	mg/kg	---	---	---	---	---	---	---	---	<50	---

Page : 21 of 24
 Work Order : ES2132828
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen - Soil Testing



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		Sampling date / time		D5 + D2		D7 + D8		INTRA DUPLICATE		Result	
Compound	CAS Number	LOR	Unit	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
EP060-071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued													
>C16 - C34 Fraction	---	100	mg/kg	520	---	230	---	---	---	---	---	---	---
>C16 - C34 Fraction	---	100	mg/kg	---	---	---	---	---	---	---	---	---	---
>C34 - C40 Fraction	---	100	mg/kg	<100	---	<100	---	---	---	---	---	---	---
>C34 - C40 Fraction	---	100	mg/kg	---	---	---	---	---	---	---	---	---	---
^ >C10 - C40 Fraction (sum)	---	50	mg/kg	630	---	280	---	---	---	---	---	---	---
^ >C10 - C40 Fraction (sum)	---	50	mg/kg	---	---	---	---	---	---	---	---	---	---
^ >C10 - C16 Fraction minus Naphthalene (F2)	---	50	mg/kg	110	---	50	---	---	---	---	---	---	---
>C10 - C16 Fraction minus Naphthalene (F2)	---	50	mg/kg	---	---	---	---	---	---	---	---	---	---
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	---	---	---	---	---	---	---	---	---	---
EP060- BTEXN													
Benzene	71-43-2	0.2	mg/kg	<0.2	---	<0.2	---	---	---	---	---	---	---
Toluene	108-88-3	0.5	mg/kg	<0.5	---	<0.5	---	---	---	---	---	---	---
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	---	<0.5	---	---	---	---	---	---	---
meta- & para-Xylene	106-38-3 106-42-3	0.5	mg/kg	<0.5	---	<0.5	---	---	---	---	---	---	---
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	---	<0.5	---	---	---	---	---	---	---
^ Sum of BTEX	---	0.2	mg/kg	<0.2	---	<0.2	---	---	---	---	---	---	---
^ Total Xylenes	---	0.5	mg/kg	<0.5	---	<0.5	---	---	---	---	---	---	---
Naphthalene	91-20-3	1	mg/kg	<1	---	<1	---	---	---	---	---	---	---
EP066S: PCB Surrogate													
Decachlorobiphenyl	2061-24-3	0.1	%	---	---	---	---	---	---	---	---	---	---
EP074S: VOC Surrogates (Ultra-Trace)													
1,2-Dichloroethane-D4	17060-07-0	0.1	%	---	---	---	---	---	---	---	---	---	---
Toluene-D8	2037-26-5	0.1	%	---	---	---	---	---	---	---	---	---	---
4-Bromofluorobenzene	460-00-4	0.1	%	---	---	---	---	---	---	---	---	---	---
EP075(SIM)S: Phenolic Compound Surrogates													
Phenol-d6	13127-88-3	0.5	%	92.3	---	---	---	---	---	---	---	---	---
2-Chlorophenol-D4	93951-73-6	0.5	%	92.2	---	---	---	---	---	---	---	---	---
2,4,6-Tribromophenol	118-79-6	0.5	%	77.1	---	---	---	---	---	---	---	---	---
EP075(SIM)T: PAH Surrogates													
2-Fluorobiphenyl	321-60-8	0.5	%	161	---	---	---	---	---	---	---	---	---
Anthracene-d10	1719-06-8	0.5	%	97.2	---	---	---	---	---	---	---	---	---

Soil Classification Analysis for General Fill Disposal

Page: 22 of 24
 Work Order: ES2132828
 Client: LOW ECOLOGICAL SERVICES
 Project: Glen Helen - Soil Testing



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		Sampling date / time		D5 + D2		D7 + D8		INTRA DUPLICATE			
Compound	CAS Number	LOR	Unit	06-Sep-2021 17:40	06-Sep-2021 17:40	06-Sep-2021 17:40	06-Sep-2021 17:40	06-Sep-2021 17:40	06-Sep-2021 17:40	06-Sep-2021 00:00	06-Sep-2021 00:00	06-Sep-2021 00:00	06-Sep-2021 00:00
				ES2132828-011	ES2132828-012	ES2132828-013	ES2132828-013	ES2132828-013	ES2132828-013	ES2132828-013	ES2132828-013	ES2132828-013	ES2132828-013
Result													
EP075(SIM)T: PAH Surrogates - Continued													
4-Terphenyl-d14	1718-51-0	0.5	%	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5
EP075S: Acid Extractable Surrogates (Waste Classification)													
Phenol-d6	13127-88-3	0.025	%	87.1	87.1	87.1	87.1	87.1	87.1	87.1	87.1	87.1	87.1
2-Chlorophenol-D4	93951-73-6	0.025	%	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0
2,4,6-Tribromophenol	115-79-6	0.025	%	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2	84.2
EP075T: Base/Neutral Extractable Surrogates (Waste Classification)													
Nitrobenzene-D5	4165-60-0	0.025	%	81.4	81.4	81.4	81.4	81.4	81.4	81.4	81.4	81.4	81.4
1,2-Dichlorobenzene-D4	2199-69-1	0.025	%	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0
2-Fluorobiphenyl	321-60-8	0.025	%	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3
Anthracene-d10	1719-06-8	0.025	%	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4	87.4
4-Terphenyl-d14	1718-51-0	0.025	%	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6
EP080S: TPH(V)BTEX Surrogates													
1,2-Dichloroethane-D4	17060-07-0	0.2	%	116	116	116	116	116	116	116	116	116	116
Toluene-D8	2037-26-5	0.2	%	101	101	101	101	101	101	101	101	101	101
4-Bromofluorobenzene	460-00-4	0.2	%	103	103	103	103	103	103	103	103	103	103

Soil Classification Analysis for General Fill Disposal

Page : 23 of 24
 Work Order : ES2132828
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen - Soil Testing



Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	41	122
EP074S: VOC Surrogates (Ultra-Trace)			
1,2-Dichloroethane-D4	17060-07-0	59	119
Toluene-D8	2037-26-5	55	117
4-Bromofluorobenzene	450-00-4	59	123
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2,4,6-Tribromophenol	118-79-6	40	136
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	126
4-Terphenyl-d14	1718-51-0	65	129
EP075S: Acid Extractable Surrogates (Waste Classification)			
Phenol-d6	13127-88-3	63	134
2-Chlorophenol-D4	93951-73-6	60	125
2,4,6-Tribromophenol	118-79-6	54	129
EP075T: Base/Neutral Extractable Surrogates (Waste Classification)			
Nitrobenzene-D5	4165-60-0	63	131
1,2-Dichlorobenzene-D4	2199-69-1	61	124
2-Fluorobiphenyl	321-60-8	69	131
Anthracene-d10	1719-06-8	70	133
4-Terphenyl-d14	1718-51-0	59	141
EP080S: TPH(V)BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	450-00-4	72	130

Page : 24 of 24
Work Order : ES2132828
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Soil Testing



Inter-Laboratory Testing

Analysis conducted by ALS Melbourne, NATA accreditation no. 825, site no. 13778 (Chemistry).

- (SOIL) EP074A: Monoaromatic Hydrocarbons
- (SOIL) EP074H: Naphthalene
- (SOIL) EP074S: VOC Surrogates (Ultra-Trace)
- (SOIL) EG048: Hexavalent Chromium (Alkaline Digest)
- (SOIL) EK026SF: Total CN by Segmented Flow Analyser
- (SOIL) EK040T: Fluoride Total
- (SOIL) EP066: Polychlorinated Biphenyls (PCB)
- (SOIL) EP066S: PCB Surrogate
- (SOIL) EP074I: Volatile Halogenated Compounds
- (SOIL) EP075B: Polynuclear Aromatic Hydrocarbons
- (SOIL) EP075I: Organochlorine Pesticides
- (SOIL) EP075A: Phenolic Compounds (Non-halogenated)
- (SOIL) EP075A: Phenolic Compounds (Halogenated)
- (SOIL) EP075T: Base/Neutral Extractable Surrogates (Waste Classification)
- (SOIL) EP075S: Acid Extractable Surrogates (Waste Classification)
- (SOIL) EA001: pH in soil using 0.01M CaCl₂ extract

Analysis conducted by ALS Melbourne, NATA accreditation no. 825, site no. 13778 (Chemistry). Only applies to samples ES2132828 (001, 006, 013).

- (SOIL) EP080071: Total Petroleum Hydrocarbons
- (SOIL) EP080071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions
- (SOIL) EA055: Moisture Content (Dried @ 105-110°C)
- (SOIL) EG005(ED093)T: Total Metals by ICP-AES
- (SOIL) EG035T: Total Recoverable Mercury by FIMS

Appendix C - Eurofins Environmental Certificate of Analysis



Environment Testing

Certificate of Analysis

IOW Low Ecological Services
Lot 1858 Isotoma Road
Alice Springs
NT 0870



NATA Accredited
Accreditation Number 1281
Site Number 18217

Accepted for compliance with ISO/IEC 17025 - Testing
NATA is a signatory to the ILAC Mutual Recognition
Arrangement for the mutual recognition of the
equivalence of testing, medical testing, calibration,
inspection, proficiency testing, scheme providers and
reference materials producers reports and certificates.

Attention: Bill Low

Report 825639-S
Project name GLEN HELEN - SOIL TESTING
Received Date Sep 14, 2021

Client Sample ID			INTER DUPLICATE
Sample Matrix			Soil
Eurofins Sample No.			S21-S037977
Date Sampled			Not Provided ^{1,2}
Test/Reference	LOR	Unit	
Total Recoverable Hydrocarbons			
TRH C6-C9	20	mg/kg	< 20
TRH C10-C14	20	mg/kg	< 20
TRH C15-C28	50	mg/kg	< 50
TRH C29-C36	50	mg/kg	< 50
TRH C10-C36 (Total)	50	mg/kg	< 50
Naphthalene ^{NOI}	0.5	mg/kg	< 0.5
TRH C6-C10	20	mg/kg	< 20
TRH C6-C10 less BTEX (F1) ^{NOI}	20	mg/kg	< 20
TRH >C10-C16	50	mg/kg	< 50
TRH >C10-C16 less Naphthalene (F2) ^{NOI}	50	mg/kg	< 50
TRH >C15-C34	100	mg/kg	< 100
TRH >C34-C40	100	mg/kg	< 100
TRH >C10-C40 (Total)*	100	mg/kg	< 100
Volatile Halogenated Compounds (VHC)			
Hexachlorobutadiene	0.5	mg/kg	< 0.5
Volatile Organics			
1,1-Dichloroethane	0.5	mg/kg	< 0.5
1,2,4-Trichlorobenzene	0.5	mg/kg	< 0.5
1,1-Dichloroethene	0.5	mg/kg	< 0.5
1,1,1-Trichloroethane	0.5	mg/kg	< 0.5
1,1,1,2-Tetrachloroethane	0.5	mg/kg	< 0.5
1,1,2-Trichloroethane	0.5	mg/kg	< 0.5
1,1,2,2-Tetrachloroethane	0.5	mg/kg	< 0.5
1,2-Dibromoethane	0.5	mg/kg	< 0.5
1,2-Dichlorobenzene	0.5	mg/kg	< 0.5
1,2-Dichloroethane	0.5	mg/kg	< 0.5
1,2-Dichloropropane	0.5	mg/kg	< 0.5
1,2,3-Trichloropropane	0.5	mg/kg	< 0.5
1,2,4-Trimethylbenzene	0.5	mg/kg	< 0.5
1,3-Dichlorobenzene	0.5	mg/kg	< 0.5
1,3-Dichloropropane	0.5	mg/kg	< 0.5
1,3,5-Trimethylbenzene	0.5	mg/kg	< 0.5
1,4-Dichlorobenzene	0.5	mg/kg	< 0.5
2-Butanone (MEK)	0.5	mg/kg	< 0.5
2-Propanone (Acetone)	0.5	mg/kg	< 0.5
4-Chlorotoluene	0.5	mg/kg	< 0.5

Date Reported: Sep 23, 2021

Eurofins Environment Testing Ltd F3, Building F, 18 Mars Road, Lane Cove West, NSW Australia, 2066
ABN: 50 005 085 621 Telephone: +61 2 9900 8400

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Report Number: 825639-S



Environment Testing

Client Sample ID			INTER DUPLICATE
Sample Matrix			Soil
Eurofins Sample No.			S21-S037977
Date Sampled			Not Provided ¹²
Test/Reference	LOR	Unit	
Volatile Organics			
4-Methyl-2-pentanone (MIBK)	0.5	mg/kg	< 0.5
Allyl chloride	0.5	mg/kg	< 0.5
Benzene	0.1	mg/kg	< 0.1
Bromobenzene	0.5	mg/kg	< 0.5
Bromochloromethane	0.5	mg/kg	< 0.5
Bromodichloromethane	0.5	mg/kg	< 0.5
Bromoform	0.5	mg/kg	< 0.5
Bromomethane	0.5	mg/kg	< 0.5
Carbon disulfide	0.5	mg/kg	< 0.5
Carbon Tetrachloride	0.5	mg/kg	< 0.5
Chlorobenzene	0.5	mg/kg	< 0.5
Chloroethane	0.5	mg/kg	< 0.5
Chloroform	0.5	mg/kg	< 0.5
Chloromethane	0.5	mg/kg	< 0.5
cis-1,2-Dichloroethene	0.5	mg/kg	< 0.5
cis-1,3-Dichloropropene	0.5	mg/kg	< 0.5
Dibromochloromethane	0.5	mg/kg	< 0.5
Dibromomethane	0.5	mg/kg	< 0.5
Dichlorodifluoromethane	0.5	mg/kg	< 0.5
Ethylbenzene	0.1	mg/kg	< 0.1
Iodomethane	0.5	mg/kg	< 0.5
Isopropyl benzene (Cumene)	0.5	mg/kg	< 0.5
m&p-Xylenes	0.2	mg/kg	< 0.2
Methylene Chloride	0.5	mg/kg	< 0.5
o-Xylene	0.1	mg/kg	< 0.1
Styrene	0.5	mg/kg	< 0.5
Tetrachloroethene	0.5	mg/kg	< 0.5
Toluene	0.1	mg/kg	< 0.1
trans-1,2-Dichloroethene	0.5	mg/kg	< 0.5
trans-1,3-Dichloropropene	0.5	mg/kg	< 0.5
Trichloroethene	0.5	mg/kg	< 0.5
Trichlorofluoromethane	0.5	mg/kg	< 0.5
Vinyl chloride	0.5	mg/kg	< 0.5
Xylenes - Total*	0.3	mg/kg	< 0.3
Total MAH*	0.5	mg/kg	< 0.5
Vic EPA IWRG 621 CHC (Total)*	0.5	mg/kg	< 0.5
Vic EPA IWRG 621 Other CHC (Total)*	0.5	mg/kg	< 0.5
4-Bromofluorobenzene (surr.)	1	%	117
Toluene-d8 (surr.)	1	%	111
Polycyclic Aromatic Hydrocarbons			
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2
Acenaphthene	0.5	mg/kg	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5
Anthracene	0.5	mg/kg	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5
Benzo(b)fluoranthene ¹⁰⁷	0.5	mg/kg	< 0.5



Environment Testing

Client Sample ID			INTER DUPLICATE
Sample Matrix			Soil
Eurofins Sample No.			\$21-5637977
Date Sampled			Not Provided ¹²
Test/Reference	LOR	Unit	
Polycyclic Aromatic Hydrocarbons			
Benzo(g,h,i)perylene	0.5	mg/kg	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5
Chrysene	0.5	mg/kg	< 0.5
Dibenz(a,h)anthracene	0.5	mg/kg	< 0.5
Fluoranthene	0.5	mg/kg	< 0.5
Fluorene	0.5	mg/kg	< 0.5
Indeno(1,2,3-cd)pyrene	0.5	mg/kg	< 0.5
Naphthalene	0.5	mg/kg	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5
Pyrene	0.5	mg/kg	< 0.5
Total PAH*	0.5	mg/kg	< 0.5
2-Fluorobiphenyl (surr.)	1	%	110
p-Terphenyl-d14 (surr.)	1	%	87
Organochlorine Pesticides			
Chlordane - Total	0.1	mg/kg	< 0.1
4,4'-DDD	0.05	mg/kg	< 0.05
4,4'-DDE	0.05	mg/kg	< 0.05
4,4'-DDT	0.05	mg/kg	< 0.05
α-HCH	0.05	mg/kg	< 0.05
Aldrin	0.05	mg/kg	< 0.05
β-HCH	0.05	mg/kg	< 0.05
δ-HCH	0.05	mg/kg	< 0.05
Dieldrin	0.05	mg/kg	< 0.05
Endosulfan I	0.05	mg/kg	< 0.05
Endosulfan II	0.05	mg/kg	< 0.05
Endosulfan sulphate	0.05	mg/kg	< 0.05
Endrin	0.05	mg/kg	< 0.05
Endrin aldehyde	0.05	mg/kg	< 0.05
Endrin ketone	0.05	mg/kg	< 0.05
γ-HCH (Lindane)	0.05	mg/kg	< 0.05
Heptachlor	0.05	mg/kg	< 0.05
Heptachlor epoxide	0.05	mg/kg	< 0.05
Hexachlorobenzene	0.05	mg/kg	< 0.05
Methoxychlor	0.05	mg/kg	< 0.05
Toxaphene	0.5	mg/kg	< 0.5
Aldrin and Dieldrin (Total)*	0.05	mg/kg	< 0.05
DDT + DDE + DDD (Total)*	0.05	mg/kg	< 0.05
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	< 0.1
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	< 0.1
Di-butylchlorodate (surr.)	1	%	95
Tetrachloro-m-xylene (surr.)	1	%	101
Polychlorinated Biphenyls			
Aroclor-1016	0.1	mg/kg	< 0.1
Aroclor-1221	0.1	mg/kg	< 0.1
Aroclor-1232	0.1	mg/kg	< 0.1
Aroclor-1242	0.1	mg/kg	< 0.1
Aroclor-1248	0.1	mg/kg	< 0.1
Aroclor-1254	0.1	mg/kg	< 0.1
Aroclor-1260	0.1	mg/kg	< 0.1



Environment Testing

Client Sample ID			INTER DUPLICATE
Sample Matrix			Soil
Eurofins Sample No.			S21-Sa37977
Date Sampled			Not Provided ⁽¹²⁾
Test/Reference	LOR	Unit	
Polychlorinated Biphenyls			
Total PCB*	0.1	mg/kg	< 0.1
Dibutylchlorodate (surr.)	1	%	95
Tetrachloro-m-xylene (surr.)	1	%	101
Phenols (Halogenated)			
2-Chlorophenol	0.5	mg/kg	< 0.5
2,4-Dichlorophenol	0.5	mg/kg	< 0.5
2,4,5-Trichlorophenol	1	mg/kg	< 1
2,4,6-Trichlorophenol	1	mg/kg	< 1
2,6-Dichlorophenol	0.5	mg/kg	< 0.5
4-Chloro-3-methylphenol	1	mg/kg	< 1
Pentachlorophenol	1	mg/kg	< 1
Tetrachlorophenols - Total	10	mg/kg	< 10
Total Halogenated Phenol*	1	mg/kg	< 1
Phenols (non-Halogenated)			
2-Cyclohexyl-4,6-dinitrophenol	20	mg/kg	< 20
2-Methyl-4,6-dinitrophenol	5	mg/kg	< 5
2-Nitrophenol	1	mg/kg	< 1
2,4-Dimethylphenol	0.5	mg/kg	< 0.5
2,4-Dinitrophenol	5	mg/kg	< 5
2-Methylphenol (o-Cresol)	0.2	mg/kg	< 0.2
3&4-Methylphenol (m&p-Cresol)	0.4	mg/kg	< 0.4
Total cresols*	0.5	mg/kg	< 0.5
4-Nitrophenol	5	mg/kg	< 5
Dinoseb	20	mg/kg	< 20
Phenol	0.5	mg/kg	< 0.5
Phenol-d6 (surr.)	1	%	94
Total Non-Halogenated Phenol*	20	mg/kg	< 20
Chromium (hexavalent)			
Chromium (hexavalent)	1	mg/kg	< 1
Cyanide (total)			
Cyanide (total)	1	mg/kg	< 1
Fluoride (Total)			
Fluoride (Total)	100	mg/kg	120
pH (1:5 Aqueous extract at 25°C as rec.)			
pH (1:5 Aqueous extract at 25°C as rec.)	0.1	pH Units	7.7
% Moisture			
% Moisture	1	%	2.7
Heavy Metals			
Arsenic	2	mg/kg	2.1
Cadmium	0.4	mg/kg	< 0.4
Chromium	5	mg/kg	18
Copper	5	mg/kg	12
Lead	5	mg/kg	14
Mercury	0.1	mg/kg	< 0.1
Molybdenum	5	mg/kg	< 5
Nickel	5	mg/kg	10
Selenium	2	mg/kg	< 2
Silver	2	mg/kg	< 2
Tin	10	mg/kg	< 10
Zinc	5	mg/kg	34



Environment Testing

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 1999 NEPM Fractions - Method: LTM-ORG-2010 TRH C6-C40	Sydney	Sep 21, 2021	14 Days
Total Recoverable Hydrocarbons - 2013 NEPM Fractions - Method: LTM-ORG-2010 TRH C6-C40	Sydney	Sep 21, 2021	14 Days
Total Recoverable Hydrocarbons - 2013 NEPM Fractions - Method: LTM-ORG-2010 TRH C6-C40	Sydney	Sep 21, 2021	14 Days
Volatile Halogenated Compounds (VHC) - Method: E016 Volatile Halogenated Compounds (VHC)	Sydney	Sep 21, 2021	7 Days
Volatile Organics - Method: LTM-ORG-2150 VOCs in Soils Liquid and other Aqueous Matrices	Sydney	Sep 21, 2021	7 Days
Polycyclic Aromatic Hydrocarbons - Method: LTM-ORG-2130 PAH and Phenols in Soil and Water	Sydney	Sep 21, 2021	14 Days
Organochlorine Pesticides - Method: LTM-ORG-2220 OCP & PCB in Soil and Water	Sydney	Sep 21, 2021	14 Days
Polychlorinated Biphenyls - Method: LTM-ORG-2220 OCP & PCB in Soil and Water	Sydney	Sep 21, 2021	28 Days
Phenols (Halogenated) - Method: LTM-ORG-2130 PAH and Phenols in Soil and Water	Sydney	Sep 21, 2021	14 Days
Phenols (non-Halogenated) - Method: LTM-ORG-2130 PAH and Phenols in Soil and Water	Sydney	Sep 21, 2021	14 Days
Chromium (hexavalent) - Method: In-house method E057.2	Sydney	Sep 21, 2021	28 Days
Cyanide (total) - Method: E054 Total Cyanide	Sydney	Sep 21, 2021	14 Days
Fluoride (Total) - Method: LTM-INO-4150 Determination of Total Fluoride PART B - ISE	Melbourne	Sep 22, 2021	28 Days
pH (1:5 Aqueous extract at 25°C as rec.) - Method: LTM-GEN-7090 pH by ISE	Sydney	Sep 21, 2021	7 Days
Metals IWRG 621 : Metals M12 - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Sydney	Sep 21, 2021	28 Days
% Moisture - Method: LTM-GEN-7060 Moisture	Sydney	Sep 18, 2021	14 Days

APPENDIX G

Glen Helen Lodge Discovery Parks Fuel Contamination from Underground Petroleum Storage System: Investigation and Remediation Report (LES, 2022)



Glen Helen Lodge Discovery Parks

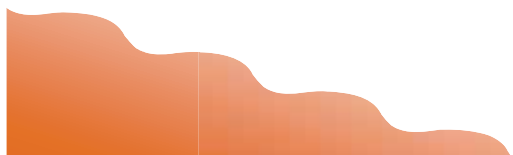


Fuel systems at edge of carpark prior to removal

Fuel Contamination from Underground Petroleum Storage System: Investigation and Remediation Report

March 2022

Report prepared by Kristen Grant and Katelyn Douglass



Low Ecological Services P/L
PO Box 3130, Alice Springs, NT 0871
Ph: (08) 89 555 222
Email: lowecol@lowecol.com.au
Web: www.lowecol.com.au



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DISCLAIMER

This document has been prepared by Low Ecological Services (LES) for Ngurratjuta Aboriginal Corporation. LES has prepared this document using the skill and care expected from professional scientists to provide factual and technical information and reasonable solutions to identified risks. It does not constitute legal advice.

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EXECUTIVE SUMMARY

Glen Helen Lodge is located in the West MacDonnell Ranges 130 km west of Alice Springs. In 2020, prior to the purchase of Glen Helen Resort from Ngurratjuta/Pmara Ntjarra Aboriginal Corporation (Ngurratjuta), Discovery Parks (DP) undertook a due diligence assessment (DD) of the Lodge and Freehold Lot. Consequently, in October 2020 DP commissioned Low Ecological Services (LES) to assess the environmental aspects including soil hydrocarbon contamination from the fuel sales systems. The DD raised a potential issue with leaking fuel from the Underground Storage Tanks (UST) and/or associated plumbing from the Underground Petroleum Storage System (UPSS). In February 2021, Ngurratjuta Aboriginal Corporation commissioned Territory Electrical and Refrigeration (Territory Electrical) to examine the fuel system for leaks. This resulted in Low Ecological Services (LES) being engaged by Territory Electrical to undertake a Preliminary Site Investigation (PSI) of fuel contamination in the soil surrounding the UPSS. The PSI showed hydrocarbon contaminated soils by use of minimally invasive hand auguring around the underground tanks.

Ngurratjuta Aboriginal Corporation opted to resolve the fuel contamination risks prior to settlement of the property sale and in March 2021, contracted Territory Electrical to remove the UPSS (tanks, bowzers, fuel pipes, vents, canopy, and concrete plinths) and LES to undertake a Detailed Site Investigation (DSI) of the extent of contamination of the leaked hydrocarbons. Excavation and removal of the tanks confirmed the presence of fuel contamination under the Diesel and Opal Unleaded Petrol tanks down to bedrock. Determination of the lateral extent required a drilling rig to verify a conceptual site model of the potential depth and downslope extent of hydrocarbon from the USTs. Drilling was undertaken in April 2021.

The investigations involved desk top examination of background information (history and environmental settings), site inspections, sampling of soils in proximity to, adjacent and beneath the underground fuel tank pits, on-site testing of soil samples for fuel vapours with a Photoionization detector (PID), and laboratory analysis of selected soil, groundwater and soil vapour samples for hydrocarbons, heavy metals and volatile organic compounds (VOCs). Site investigation works and soil sampling were undertaken on 12th February, 23rd March, 28th of April and 3rd September 2021.

The PSI determined there was fuel contamination of soil immediately surrounding the Opal and Diesel underground fuel tank systems down to a rock layer or bedrock at approximately three (3) metres below ground level (mbgl). Soil around the approximately 40+ year old diesel tank had significantly higher total hydrocarbon concentration (average 20 times) than the soil around the 30+ year old Opal (unleaded) tank. Soil around a smaller decommissioned premium tank, likely 40+ years old, west of

the opal bowser, did not show signs of contamination. Phase 1 of the DSI analysed the degree of localized contamination after the fuel tanks had been removed, again confirming that contamination around the diesel tank was much higher than the contamination around the Opal tank. The old petrol tank pit was also confirmed to be uncontaminated. Phase 2 of the DSI with the drilling rig, found bedrock was less than 3.5 mbgl, no water table was present, a levy bank (likely based on rock) formed a geological gully around the tank pits, fuel contaminated soil was localized to the diesel and Opal fuel tank pits and immediate surrounds and the contamination did not extend to drill hole sample points, which were drilled down to bedrock, located 6 m to 90 m downslope of the UST pit area, along the natural drainage line.

The risks of the localized soil contamination to human health, the environment and management of the site were assessed for the current and planned use of the area of the site. Given the setting within the Tjoritja / West MacDonnell National Park, and proximity to the Finke River and Glen Helen Gorge, the potential ecological risk of leaked fuel was of greatest concern. Potential risks included:

- Impact on native vegetation health e.g. river red gums
- Potential contamination migration into Finke River waterhole and impacts on aquatic ecology and aesthetic environmental values.

Due to the ecological sensitivity of the area, in July 2021, the NT EPA issued a s48 Notice requiring the investigations, remediation and validation works to be completed under an environmental audit program under the relevant provisions of the Waste Management and Pollution Control Act 1998. Ngurratjuta commissioned Steven Kirsanovs of Kirsa Environmental, who is accredited under the Victorian EPA auditor scheme, to complete the environmental audit program. All investigations and reporting have been completed under the oversight of Mr. Kirsanovs who will eventually produce an environmental audit report as required under the s48 Notice.

Under the oversight of Mr. Kirsanovs, Phase 3 of the DSI was undertaken to confirm the posed health and ecological risks from the contamination. This phase of the investigation involved soil vapour passive sampling by use of Waterloo Membrane Samplers (WMS) deployed between the contamination sites and nearby buildings to quantify the vapour intrusion potential. Groundwater samples were also taken adjacent to the Finke River and tested for hydrocarbons to indicate if the contamination had migrated into the waterway. The WMS soil vapour results indicated that there is no vapour intrusion risk to people occupying the nearby buildings or to invasive maintenance workers

and the groundwater sample analysis detected no levels of hydrocarbons above LOR indicating that the hydrocarbon contamination had not migrated into the Finke River.

All contaminated soil excavated from around the diesel and petrol pits was placed into labelled Intermediate Bulk Containers (IBC)/soil pods and removed from site for appropriate disposal/remediation. They were temporarily stored in an Alice Springs storage yard, where they were each bulk sampled and tested for VOC vapour by use of a PID. Highly volatile soil pods were transported to Cleanaway in Adelaide for disposal/remediation. The remaining soil pods with low volatility were sampled and sent to ALS laboratories in accordance with Alice Springs Town Council (ASTC), Regional Waste Management Facility (RWMF) sampling methodology requirements for general fill analysis. The results were within General Fill Acceptable Threshold Limits. Therefore, a report was prepared outlining the sampling method and analysis results and submitted to ASTC, RWMF. Shortly after submission, the report was accepted, and the low-level contaminated soil was transported and disposed of at ASTC, RWMF. (Refer Appendix P for disposal receipt)

The diesel and petrol pits were lined and backfilled with clean imported soil. A perforated vent pipe system, designed by LES and agreed upon by Mr Kirsanovs (Auditor), was installed in both pits to increase aeration and natural remediation of the soil at the bottom of the pits.

The findings from each phase of this investigation prove that the migration of hydrocarbon contamination off site is not occurring. There is no evidence of contamination beyond the pits, all proximal soil and water samples were uncontaminated. The source of the fuel leak has been removed, pits have been lined, the consistent layer of bedrock at ~2.7 mbgl and the clay soils will limit further migration of the residual hydrocarbon contamination. Hence the ecological risk is negligible.

Furthermore, there is no risk to human health from the residual in-situ contaminated soil in the open car park area in which the tank pits are located, given the contaminated soil is deeper than 1.2 m below the ground surface. This was confirmed in the soil vapour sampler results having low vapour readings that would not pose human health risks which has been further justified using the HSL application checklist. The residual contaminated soil deeper than 1.2 m below ground surface is also not considered a concern for site management at this site for the proposed use of the area of the backfilled tank pits, as future trenching and services will be shallower.

Thus, the findings of this investigation show that the lateral and vertical extent of the residual localized contamination will not pose a risk to human health, the environment, or management of the site,

given that the current and proposed medium-term future use of this area within the site as a carpark and lawn area as agreed upon by the new land owners, Discovery Parks.

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ACRONYMS/GLOSSARY

Acronym	Definition
ALRA	Aboriginal Land Rights Act
APHA	American Public Health Association
AS	Alice Springs
BTEXN	Benzene, toluene, ethylbenzene, xylenes, and naphthalene. These are often found in unleaded fuels.
CSM	Conceptual site model (CSM) is a description of a site including the environmental setting, geological, hydrogeological and soil characteristics together with the nature and distribution of contaminants. Potentially exposed populations and exposure pathways are identified.
DSI	Detailed Site Investigation.
ESLs	Ecological screening levels (ESLs) for petroleum hydrocarbons, are the concentrations above which the NEPM recommends further appropriate investigation and evaluation will be required. They are generally applicable to the top 2 m of soil.
EPA	Environmental Protection Agency
HSLs	Health Screening Levels (HSLs) for selected petroleum compounds and fractions, applicable to assessing human health risk via the inhalation and direct contact pathways. They are the concentrations above which the NEPM recommends further appropriate investigation and evaluation will be required
F1	C6 - C10 Total Recoverable Hydrocarbons (TRH) fraction minus BTEX. Volatile Carbon chain fraction of total recoverable hydrocarbons (TRH) defined by the National Environment Protection (Assessment of Site Contamination) Measure 2013 (NEPM 2013) for contamination risk assessment. Petrol (unleaded and premium unleaded) is largely made up of C4-C12 fractions (CRC Care) and high-performance petrol with highly volatile additives are in this fraction.
F2	>C10 - C16 TRH fraction minus Naphthalene. Semi-volatile carbon chain fraction of TRH defined by NEPM 2013. Petrol (unleaded and premium unleaded) is largely made up of C4-C12 fractions and diesel fuel is predominantly comprised of C9-C21 fractions (CRC Care).
F3	>C16 – C34 TRH fraction. Non-volatile carbon chain fraction of TRH defined by NEPM 2013. Diesel fuel is predominantly comprised of C9-C21 fractions, and lubricating oils are comprised of longer carbon chain compounds >C18 (CRC Care).
F4	>C34 - C40 TRH fraction. Non-volatile carbon chain fraction of TRH defined by NEPM 2013. This fraction includes heavy oils and greases.
HSLs	Health screening levels (HSLs) for petroleum hydrocarbons are the concentrations above which the NEPM recommends further appropriate investigation and evaluation will be required. HSLs depend on physicochemical properties of soil, as these affect hydrocarbon vapour movement in soil, and the characteristics of building structures.
LOR	Limit of reporting. The lowest concentration at which laboratory analysis can detect the target substance in the sample material.
NEPM	National Environment Protection (Assessment of Site Contamination) Measure 2013 (NEPM 2013).
PID	Photoionization detector. Instrument which detects/measures VOCs. Often used to detect fuel vapours (volatile component) in soil contamination investigations.
PPM	Parts per million. Unit measure of concentration, often used for gas/air.
PSI	Preliminary Site Investigation.

TPH	Total Petroleum Hydrocarbons. A measure of the concentration of Hydrocarbons in a sample (soil or water).
TRH	Total recoverable hydrocarbons. Hydrocarbons that are recoverable from a sample via laboratory extraction with specific solvents.
UPSS	Underground Petroleum Storage System. Also refer to as underground fuel tank system(s)/pits.
US EPA	United States Environmental Protection Authority
UST	Underground Storage Tanks.
VOC	Volatile organic compound. VOCs are a group of carbon-based chemicals that easily evaporate at room temperature.
YSI	YSI is the maker of environmental monitoring instruments, sensors, software, systems, and data collection platforms for water quality monitoring and testing, and water velocity data.

1. INTRODUCTION

In June 2021, Ngurratjuta/Pmara Ntjarra Aboriginal Corporation (Ngurratjuta) sold the Glen Helen Lodge to Discovery Parks.

The Glen Helen Lodge is a tourism business located 130 km west of Alice Springs at the end of Byrnes Road off Namatjira Drive, with address 8495 Namatjira Drive, Mount Zeil, Northern Territory, on title NT Portion 830 which is 71,800 sqm. (Figures 1 & 2). The property is unzoned, Aboriginal Land (NT enhanced freehold) owned by Ngurratjuta/Pmara Ntjarra Aboriginal Corporation; the land is within the Tjoritja / West MacDonnell National Park.

The business provides motel accommodation and camping facilities with an on-site restaurant, pub, and fuel sales. The site has been owned by Ngurratjuta since 1992 and subleased to various lessors during that time. In August 2020, the Glen Helen Lodge closed to the public and ceased its fuel sales in the prospect of selling the business to Discovery Parks.

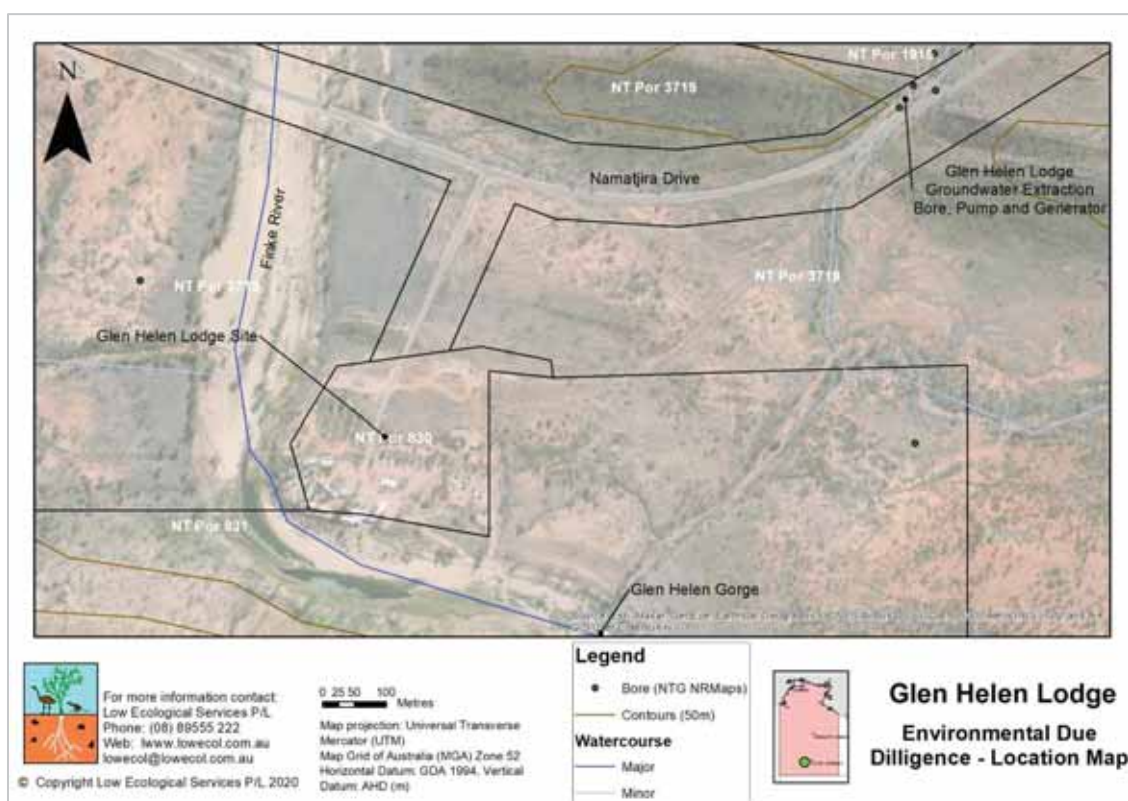


Figure 1 Location of the property

In October 2020, prior to purchase, Discovery Parks, undertook a Due Diligence assessment (DD) of the Lodge and Freehold Lot. They commissioned LES to conduct an environmental risk assessment at the site, including soil hydrocarbon contamination from fuel and supply/storage system . The DD raised the potential for fuel leaks from the Underground Storage Tanks (UST) or associated plumbing from the Underground Petroleum Storage System (UPSS). In February 2021, Ngurratjuta Aboriginal Corporation commissioned Territory Electrical to examine the fuel system for leaks and this resulted in LES being engaged by Territory Electrical, to undertake a Preliminary Site Investigation (PSI) of fuel contamination in the soil surrounding the UPSS. The results of the PSI showed hydrocarbon contaminated soils around the underground tanks and the diesel bowser.

Ngurratjuta opted to resolve the fuel contamination risks prior to settlement of the property sale and, in March 2021, contracted Territory Electrical to remove the UPSSs and LES to undertake a more detailed site investigation (DSI) of the extent of contamination by leaked hydrocarbons with a view to remediation and protection of the Glen Helen Gorge waterhole area. The excavation and removal of the fuel systems (tanks, bowsers, fuel pipes, vents, and concrete plinths) confirmed fuel leakages from the Diesel and the Opal Unleaded Petrol tanks. In April 2021, drilling was undertaken to determine the lateral extent of the potential depth and downslope of hydrocarbon .

Further investigation was undertaken to confirm negligible ecological and health risks by use of soil vapour passive samplers and groundwater sampling. Due to the ecological sensitivity of the area, the NT EPA issued a s48 Notice requiring the investigations, remediation and validation works to be completed under an environmental audit program adhering to the relevant provisions of the Waste Management and Pollution Control Act 1998. Ngurratjuta commissioned Steven Kirsanovs of Kirs Environmental, who is accredited under the Victorian EPA auditor scheme, to complete the environmental audit program. All investigations and reporting have been completed under the oversight of Mr. Kirsanovs who will eventually produce an environmental audit report as required under the s48 Notice.

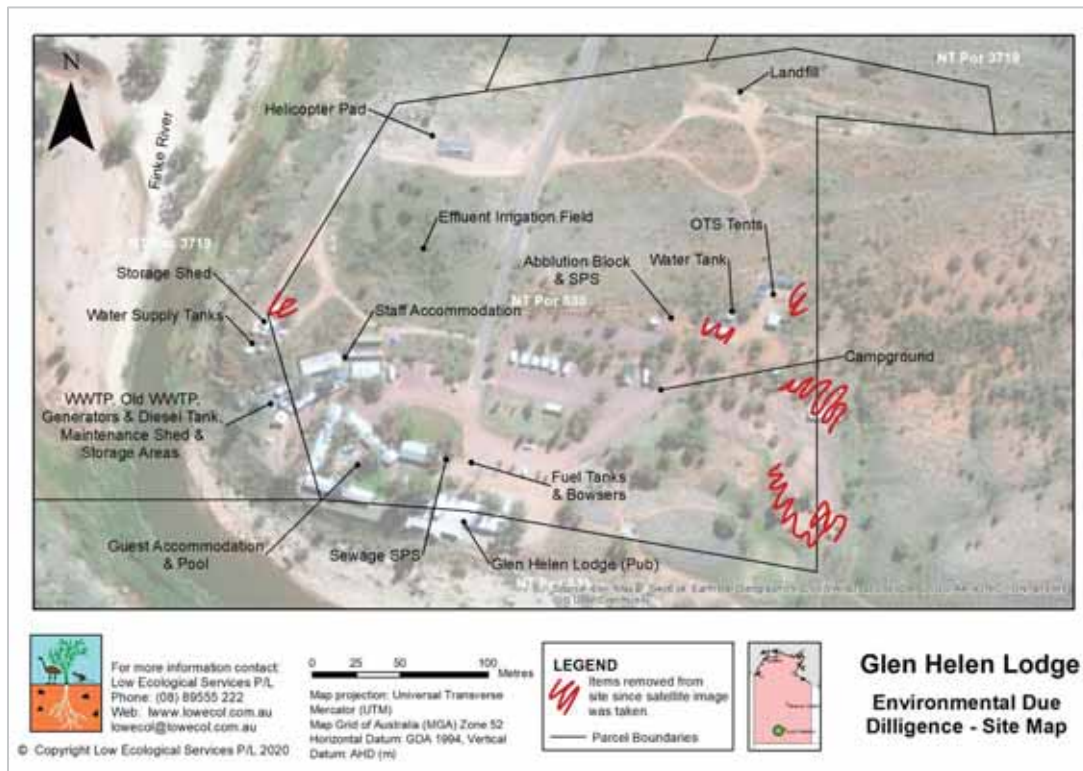


Figure 2: NT Portion 830 title boundary and fuel system location

1.1. SCOPE OF WORK

The contract required assessment of fuel contamination in the soil immediately surrounding the underground fuel tanks and whether the leaked fuel had migrated from the original point of contamination. As such the following steps were involved.

- Desktop review of site environment context and fuel systems history.
- Sample soil from the walls and base of each of the fuel tank pits after removal of the fuel systems.
- Sample soil excavated from the pits and stockpiled during tank removal works.
- Sample soils from the greater perimeter of the two (2) underground fuel tanks at various distances and depths to determine the extent of fuel migration from the source.
- Test all soil samples on-site for the presence of fuel vapours using a portable PID.
- Select representative soil samples based on location, depth, and PID vapour concentrations and analyse for the presence of hydrocarbons and heavy metals.
- Remove all contaminated soil excavated from site.
- Sample and analyse excavated soil to determine level of contamination.
- Dispose of excavated soil appropriately

- Backfill tank pits with clean imported material and install perforated vent pipes for aeration purposes.
- Deploy six passive diffusion samplers in 1.5 m deep soil bores in varying locations around the backfilled tank pits and nearby buildings and analyse samples for presence of vapour.
- Sample shallow groundwater adjacent to the Finke River and analyse samples for the presence of hydrocarbons
- Assess the risks of identified contamination and recommend remediation options.
- Provide a report on the findings of the above.

2. HISTORY OF FUEL SYSTEMS ON SITE

2.1. DIESEL SYSTEM

The diesel system was very old (pre-1992) and showed obvious signs of spillage or leakage around the bowser in its final days. The diesel tank has a safe fill volume of 4,500 L with an estimated total volume up to 5,000 L. The bottom (invert) of the underground diesel tank was measured to be 2.3 m below ground level. The diesel system (tank, bowser, fuel pipes, vent, and concrete plinths) was removed on the 23rd of March 2021 and found to be in very poor condition.

2.2. LARGE OPAL UNLEADED PETROL SYSTEM

The opal petrol system was the newest of the petrol system on the site. The installation date is unknown but was also pre-1992. The Opal tank had a safe fill volume of 11,900 L and was estimated to have a total volume of 12,300 L. The bottom (invert) of the underground tank was measured as 2.8 m below ground level. The soil around the tank was found to be contaminated with petrol. The Opal system (tank, bowser and canopy, fuel pipes, vent, and concrete plinths) was removed on the 23rd of March 2021 and was also found to be in poor condition with signs of corrosion and likely leakage points on the tank and pipework.

2.3. OLD SMALL PETROL SYSTEM

An older decommissioned petrol tank was also removed on the 23rd of March 2021. There were no signs of possible leakage points observed on this older petrol system. The tank was in good condition, likely due to the pit having been backfilled with river sand when installed, thus reducing corrosion potential.

3. ENVIRONMENTAL SETTING



Figure 3 Glen Helen Lodge contour map

3.1. SURROUNDING LAND USE

The site is surrounded by the Tjoritja / West MacDonnell National Park. The land portions within the National Park are Aboriginal Land (scheduled under ALRA (Northern Territory) 1976) owned by the Tyurretye Aboriginal Land Trust. Within the National Park, the Finke River flows from north to south, forming the western and southern boundary of the site. The iconic Glen Helen Gorge is approximately 450 m southeast of the fuel tank site (Figures 1 and 2).

3.2. SOIL AND GEOLOGY

The site is in an area with surface regolith and geology mapped as alluvial silt and sand within and adjacent to the Finke River, with the lodge built on a levy bank over sub-crop rocky ridge adjacent to the Finke River. North of the alluvium associated with the river, the surface outcropping geology is mapped as Hugh River Shale (Eh) (shale, siltstone; minor limestone). The hill to the north of the fuel system and carpark is made up of Hugh River Shale (NR Maps). Local bedrock encountered in the direct drill soil sample holes around the fuel system was also limestone and siltstone of the Hugh River Shale formation. Site soil sampling observations included:

- During original construction of the fuel tank pits, imported sand was not used for backfilling; local soil may have been used.
- The texture of the soil indicates a predominantly clay consistency, with variations to clay loam or silty clay.
- Small rock(s) were struck in all auger and drilled holes. The depth from surface to rock(s) was 2.4-3.9 m. Both the drilling rig and hand auger consistently came to rock at these depths. A layer of sparse limestone gravel occurred in the opal and diesel tank pits at about 1.8 mbgl.

3.3. STORMWATER AND SURFACE WATER

The area around each of the fuel systems slopes towards the large carpark area to the east of the tanks. Stormwater runoff flows from the carpark to the east into a vegetated lower lying area which then turns south and flows into the Finke River. Flow path of stormwater runoff to local surface drainage from the area where the fuel tanks are located are shown in Figure 4.

The Finke River nearly is an ephemeral watercourse which flows for short periods following significant rainfall events, with waterholes adjacent to the site that persist for significant periods after river flows cease. The iconic Glen Helen Gorge, downstream from the site, is a permanent waterhole and ecologically important as it is a refuge for all nine species of fish recorded in the Finke River, as well as migrating waterbirds (Tourism NT 2021). The waterhole is also a tourist attraction and people enjoy viewing the gorge as well as swimming in the waterhole. The gorge is culturally significant to the area's aboriginal Traditional Owners who believe that this inviting swimming spot is the home of an ancient and powerful Rainbow Serpent and regard it as off limits (Tourism NT 2021). River water is not extracted or used by the Lodge. The section of the Finke River adjacent to Glen Helen Lodge and the Glen Helen Gorge waterhole are typically very salty due to rock formations in the area, so have limited value as drinking water.

3.4. GROUNDWATER

There are no groundwater bores recorded on the property (NT Gov NR Maps 2020). The bores nearest to the site are observation bore RN016364 (~520m NW of fuel systems) and disused bore RN006146 (~880m ENE of fuel systems). The current groundwater bore used to supply water to the Glen Helen Lodge is bore RN016944 located adjacent to Namatjira Drive ~1,140 m NE of the fuel systems. The location of these groundwater bores relative to the fuel systems is shown in Figure 2. Additional details of these bores are included in Table 1 below. No local groundwater (Cenozoic aquifer) was encountered during soil sampling activities, with the deepest soil sample hole augured/drilled to 3.9 m below ground level. The eight holes drilled to bedrock with the AS Technical Drill did not encounter groundwater. LES

considers that local regolith groundwater drainage is likely to flow southeast down the slope from the rocky hill in the north towards the Finke River with a subcrop rocky ridge under the lodge itself to the south of the bowers. Formation groundwater is likely to be at depth below the local bedrock at the site. The Glen Helen Lodge site, and bores RN016364 and RN00646, are within a band mapped in the Groundwater Map of the NT as an intermediate scale fractured and karstic limestone aquifer with a standard yield of 0.5 L/s (refer Appendix M for aquifer map).

Table 1: Details of nearby groundwater bores (NR Maps & Google Earth Imagery)

Bore ID	RN016364	RN006146	RN016944
Bore Type	NTG Glen Helen Observation Bore	Glen Helen Bore Not Used	Glen Helen Production Bore
Current Use	Observation	Not Used	Current Production Bore (domestic & irrigation)
Year Drilled	1994	1968	1999
Depth Drilled	35.67 m	61 m	49 m
Completion Depth	34.45 m	61 m	49 m
Approx. Ground Level	~632 m (GE)	~640 m (GE)	~643 m (GE)
Screen Depth BGL	22.55-34.45 m	10.7-22.9 m 42.7-61 m	37-43 m
Completion SWL BGL	8.8 m	8.2 m	17.6 m
Completion Yield	2.0 L/s	1.3 L/s	1.0 L/s
Depth water struck BGL during drilling	19.76 m (seepage) 24.60 (1 L/s)	15.24 m	38 m
Strata	0-5 m: silty clay, sandy clay, quartzite. 5-15 m: brown & white sandstone & quartzite with mixed coloured sandy clays. 15-24.1 m: dark grey & brown fractured sandstone. 24.1-30.67 m: dark grey sandy limestone with yellow/brown sandstone. 30.67-35.67 m: dark grey sandy limestone.	0-1.8 m: clay and Boulders. 1.8-15.24 m: grey limestone & clay. 15.24-26.2 m: dark grey limestone and shale. 26.2-45.7 m: limestone 45.7-61 m: blue shale.	0-2.5 m: fractured sandstone. 2.5-49 m: brown sandstone
EC	~7,000 uS/cm	5,200 uS/cm	1900 uS/cm
TDS	-	3,201 mg/L	1220 mg/L
Comments	Not suitable for human consumption.	Not suitable for human consumption. Jay Creek Limestone Formation.	

* L/s = Litres per Second, m = metres, BGL = Below Ground Level, SWL = Standing , Water Level, EC = Electrical Conductivity , TDS = Total Dissolved Solids, GE = General Elevation, uS/cm = Micro Seconds / Centimetre, mg/L = Milligrams per Litre.

4. PRELIMINARY CONCEPTUAL SITE MODEL

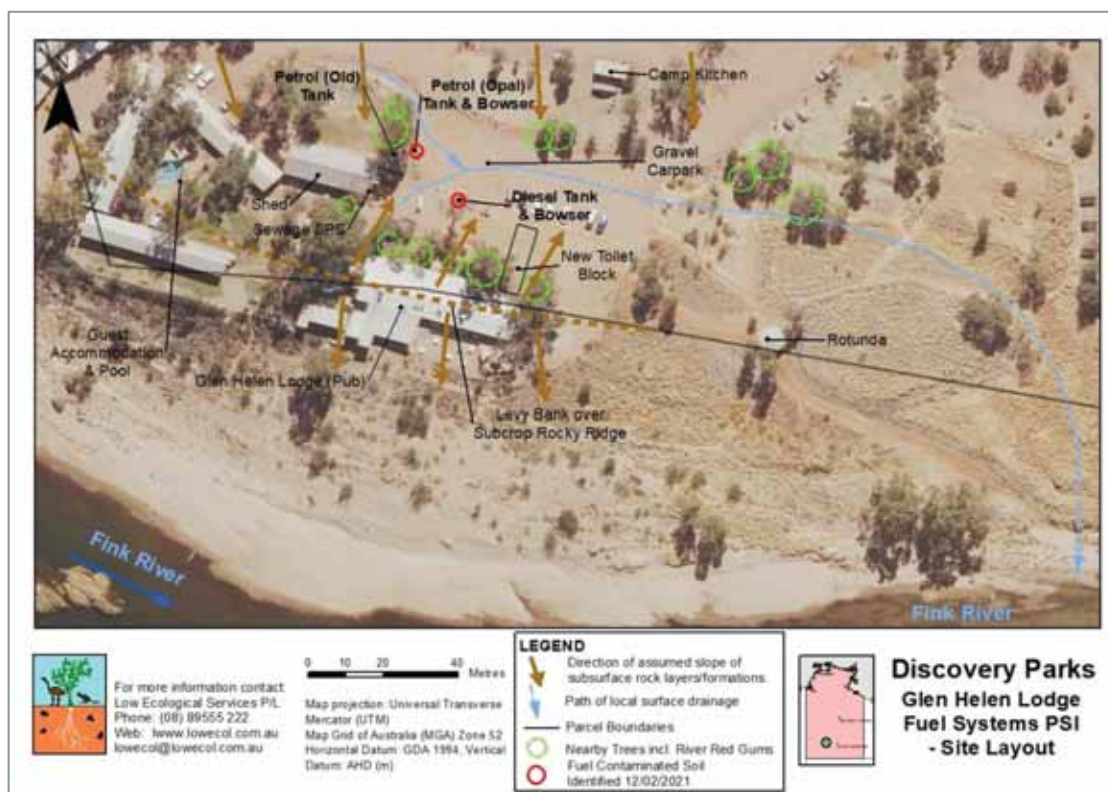


Figure 4: Layout plan showing location of significant contamination identified in soil immediately surrounding the diesel and Opal fuel system/tanks

This preliminary conceptual site model (CSM) identifies:

1. the source of the contaminated soil around the UPSS
2. potential contamination movement into the environment via the assumed slope of subsurface rock layers/formations and the path of local surface drainage
3. objects that may come into contact with the contamination (e.g. trees, fishes and humans).
4. people potentially at risk from contaminants (workers at the lodge, visitors to the lodge, future intrusive maintenance workers who may be required to undertake maintenance or installation of shallow utilities);
5. potential environmental receptors (waterway of the Finke River, downstream Finke River Gorge waterhole, trees and vegetation on the Lodge site and in the surrounding National Park).

5. METHODOLOGY

The methodology undertaken for the investigation of fuel leaks from the UPSS at the Glen Helen Lodge is described in Table 2.

Table 2 - Methodology

VARIABLE	METHOD
Media Sampled	Immediate and surrounding soil, vapour, and water in proximity to fuel contamination
Sample Locations	Feb 2021 PSI and March 2021 DSI Phase 1 - A 50 mm diameter hand augur was used to drill at selected locations adjacent to the in-ground tanks to determine potential depth and distance of spread of fuel from the tanks. - Samples were collected from inside the two petrol tank pits and the diesel tank pit at varying depths, as well as from each side and in the middle of the bottom of the pit. - One (1) control sample was taken 100 m north of the diesel pit - Above ground samples were taken from each of the excavated soil stockpiles. - Samples were collected at 1 m intervals down to bedrock and placed in zip lock plastic bags for 10 to 15 minutes prior to taking a PID reading. Soil samples from selected depths and including the full range of PID values were immediately placed in glass soil sample jars. April 2021 DSI Phase 2 - Drilling rig samples were collected from eight locations along the migration pathway from the fuel pits. - In each of the eight locations, at least three samples were taken: at 1 m intervals down to bedrock. - One (1) auger sample was taken from the base of the diesel and petrol pit, the samples were taken from 10 cm into the pit base wall. September DSI Phase 3 Excavated Soil Analysis - Each of the 42 IBCs filled with the excavated contaminated soil was bulk sampled from various depths within in each pod. Soil Vapour Passive Diffusion Analysis - Six passive diffusion samplers were deployed in 1.5m deep soil auger holes immediately adjacent to the backfilled tank pits,

	between the buildings and the tank pits, and in east end of carpark for soil vapour analysis Finke River Water Sampling Four (4) shallow groundwater samples were collected adjacent to the Lodge along the Finke River
Field Observations	- Odour, colour, and texture of each sample. - Photographs of the site and sample material. - GPS coordinates of sample locations - Soil samples PID readings - Water samples YSI readings
Transport & Storage	Samples were chilled, transported to Alice Springs and sent via courier to ALS Sydney, all within recommended holding times.
Analytical Methods	- Forty-one (41) soil samples were analysed for TRH/TPH, BTEXN and heavy metals by ALS laboratories. - Six (6) soil vapour samples were analysed for NEPM TRH / BTEXN analysis by SGS Laboratories. - Four (4) water samples were analysed for TRH/TPH, BTEXN and heavy metals by ALS laboratories. - Two (2) stored excavated bulk soil samples were analysed for Suite 1 (VIC EPA 448.3) and 10 stored excavated bulk soil samples were analysed for TRH/TPH, BTEXN, PAH and heavy metals by ALS Laboratories. - One (1) inter-laboratory (external) quality control sample was analysed by Eurofins Laboratory as well as one (1) intra-laboratory (internal) quality control sample for Suite 1 (VIC EPA 448.3) by ALS Laboratories. All soil samples were tested for the presence of fuel vapours using a portable PID instrument on site. All water samples were tested using a portable YSI instrument on site.

5.1. FUEL VAPOUR TESTING

All soil samples were tested on-site for the presence of fuel vapours using a portable PID (Appendix A Image1). A PID instrument is a broad-band monitor that detects a range of volatile organic compounds (VOCs) including hydrocarbon vapours released from unleaded and diesel fuels. PID readings give a total concentration of detectable VOCs in parts per million (PPM) but do not identify or differentiate between different VOCs in the sample. PIDs are used regularly for screening soil or water samples in soil

contamination investigations and provide indicative levels of hydrocarbons across samples. Laboratory analysis is required to confirm the actual type and concentration of contaminants. If relatively fresh hydrocarbons are present in soil, vapour readings generally correlate quite well with hydrocarbon concentrations in laboratory analysis results. Petrol contains more volatile compounds than diesel so gives relatively higher readings on the PID.

5.2. QUALITY CONTROL

5.2.1. General Sampling Protocols

For all sample media, quality assurance and quality control practices were conducted , including but not limited to:

- sampling and analysis procedures which minimise the potential for cross contamination wearing powder-free gloves when appropriate
- maintaining conditions of samples prior to analysis (keeping chilled and sealed as required)
- sending samples to laboratory within holding times
- documenting the chain of custody and sending with samples

5.2.2. Specific Sampling Protocols

Soil

- using new, laboratory approved soil jars
- filling the jar completely with limited headspace/air gaps from zip lock sample bag after PID testing
- soil jars were tightly capped with lids, and placed upright into an esky and stored below 4°C.

Soil Vapour

- sampling at a depth greater than 1m bgl to avoid the potential for ambient air dilution of the samples and other near-surface effects
- sample holes were deployed under a foam cube in protective plastic to minimise air and dirt infiltration. At the top of the sample hole a zip lock bag was filled with soil and wedged in place, and a large cone was placed on top the hole to deter any human interference for the duration of the week long sampling period
- upon retrieval sample vial was carefully placed in a small glass jar and sealed with Teflon tape, the jar was then placed in a sealed bubble wrap bag within another sealed Aluminium silver foil bag.

Groundwater

- installing and sampling wells in the same visit; so the water was fresh out of the soil pores
- calibrating PSI before use
- purging water from the shallow temporary wells prior to sampling
- using a new bailer for each hole to purge and sample
- using new, laboratory approved sampling bottles
- filling bottles completely with no headspace/air gap
- not overfilling bottles which contained preservatives
- Capping all bottles tightly once filled
- placing bottles upright in an esky
- storing below 4°C.

5.2.3. Duplicate Samples

Inter-laboratory and intra-laboratory quality control samples were taken for one phase of the investigation, However the ratio/extent of quality control samples for the entirety of the investigation was not met in accordance with the National Environmental Protection Council (NEPC) 2012 NEPM Schedule B3: Guideline on Laboratory Analysis of Potentially Contaminated Sites. Nevertheless, the completed sampling was appropriate to the setting on account of the remote location, the variety of samples taken and the large size of the dataset. Therefore, the lack of quality control samples does not diminish the assessment or limit the overall results, as agreed upon by Mr Kirsanovs (Auditor).

The quality control samples analysed included the intra-laboratory and inter-laboratory samples -taken from the excavated soil. Table 15 and Table 16 present the relative percentage difference (RPD) for field duplicate samples from the excavated soil sample results. Overall, the quality *control* (QC) results were deemed to be acceptable.

QC acceptance criteria are adopted from the acceptance criteria used by Tierra environment (who prepared the Alice Springs Town Council Landfill General Fill Classification and Disposal Method document) are as follows:

1. Results <10 times the LOR: RPD must lie between 0 – 80%
2. Results between 10 – 30 times the LOR: RPD must lie between 0 – 50%
3. Results >30 times the LOR: RPD must lie between 0 – 30%

SUMMARY TABLE OF OBTAINED QUALITY DATA WITH ASSESSMENT**Table 3 - Intra-Laboratory Duplicate Results:**

Analyte grouping/Analyte	Units	LOR	P5 (6+10)	QC01	RPD (%)	Acceptance Criteria
Moisture Content	%	1	3.8	3.9	2.60	Pass
pH	pH Unit	0.1	7.9	8	1.26	Pass
Arsenic	mg/kg	5	<5	<5	-	Pass
Cadmium	mg/kg	1	<1	<1	-	Pass
Chromium	mg/kg	2	----	----	-	Pass
Copper	mg/kg	5	11	13	16.67	Pass
Lead	mg/kg	5	12	13	8.00	Pass
Molybdenum	mg/kg	2	<2	<2	-	Pass
Nickel	mg/kg	2	9	10	10.53	Pass
Selenium	mg/kg	5	<5	<5	-	Pass
Silver	mg/kg	2	<2	<2	-	Pass
Tin	mg/kg	5	<5	<5	-	Pass
Zinc	mg/kg	5	30	32	6.45	Pass
Mercury	mg/kg	0.1	<0.1	<0.1	-	Pass
Hexavalent Chromium	mg/kg	0.5	<0.5	<0.5	-	Pass
Total Cyanide	mg/kg	1	<1	<1	-	Pass
Fluoride	mg/kg	40	320	320	0	Pass

The relative percentage difference of the duplicate results analysed within the ALS laboratory are all <10 times the LOR and lie between 0 – 80%. This passes the quality control acceptance criteria.

Table 4 - Inter-Laboratory Duplicate Results:

Analyte grouping/Analyte	Units	ALS LOR	P5 (6+10)	Eurofins LOR	QC02	RPD (%)	Acceptance Criteria
Moisture Content	%	1	3.8	1	2.7	33.8	Pass
pH	pH Unit	0.1	7.9	0.1	7.7	2.6	Pass
Arsenic	mg/kg	5	<5	2	2.1	-	Pass
Cadmium	mg/kg	1	<1	< 0.4	< 0.4	-	Pass
Chromium	mg/kg	2	----	5	18	-	Pass
Copper	mg/kg	5	11	5	12	8.7	Pass
Lead	mg/kg	5	12	5	14	15.4	Pass
Molybdenum	mg/kg	2	<2	< 5	< 5	-	Pass
Nickel	mg/kg	2	9	5	10	10.5	Pass
Selenium	mg/kg	5	<5	< 2	< 2	-	Pass

Silver	mg/kg	2	<2	< 2	< 2	-	Pass
Tin	mg/kg	5	<5	< 10	< 10	-	Pass
Zinc	mg/kg	5	30	5	34	12.5	Pass
Mercury	mg/kg	0.1	<0.1	< 0.1	< 0.1	-	Pass
Hexavalent Chromium	mg/kg	0.5	<0.5	< 1	< 1	-	Pass
Total Cyanide	mg/kg	1	<1	< 1	< 1	-	Pass
Fluoride	mg/kg	40	320	100	120	90	Fail

The relative percentage difference of the duplicate results analysed across two different laboratories are all <10 times the LOR. All but one of the RPD results lie between 0 – 80%. Fluoride was found to have a RPD of 90%. However considering the low levels of fluoride contaminant when compared to acceptable threshold values from the Victorian guidelines the RPD results can still be deemed acceptable.

Refer Appendix I and JK for the ALS and Eurofins respective Environmental Certificates of Analysis

5.3. SCREENING ASSESSMENT CRITERIA

Rationale and justification for the adopted screening criteria for the various media.

- The initial soil samples were analysed for TRH/TPH BTEXN PAH and Heavy Metals to determine the petroleum contaminants of concern based on schedule B1 in the ASC NEPM guidelines.
- Due to no PAH being detected its analyses was not continued in further investigations
- TRH/TPH BTEXN were analysed for the remainder of the soil, water and vapour samples in the Detailed Site Investigation, as these were the contaminants of concern that could be screened against NEPM 2013 HSL's, EIL's and Management limits. Soil samples were also continuously analysed for heavy metals and water samples were analysed for their physical and chemical properties for a complete interpretation of the results. The adopted screening criteria for the excavated soil stored in soil pods was based upon Alice Springs Town Council's General Fill Classification and Disposal Method prepared by Tierra Environment.
- A control soil sample was analysed for TRH/TPH BTEXN and Heavy Metals for comparison purposes
- An intra and inter analysis sample was sent to respective laboratories for quality control purposes

Samples were screened based on the below characteristics:

1. Recreational/ Open Space was chosen due to the site being in a large open car park of a roadhouse as a more conservative approach compared to screening against Commercial levels.
2. Clay (Fine Soil) was chosen based on the soil texture analysis completed by LES
3. The choice of depth was based on the CSM indicating that there is potentially residual contamination from approximately 1.2m bgl to 3m bgl.
4. The most conservative options were chosen for CEC and %Clay as this variables weren't accurately known when screening against HSL's for Heavy Metals.

Table 5 HSLs, ESLs and Management Limit Variables

Media	Land Use Setting	Texture/type	Depth	pH
Soil	<i>Recreational/ Open Space.</i>	Clay (Fine Soil)	2 m -4 m	7.5-8
Vapour	<i>Recreational/ Open Space</i>	Clay (Fine Soil)	0 m-1 m	7.5-8
Groundwater	<i>Recreational/ Open Space</i>	Fresh water	8 + m	7.5-8

5.4. PHASE 1 OF DETAILED SITE INVESTIGATION 23/03/2021

Hand Tool and Excavator Soil Testing

Soil samples were collected at various points during the removal process of the fuel systems on the 23rd of March 2021. Soil samples were obtained from inside the bucket of the excavator during excavation and from locations around the empty fuel tank pits and excavated soil stockpiles after the tanks had been removed. Samples were taken from each of the remaining stockpiles of excavated soil and from the three pits to determine the degree of localized contamination after the fuel tanks had been removed. Multiple bulk soil samples were taken from different sides of the stockpiles (Figure 5), and other samples were taken from various locations and depths within the pits (Figures 6 and 7).

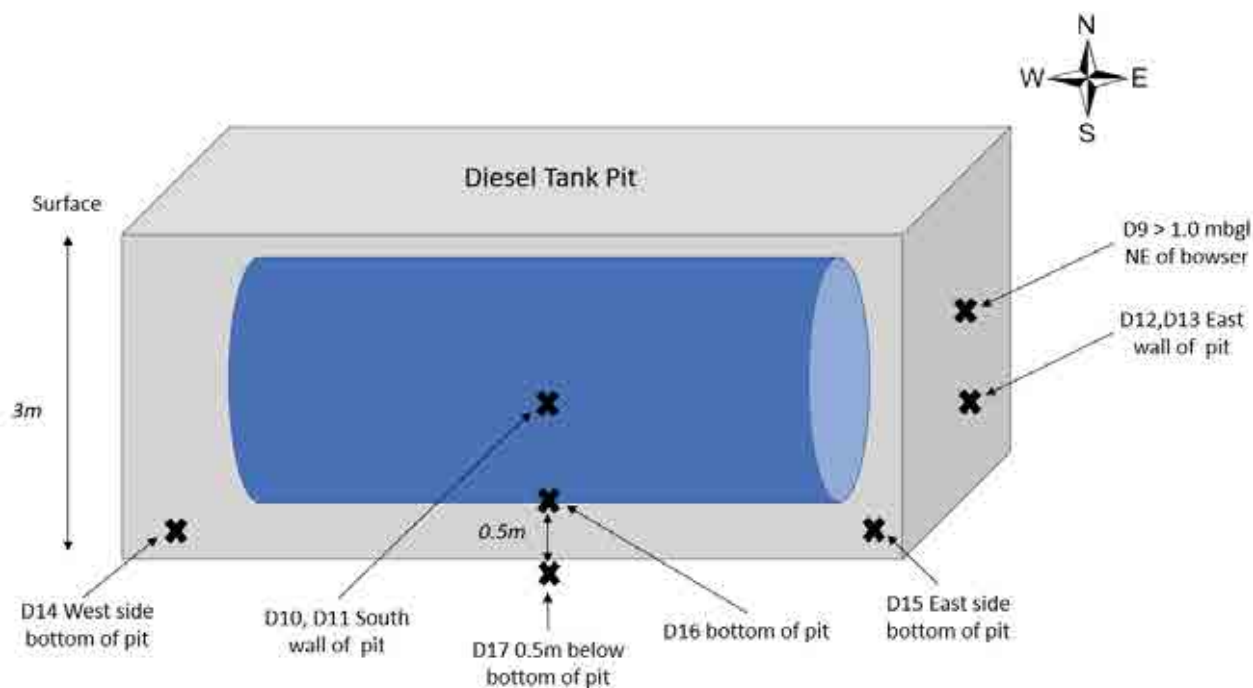


Figure 5: Diesel tank pit key sampling points and ID's

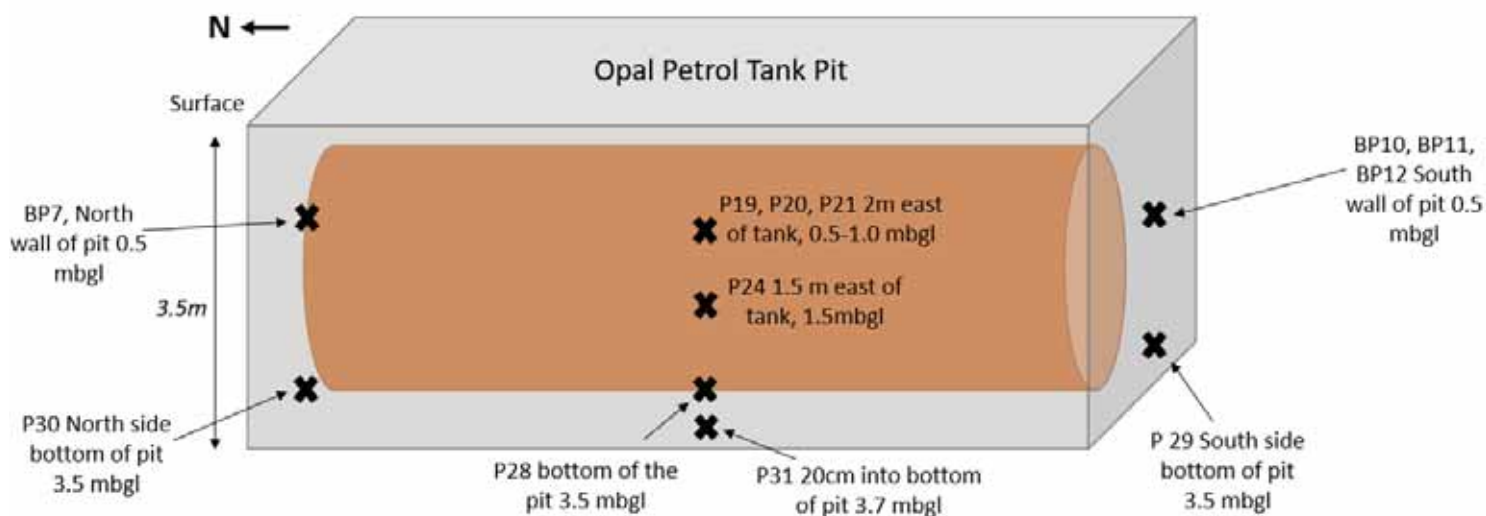


Figure 6: Opal petrol tank pit key sampling points and ID's

Each sample was placed in zip lock bag and tested for presence of fuel vapour using a portable PID. Key soil samples were selected and sent for laboratory analysis.

DSI Phase 1 Conceptual Site Model

Following the March site investigation, the Conceptual Site Model (CSM) (Figure 4) was updated to include the site sampling points including where contamination was identified following the preliminary CSM.

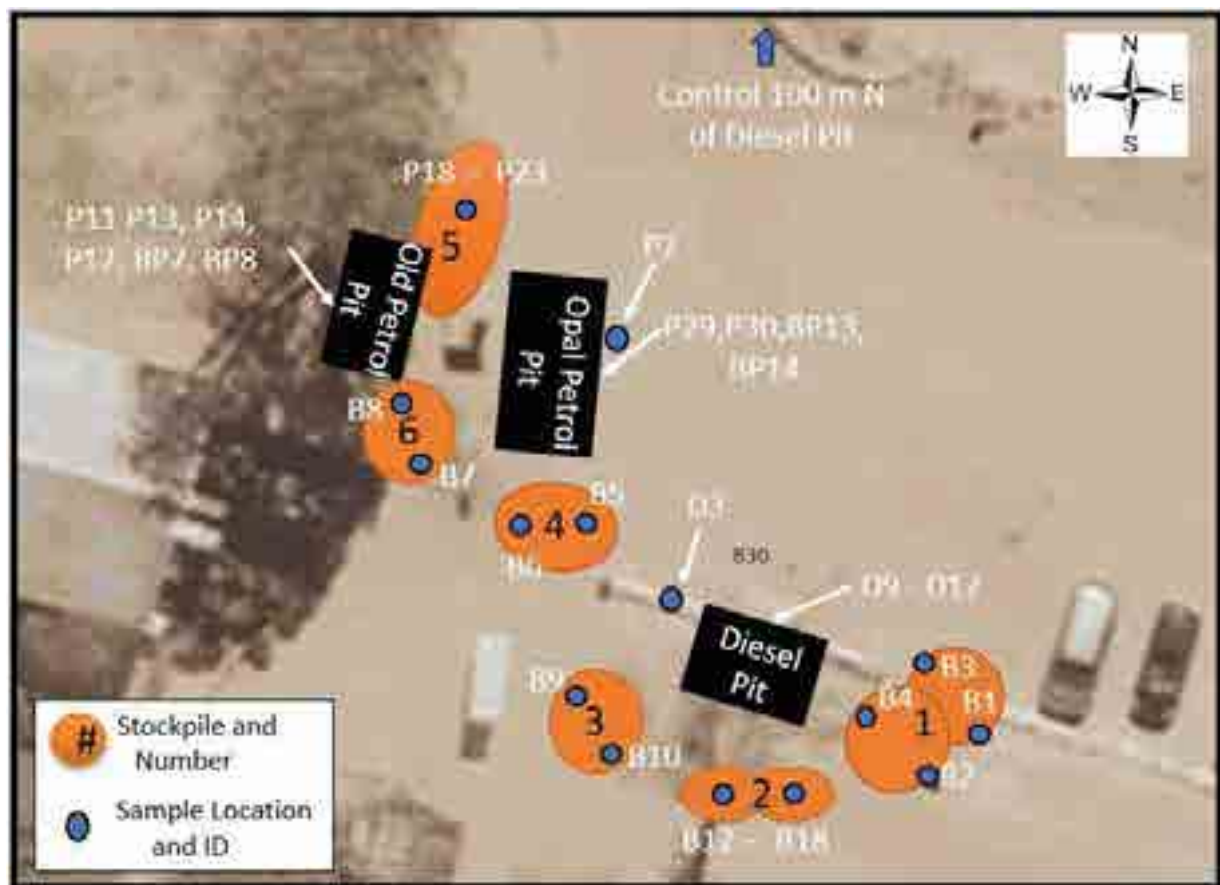


Figure 7: Localized sampling points/IDs from fuel tank pits and surrounding soil stockpiles (NR Maps)

5.5. PHASE 2 OF THE DETAILED SITE INVESTIGATION 28/04/2021

Drilled Soil Testing

Soil samples were collected at eight locations down slope from the fuel tank pits on the 28th of April 2021. Each was drilled with a Geoprobe 6610DT direct push core drilling rig to the depth of refusal at just over 3 m. At least three samples were taken from each drill hole at varying depths, generally one from the surface, middle and bottom of the hole. Soil from each sample was placed in zip loc bags, sealed, let stand for and tested for presence of fuel vapour using a portable PID.

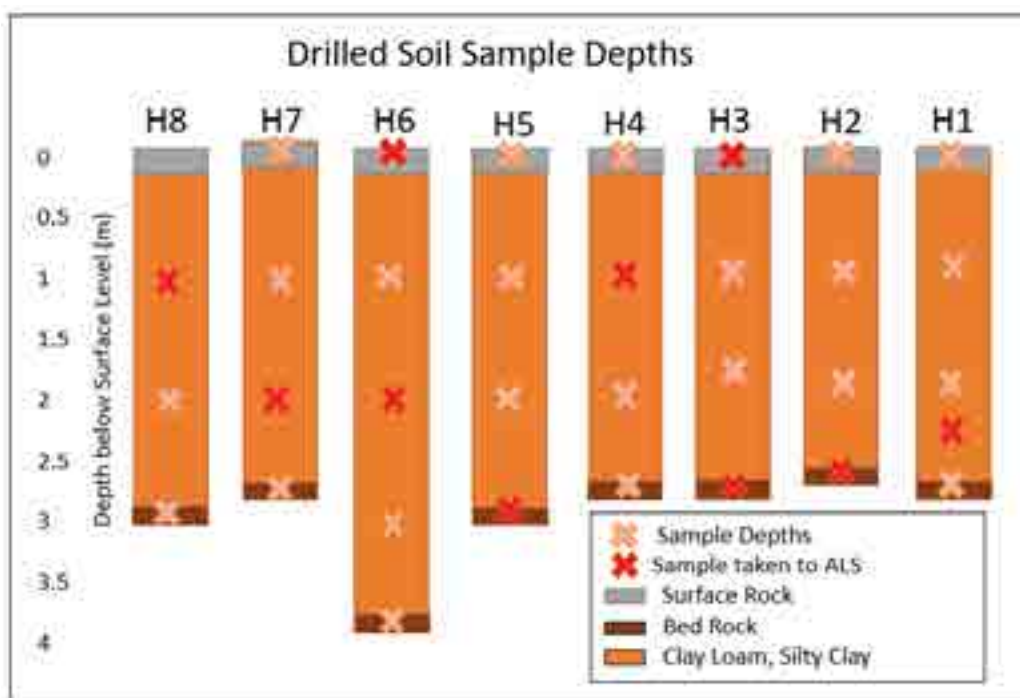


Figure 8: Migration drilled soil sample depths

DSI Phase 2 Conceptual Site Model

Following the April site investigation, the CSM was updated to include the different level of contamination at the site sampling points.

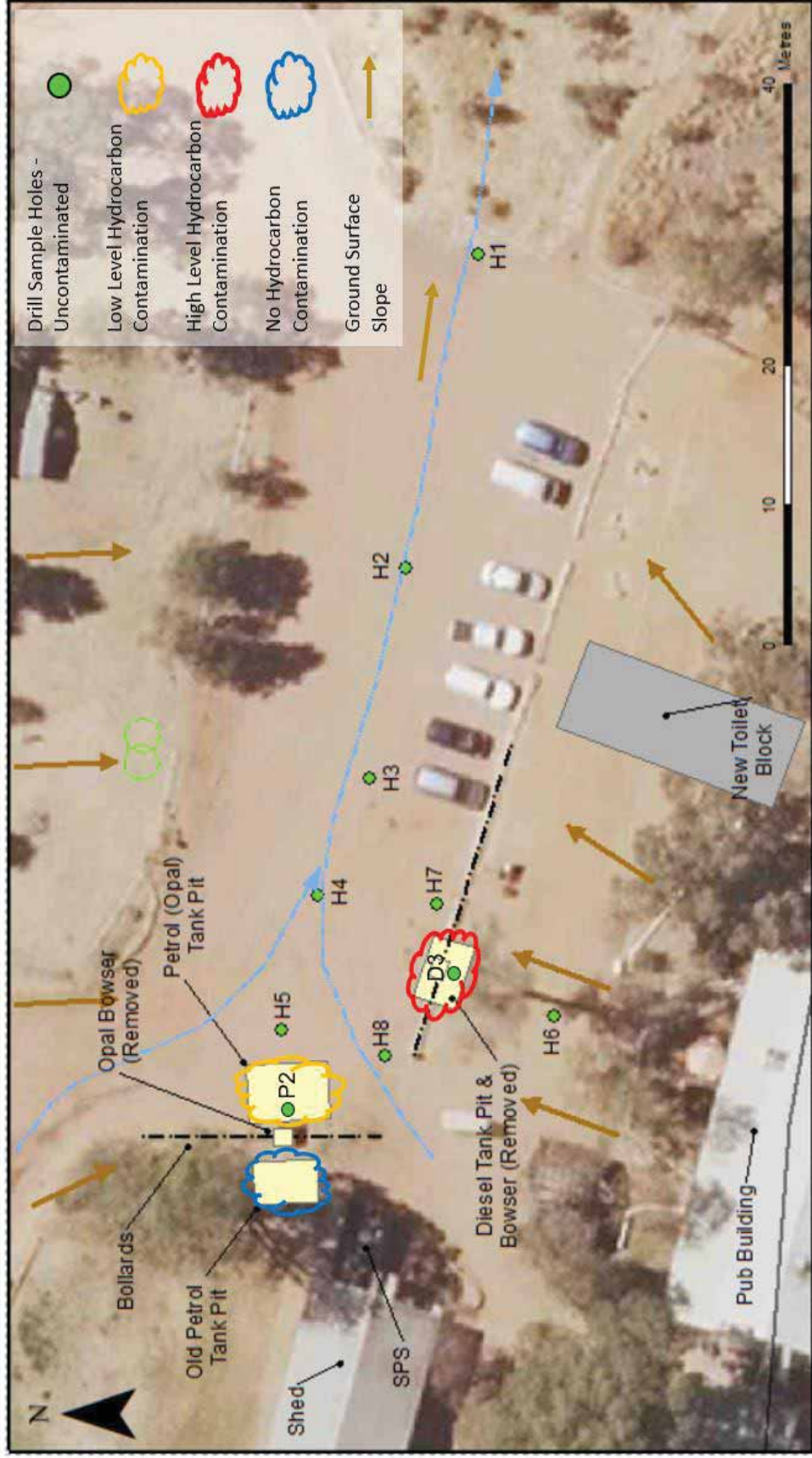


Figure 9: Contaminant migration sampling points/IDs in proximity to the fuel tank pits drilled with Geoprobe 6610DT

5.6. PHASE 3 OF THE DETAILED SITE INVESTIGATION 03/09/2021

5.6.1. Soil Vapour Passive Diffusion

Six (6) Waterloo Membrane Samplers (WMS) (refer Appendix N) were deployed in 1.5 m deep soil bores immediately adjacent to the backfilled tank pits, between the buildings and the tank pits, and in east end of carpark (Figure 10). The soil bores were temporarily sealed, and samplers were left underground for one week. Samplers were then retrieved and analysed by the laboratory for hydrocarbon vapour.

5.6.2. Finke River Water Sampling

Four (4) shallow groundwater wells were dug in the riverbank adjacent to the Finke River (Figure 10). Water was initially purged and then sampled from the wells using a fresh bailer each time, samples were retrieved from the bottom of the well and collected in ALS laboratory sampling bottles, chilled, and sent to the laboratory for analyses.

5.6.3. Excavated Soil for Disposal

Each of the forty (40) IBCs storing the excavated contaminated soil was bulk sampled in zip loc bags and tested for presence of fuel vapour using a portable PID. Storage pods and IBCs with high PID readings (>50ppm) were classed as moderately to highly contaminated (TRH >1000mg/kg), so could only be disposed of/treated interstate. Storage pods and IBCs with low PID readings (<50ppm) were considered to have no or a low level of contamination (TRH < 1000mg/kg). Therefore, it was possible that the soil could be accepted by the Alice Springs Town Council (ASTC), Regional Waste Management Facility (RWMF) as general fill. The soil from these pods was sampled and analysed by ALS Laboratories in accordance with the landfill's testing criteria. Refer Figure 11 below for sampling ID's

DSI Phase 3 Conceptual Site Model

Following the September site investigation, the CSM was updated to include the soil vapour and the groundwater sampling points.

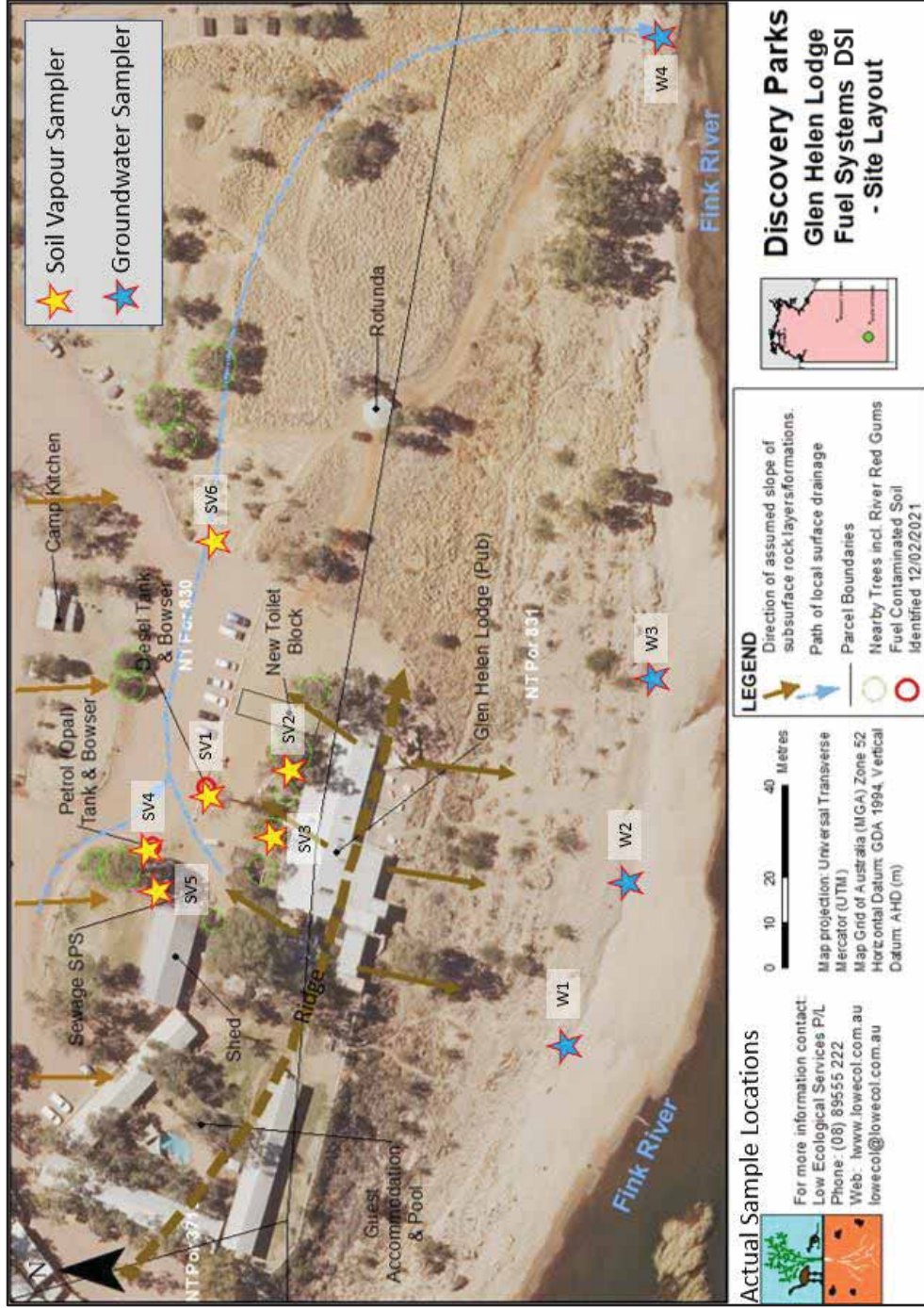


Figure 10: Soil Vapour Sampler Locations and Fink River Water Sampling locations

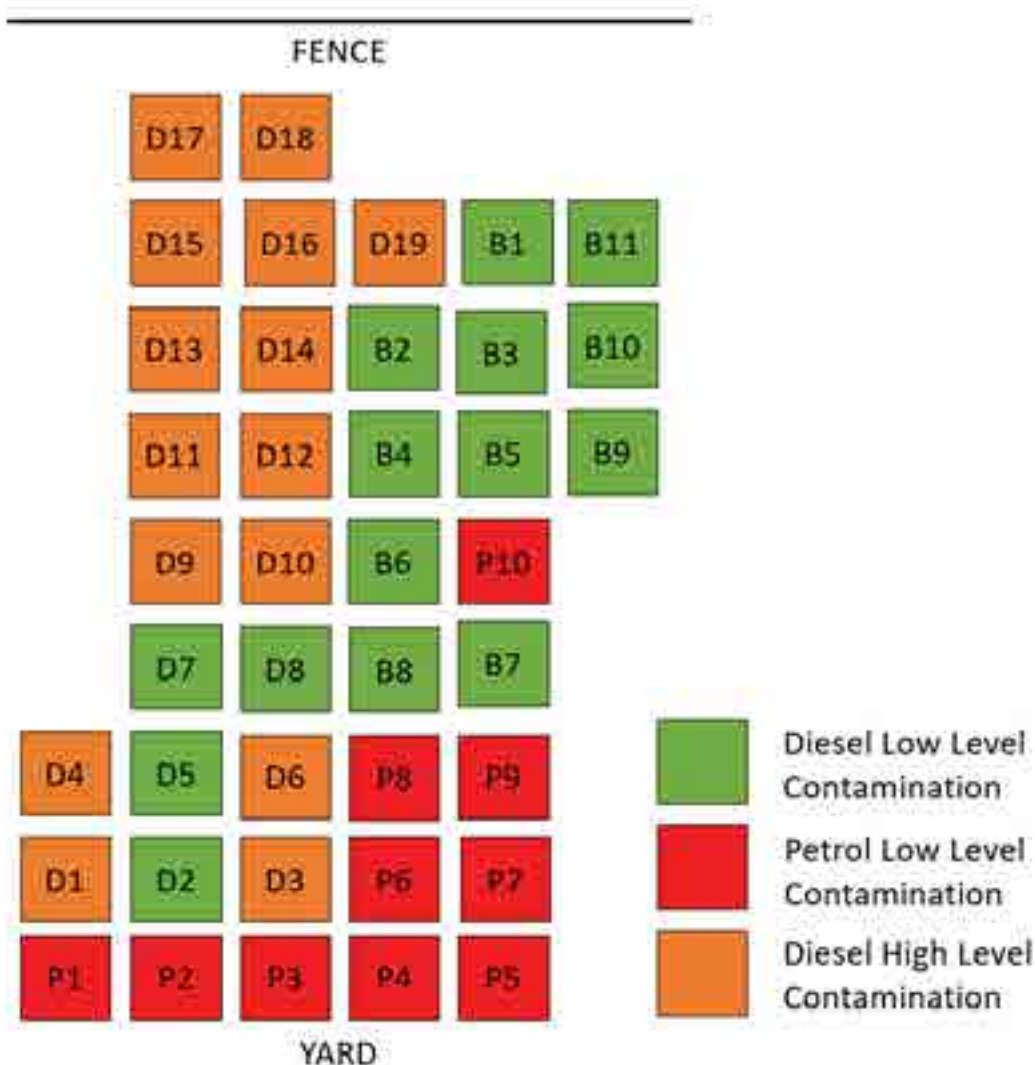


Figure 11: Stored contaminated storage pods sampling ID's with contamination grading

P = Petrol,

D = Diesel,

B = Bulk Diesel.

5.7. LABORATORY PROGRAM

Soil samples for laboratory analysis were selected to represent the range of location, depth, and PID vapour results. Soil and water samples were sealed in the appropriate laboratory-supplied sample jars and bottles. Both soil and water samples were placed in a car refrigerator for storage and transport to Alice Springs, then sent in an ice-chilled esky via courier to ALS Laboratories in Sydney for analysis. The soil vapour samplers were placed into a small glass jar which was sealed with plumbers tape and then placed into two further sealed bags and sent to SGS laboratories in Melbourne. Samples were received by the laboratory within recommended holding time for all analytes.

ALS and SGS Laboratories use established, internationally recognized procedures as published by the US EPA, APHA, and NEPM. In the absence of documented standards or on client request, procedures developed In-house are used. Upon sampling and analysis, the NATA accredited ALS laboratory completed the following quality control procedures as part of their internal Quality Control Report:

1. Laboratory duplicate (DUP) report;
2. relative percentage difference (RPD) and acceptance limit;
3. Method blank (MB) and laboratory control spike (LCS) report;
4. recovery and acceptance limits;
5. Matrix spike (MS) report; and
6. recovery and acceptance limits.

6. FIELDWORK RESULTS

Soil Texture Analysis

Soil texture determination was conducted, which found that the texture of the soil is predominantly of clay consistency with some variations to clay loam or silty clay. Clay soils would reduce the likelihood of hydrocarbon contamination moving from the source, when compared with sandy soils.

Soil Vapour Analysis

Table 6 A summary of fuel vapour PID readings taken on 23/03/2021:

Sample ID	Depth (mbgl)	PID (ppm)	Lab Sample
B3	Above	40.4	Taken
B5	Above	0.0	Taken
B6	Above	0.0	
B7	Above	0.0	Taken
B8	Above	0.0	
B9	Above	143.7	Taken
D10	~1.5	438.2	
D11	~1.5	374.8	Taken
D12	~2.5	396.5	
D13	~2.5	442.3	
D16	3	707.3	
D17	3.5	710.6	Taken
BP7	0.5	148.7	
BP9	0.5	456.3	
BP10	0.5	1327	
BP11	0.5	1525	
BP12	0.5	1702	
BP13	0.5	1438	
P11	2.5	3.0	Taken
P13	2.3	2.4	Taken
P14	2.3	1.4	Taken
P17	0.1	1.3	Taken
P24	1.5	639.8	
P28	3.5	1530	
P29	3.5	1730	Taken
P30	3.5	1645	Taken
P31	3.7	1511	Taken

D=Diesel Tank (taken directly from the ground)

P=Petrol Tank (taken directly from the ground)

B=Bulk Sample (taken from above ground pile)

BP=Bulk Petrol Sample (Taken from above ground pile)

*Refer Figures 4,6 and 7 for sample locations

Table 7 - A summary of fuel vapour PID readings taken on 28/04/2021

Sample ID	Depth (mbgl)	PID (ppm)	Lab Sample
D3	0.1	389	Taken
P2	0.1	1863	Taken
H1	0.1	0.2	
H1	1	0.7	
H1	2	0.4	
H1	2.3	0.1	Taken
H1	2.7	0.8	
H2	0.1	1.9	
H2	1	2.5	
H2	2	3.6	
H2	2.6	5.6	Taken
H3	0.1	4.2	Taken
H3	1	3.7	
H3	1.7	4.1	
H3	2.7	3.5	Taken
H4	0.1	4.7	
H4	1	4.8	Taken
H4	2.2	4.8	
H4	2.7	4.7	
H5	0.1	4.4	
H5	1	5.6	
H5	2	6.5	
H5	3	10.6	Taken
H6	0.1	4.5	Taken
H6	1	4.6	
H6	2	5.5	Taken
H6	3	4.4	
H6	3.9	3.6	
H7	0.1	4.2	
H7	1	4.2	
H7	2	5.1	Taken
H7	2.7	4.6	
H8	1	11.4	Taken
H8	2	8.1	
H8	3	5.6	

*Refer Figures 8 and 9 for sample locations

D=Diesel Tank (taken directly from the ground)

P=Petrol Tank (taken directly from the ground)

H = Hole (taken from digger's sample)

Table 8 – Soil vapour sampler holes PID readings taken on 03/09/2021

Sample Location/ID	Depth (m)	PID (ppm)	Lab Sample
SV1 TUBE	0	1.9	
SV1 TUBE HOLE	1.5	12.2	
SV1 BAG	1.4-1.5	30.2	Taken
SV2 TUBE	0	1.6	
SV2 TUBE HOLE	1.5	6.5	
SV2 BAG	1.4-1.5	0.4	Taken
SV3 TUBE	0	2	
SV3 TUBE HOLE	1.5	5.9	
SV3 BAG	1.4-1.5	0.5	Taken
SV4 TUBE	0	2.1	
SV4 TUBE HOLE	1.5	163.2	
SV4 BAG	1.4-1.5	20.7	Taken
SV5 TUBE	0	1.2	
SV5 TUBE HOLE	1.5	3.5	
SV5 BAG	1.4-1.5	0.5	Taken
SV6 TUBE	0	1.2	
SV6 TUBE HOLE	1.5	2.9	
SV6 BAG	1.4-1.5	1.9	Taken

*Refer to Figure 10 for sample locations marked with yellow stars.
SV=Soil Vapour.

Table 9 Groundwater on site field measurement results taken on 03/09/2021

Sample ID	W1	W2	W3	W4
Sample location details	2.8m back from water edge in sand. Water 270mm below surface	2.1m back from water edge in sand. Water 370mm below surface	3.8m back from water edge in sand. Water 400mm below surface	1.3m back from water edge in sand. Water 250mm below surface
Temp (°C)	20.2	19.4	18.5	18.6
DO (%)	61.6	47.4	49.9	48.5
DO (mg/l)	5.5	4.3	4.61	4.43
SPC (-mS/cm)	4.75	4.03	4.31	6.47
C (-uS/cm)	4315	3604	3779	5680
pH	7.77	7.7	7.41	7.26

* DO = Dissolved Oxygen, SPC = Specific Conductivity, C = Conductivity. Refer to Figure 10 for sample locations marked with blue stars.

Visual Observations: No visual indication of fuel contamination (e.g., surface sheen) was observed at the Glen Helen Gorge waterhole during each of the site visits.

Table 10 PID results of the excavated contaminated soil storage pods taken on 06/09/2021

Sample Location/ID		Depth (m)	Time	PID (ppm)	Lab Sample
Petrol Exposed Soil	P1	0.25	1:40:00 PM	3	Bulk Samples Taken (P6+P10), (P2+P7), (P1+P5), (P9+P4), (P3+P8)
	P2	0.25	1:45:00 PM	1	
	P3	0.25	2:00:00 PM	0.6	
	P4	0.25	2:00:00 PM	2.1	
	P5	0.25	2:15:00 PM	1.1	
	P6	0.25	2:30:00 PM	3.7	
	P7	0.25	2:20:00 PM	4.7	
	P8	0.25	2:35:00 PM	3.5	
	P9	0.25	2:10:00 PM	3.1	
	P10	0.25	2:20:00 PM	4.8	
Diesel Exposed Soil	D1	0.5	2:36:00 PM	83.2	
	D2	0.5	2:46:00 PM	6.3	Taken (D2+D5)
	D3	0.5	3:02:00 PM	152.4	
	D4	0.5	2:50:00 PM	200.4	
	D5	0.5	3:10:00 PM	8.9	Taken (D2+D5)
	D6	0.5	3:10:00 PM	324.1	
	D7	0.5	3:10:00 PM	11.6	Taken (D7+D8)
	D8	0.5	3:15:00 PM	14.9	Taken (D7+D8)
	D9	0.5	3:17:00 PM	187.4	
	D10	0.5	1:18:00 AM	399.0	
	D11	0.5	3:20:00 PM	334.1	
	D12	0.5	3:20:00 PM	142.1	
	D13	0.5	3:31:00 PM	185.8	
	D14	0.5	3:35:00 PM	214.2	
	D15	0.5	3:43:00 PM	381.6	
	D16	0.5	3:36:00 PM	386.0	
	D17	0.5	3:46:00 PM	322.5	
	D18	0.5	3:53:00 PM	387	
	D19	0.5	3:54:00 PM	75.2	
	B1	0.5	3:55:00 PM	14.3	Taken (B1+B5), (B11+B8), (B4+B7), (B2+B6), (B10+B3+B9)
	B2	0.5	3:56:00 PM	9.5	
	B3	0.5	4:00:00 PM	5.9	
	B4	0.5	4:00:00 PM	6.0	
	B5	0.5	4:00:00 PM	5.7	
	B6	0.5	4:01:00 PM	7.5	
	B7	0.5	4:01:00 PM	3.8	
	B8	0.5	4:05:00 PM	9.8	
	B9	0.5	4:05:00 PM	5.8	
	B10	0.5	4:06:00 PM	8.6	
	B11	0.5	4:07:00 PM	7.3	

P = Petrol, D = Diesel, B = Black Tape IBC with Diesel.

Homogenous samples from the same fuel pits were combined to create a bulk representative sample for analysis.

7. LABORATORY RESULTS

Laboratory results for the initial DSI Phase 1 soil samples are presented in summary Table 9, the summary of laboratory results from the DSI phase 2 soil samples are presented in Table 10. The summary of laboratory results from the DSI phase 3 ground water samples and soil vapour samples are presented in Tables 11 and 12, and the excavated soil laboratory results are presented in Table 13. The full laboratory results showing individual BTEXN compounds and heavy metals, and the certificates of analysis are provided in the appendices.

Lab results and PID readings correlation

Laboratory analysis results correlated well with PID readings for respective drilled soil samples, with all samples analysed with a low PID reading having no hydrocarbons (TRH) in the laboratory analysis. The diesel pit samples with high PID readings correlated with also having high concentrations of hydrocarbons, whereas samples from the Opal (unleaded) tank pit with high PID readings recorded low hydrocarbon concentration in the laboratory analysis. This difference in PID-Lab correlation for petrol and diesel contaminated samples is due to petrol having more volatile compounds compared with diesel.

7.1. PHASE 1

Fuel Tank Removal Soil Sample Results

Refer to Appendix C for full analysis results including heavy metals.

Table 11: Summary results of soil sample analysis taken on 23/03/2021 for TRH, and BTEXN.

Analyte grouping/Analyte <i>PID Reading (Non-Lab Field Measurement)</i>	Unit	LOR	Sample ID's																	NEPM 2013				
			B1	B3	B5	B7	B9	B13	B15	B10	D11	D17	P29	P31	BP13	P11	P13	P14	P17	Control 100m NORTH	ESI's	ML's	HSL's	HSL (Direct Contact)
Depth below ground level	Metres	0.0	Above	Above	Above	Above	Above	Bucket	Bucket	Bucket	1.5	3.5	3.5	3.7	0.1	2.5	2.3	2.3	0.0	0.1	-	-	-	-
PID Vapour Reading	ppm	0.1	19.6	40.4	0.0	0.0	143.7	498.8	151.3	589.6	374.8	710.6	1730	1645	1438	3.0	2.4	2.3	1.3	-	-	-	-	-
Heavy metals																								
Arsenic	mg/kg	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	100	-	300	-
Cadmium	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	-	90	-
Chromium	mg/kg	2	11	10	10	10	16	10	14	15	16	17	9	15	17	15	14	8	15	10	320	-	300	-
Copper	mg/kg	5	8	6	6	6	10	7	10	10	10	12	9	10	12	10	9	6	8	<5	560	-	17000	-
Lead	mg/kg	5	19	21	6	<5	10	6	34	6	8	12	<5	8	12	6	27	<5	24	8	1100	-	600	-
Nickel	mg/kg	2	7	7	6	6	9	6	8	9	9	10	6	9	10	9	8	5	9	5	270	-	1200	-
Zinc	mg/kg	5	32	30	23	74	28	12	25	21	23	32	13	26	32	21	17	10	23	10	230	-	30000	-
Mercury	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	-	-	80	-
Total Recoverable Hydrocarbons - NEPM 2013 Fractions																								
C6 - C10 Fraction minus BTEX (F1)	mg/kg	10	<10	<10	<10	<10	23	403	<10	415	114	370	469	93	<10	<10	<10	<10	<10	<10	180	800	NL	5100
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50	790	1090	<50	<50	4960	15000	240	15800	9580	14900	60	130	180	<50	<50	<50	<50	<50	120	1000	NL	3800
>C16 - C34 Fraction (F3)	mg/kg	100	1640	2740	<100	<100	6040	10900	500	11000	11000	13100	<100	<100	<100	<100	<100	<100	<100	<100	1300	3500	NL	5300
>C34 - C40 Fraction (F4)	mg/kg	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	5600	10,000	NL	7400
>C10 - C40 Fraction (sum)	mg/kg	50	2430	3830	<50	<50	11000	25900	740	26800	20600	28000	60	130	180	<50	<50	<50	<50	<50	7320	14500	NL	-
BTEXN																								
Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	65	-	-	120
Toluene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	<0.5	1.4	<0.5	6.7	3.3	4.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	105	-	-	18000
Ethylbenzene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.8	<0.5	1.8	<0.5	7.2	3.3	4.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	125	-	-	5300
meta- & para-xylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8.2	<0.5	8.4	1.1	22.4	8.6	8.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-
ortho-xylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	6.8	<0.5	8.2	1.7	14.1	4.9	4.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-
Total Xylenes	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	15.0	<0.5	16.6	2.8	36.5	13.5	13.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	45	-	-	15000
Sum of BTEX	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	18.0	<0.2	19.8	2.8	50.4	20.1	23.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	340	-	-	-
Naphthalene	mg/kg	0.2	<1	<1	<1	<1	<1	1	<1	<1	<1	1	1	2	<1	<1	<1	<1	<1	<1	170	-	-	1900

Notes:

- Samples in orange are from around diesel tank, sample in light green are from around opal petrol tank, sample in dark green is from old petrol tank, samples in red are from excavated soil stockpiles. Limit of Reporting (LOR) is the measure of detectability and indicates presence below these levels is not sufficient to be measured.
- Samples were compared against NEPM 2013 Environmental Screening Levels (ESL's), Management Limits (ML's) and Health Investigation Levels (HIL's) and classified as Fine soil in Urban Residential and Public Open Space.

7.2. PHASE 2

Soil Sampling to test for movement of contaminants

Refer to Appendix D for full analysis results including heavy metals.

Table 12: Summary results of soil sample analysis taken on the 28/04/2021 for TRH, and BTEXN

Analyte grouping/Analyte	Unit	LOR	Sample ID's											ASC NEPM 2013				
			D3 – 0.1m	P2 - 0.1m	H1 - 2.3m	H2 - 2.6m	H3-0.0m	H3 - 2.2- 2.7m	H4 - 1.0m	H5 - 3.0m	H6 - 0.0m	H6 - 2.0m	H7 - 2.0m	H8 - 1.0m	ESL's	ML's	HSL's	HSL (Direct Contact)
PID Reading (Non-Lab Field Measurement)																		
Depth below ground level	Metres		3.1	3.1	2.3	2.6	0.1	2.2-2.7	1.0	3.0	0.1	2.0	2.0	1.0	-	-	-	
PID Vapour Reading	ppm	0.1	389	1863	0.1	5.6	4.2	3.5	4.8	10.6	4.5	5.5	5.1	11.4	-	-	-	
Total Metals																		
Arsenic	mg/kg	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	100	-	300	
Cadmium	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	-	90	
Chromium	mg/kg	2	12	16	12	12	6	17	5	12	10	12	17	12	320	-	300	
Copper	mg/kg	5	9	10	8	10	<5	12	<5	8	7	9	12	9	560	-	17000	
Lead	mg/kg	5	6	8	<5	7	<5	8	<5	6	<5	5	7	6	1100	-	600	
Nickel	mg/kg	2	7	9	7	10	4	10	3	8	6	8	10	7	270	-	1200	
Zinc	mg/kg	5	17	21	13	22	8	26	6	20	14	17	26	17	230	-	30000	
Mercury	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	80	
Total Recoverable Hydrocarbons - NEPM 2013 Fractions																		
C6 - C10 Fraction minus BTEX (F1)	mg/kg	10	660	42	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	180	800	NL	5100
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50	32000	110	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	120	1000	NL	3800
>C16 - C34 Fraction (F3)	mg/kg	100	30500	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	1300	3500	NL	5300
>C34 - C40 Fraction (F4)	mg/kg	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	5600	10,000	NL	7400
>C10 - C40 Fraction (sum)	mg/kg	50	62500	110	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	7320	14500	NL	-
BTEXN																		
Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	65	-	-	120
Toluene	mg/kg	0.5	1.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	105	-	-	18000
Ethylbenzene	mg/kg	0.5	5.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	125	-	-	5300
meta- & para-Xylene	mg/kg	0.5	21.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-
ortho-Xylene	mg/kg	0.5	14.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-
Total Xylenes	mg/kg	0.5	35.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	45	-	-	15000
Sum of BTEX	mg/kg	0.2	42.8	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	340	-	-	-
Naphthalene	mg/kg	0.2	6	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	170	-	-	1900

Notes:

- Sample in orange are from around diesel tank, sample in green are from around petrol tank and samples in red are from various surrounding drill holes. Limit of Reporting (LOR) is the measure of detectability and indicates presence below these levels is not sufficient to be measured.
- Actual depths of all drill holes are 15cm more than presented when factoring in the length of the drill bit.
- Samples were compared against NEPM 2013 Environmental Screening Levels (ESL's), Management Limits (ML's) and Health Investigation Levels (HIL's) and classified as Fine soil in Urban Residential and Public Open Space.

7.3. PHASE 3

7.3.1. Finke River Water Sampling Results

Each of the four (4) groundwater samples were analysed by the laboratory for TRH and BTEXN. One of the samples was analysed for the full physical and general chemistry properties water suite. Refer Appendix G for certificate of analysis.

Table 13: Summary results of Groundwater sample analysis taken on 3/09/2021 for TRH, and BTEXN.

Analyte grouping/Analyte	Unit	LOR	Sample IDs				ASC NEPM 2013	
			W1	W2	W3	W4	GILs	HSL C
PID Reading (Non-Lab Field Measurement)								
Depth below surface	mm	-	270	370	400	250	8+ metres	
Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction minus BTEX (F1)	mg/kg	10	<10	<10	<10	<10	-	NL
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50	<50	<50	<50	<50	-	NL
>C16 - C34 Fraction (F3)	mg/kg	100	<100	<100	<100	<100	-	NL
>C34 - C40 Fraction (F4)	mg/kg	100	<100	<100	<100	<100	-	NL
>C10 - C40 Fraction (sum)	mg/kg	50	<50	<50	<50	<50	-	NL
BTEXN								
Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	950	NL
Toluene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	-	NL
Ethylbenzene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	-	NL
meta- & para-Xylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	200	NL
ortho-Xylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	350	NL
Total Xylenes	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	550	NL
Sum of BTEX	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	-	NL
Naphthalene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	16	NL

Notes:

- GILs = Groundwater Investigation Levels.
- Screening against fresh water levels

7.3.2. Soil Vapour Passive Diffusion Sampling Results

Six (6) soil vapour samples were taken with the WMS method and analysed for TRH and BTEXN. Refer to Appendix HI for certificate of analysis.

Table 14: Results of WMS passive soil vapour sampler analysis taken on 03/09/2021 for TRH, and BTEXN

Description: Contaminated Soil Vapour ID				Soil Vapour Health Screening Levels for Clay (mg/m³)						
Deployment Date and Time				Public Open Space			Intrusive Worker			
Matrix				NEPM 2013 0 – 1m	NEPM 2013 1 – 2m	CRC 2011 0 – 1m				
Job Number	Method Name	Analyte Name	Units	LOR	Results					
ME322526	VOC in Waterloo Samplers MA-5.WL.LU	Benzene	µg/m³	0	<6.5	<6.5	16	<6.5	<6.5	SV6
ME322526	VOC in Waterloo Samplers MA-5.WL.LU	Toluene	µg/m³	0	67	5.5	6.4	6.6	4.9	SV5
ME322526	VOC in Waterloo Samplers MA-5.WL.LU	Ethylbenzene	µg/m³	0	51	<3.5	<3.5	<3.5	<3.5	SV4
ME322526	VOC in Waterloo Samplers MA-5.WL.LU	m&p-Xylene	µg/m³	0	220	<3.6	<3.6	<3.6	<3.6	SV3
ME322526	VOC in Waterloo Samplers MA-5.WL.LU	o-Xylene	µg/m³	0	300	<3.6	<3.6	<3.6	<3.6	SV2
ME322526	VOC in Waterloo Samplers MA-5.WL.LU	Naphthalene	µg/m³	0	<4.4	<4.4	7.8	<4.4	<4.4	SV1
ME322526	TRH in air MA-30.AIR.01	C6-C10	mg/m³	0	46	4.7	1800	<0.86	<0.86	
ME322526	TRH in air MA-30.AIR.01	>C10-C16	mg/m³	0	120	1.9	550	0.47	0.74	

7.3.3. Low Level Contaminated Excavated Soil Storage Pods Soil Results

Suite 1 was analysed under the ALS analysis suite IWRG621 (previously known as VIC EPA 448.3) – Soil Hazard Categorisation & Management (including Ultra Trace organics to meet low level ‘fill criteria’).

The acceptable threshold criteria is outlined in the **Orange** shaded column. The **Green** samples represent the homogenous samples obtained from the Glen Helen petrol fuel pit. **Red** samples represent the diesel samples obtained from the Glen Helen diesel fuel pit

Table 15 - Summary laboratory analysis results table for Suite 1

Analyte grouping /Analyte	Unit	LOR	General Fill Acceptable Threshold	Sample ID			
				Petrol: P5 (6+10)	Diesel: B10 +B3 +B9	INTRA – LAB QC01	INTER – LAB QC02
Average PID Reading	ppm	0.1	-	4.3	6.8	-	-
Moisture Content	%	1	-	3.8	4.8	3.9	2.7
pH	pH Unit	0.1	-	7.9	7.9	8.0	7.7
Arsenic	mg/kg	5	20	<5	<5	<5	2.1
Cadmium	mg/kg	1	3	<1	<1	<1	< 0.4
Chromium	mg/kg	2	400	----	----	----	18
Copper	mg/kg	5	60	11	11	13	12
Lead	mg/kg	5	300	12	18	13	14
Molybdenum	mg/kg	2	40	<2	<2	<2	< 5
Nickel	mg/kg	2	60	9	9	10	10
Selenium	mg/kg	5	10	<5	<5	<5	< 2
Silver	mg/kg	2	10	<2	<2	<2	< 2
Tin	mg/kg	5	50	<5	<5	<5	< 10
Zinc	mg/kg	5	200	30	29	32	34
Mercury	mg/kg	0.1	1	<0.1	<0.1	<0.1	< 0.1
Hexavalent Chromium	mg/kg	0.5	1	<0.5	<0.5	<0.5	< 1
Total Cyanide	mg/kg	1	50	<1	<1	<1	< 1
Fluoride	mg/kg	40	450	320	310	320	120
C6 - C9 Fraction	mg/kg	10	65	<10	<10	<10	< 20
C10 - C14 Fraction	mg/kg	50	1000	<50	<50	<50	< 20
C15 - C28 Fraction	mg/kg	100	1000	<100	720	<100	< 50
C29 - C36 Fraction	mg/kg	100	1000	<100	<100	<100	< 50
C10 - C36 Fraction (sum)	mg/kg	50	1000	<50	720	<50	< 50
C6 - C10 Fraction	mg/kg	10	65	-	-	-	< 20
C6 - C10 Fraction minus BTEX (F1)	mg/kg	10	65	<10	<10	<10	< 20
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50	1000	<50	180	<50	< 50
>C16 - C34 Fraction (F3)	mg/kg	100	1000	<100	570	<100	< 100

Analyte grouping /Analyte	Unit	LOR	General Fill Acceptable Threshold	Sample ID			
				Petrol: P5 (6+10)	Diesel: B10 +B3 +B9	INTRA – LAB QC01	INTER – LAB QC02
>C34 - C40 Fraction (F4)	mg/kg	100	1000	<100	<100	<100	< 100
>C10 - C40 Fraction (sum)	mg/kg	50	1000	<50	750	<50	< 100
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50	1000	<50	180	<50	< 50
Benzene	mg/kg	0.2	1	<0.2	<0.2	<0.2	< 0.1
Toluene	mg/kg	0.5	1.4	<0.5	<0.5	<0.5	< 0.1
Ethylbenzene	mg/kg	0.5	3.1	<0.5	<0.5	<0.5	< 0.1
meta- & para-Xylene	mg/kg	0.5	-	<0.5	<0.5	<0.5	< 0.2
Styrene	mg/kg	0.5	-	<0.5	<0.5	<0.5	< 0.5
ortho-Xylene	mg/kg	0.5	-	<0.5	<0.5	<0.5	< 0.1
Total Xylenes	mg/kg	0.5	14	<0.2	<0.2	<0.2	< 0.3
Sum of monocyclic aromatic hydrocarbons	mg/kg	0.2	-	<0.5	<0.5	<0.5	< 0.5
Naphthalene	mg/kg	1	-	<1	<1	<1	< 0.5
Sum of organochlorine pesticides	mg/kg	0.03	-	<0.03	<0.03	<0.03	< 0.1
Sum of Aldrin + Dieldrin	mg/kg	0.03	2	<0.03	<0.03	<0.03	< 0.05
Sum of DDD + DDE + DDT	mg/kg	0.05	2	<0.05	<0.05	<0.05	< 0.05
Chlordane	mg/kg	0.03	2	<0.03	<0.03	<0.03	< 0.1
Sum of other organochlorine pesticides	mg/kg	0.03	-	<0.03	<0.03	<0.03	< 0.1
Sum of polycyclic aromatic hydrocarbons	mg/kg	0.5	5	<0.5	<0.5	<0.5	<0.5
Sum of Phenols (halogenated)	mg/kg	0.03	1	<0.03	<0.03	<0.03	< 1
Sum of Phenols (non-halogenated)	mg/kg	1	60	<1	<1	<1	< 20
Sum of volatile chlorinated hydrocarbons	mg/kg	0.01	1	<0.01	<0.01	<0.01	< 0.5
Sum of other chlorinated hydrocarbons	mg/kg	0.01	1	<0.01	<0.01	<0.01	< 0.5
Total Polychlorinated biphenyls (PCB)	mg/kg	0.1	2	<0.1	<0.1	<0.1	< 0.1

Suite 2 was not analysed as it was not applicable to these samples. Rather, the contaminants of concern were focused upon which included TRH/TPH, BTEXN, PAH and heavy metals analysis. This method adjustment was agreed upon by an Alice Springs Town Council Representative.

Table 16 - Summary laboratory analysis results table for Contaminants of Concern (TRH/TPH, BTEXN, PAH and heavy metals).

Analyte grouping /Analyte	Unit	LOR	Acceptable Threshold	Sample ID									
				P5 (2+7)	P5 (1+5)	P5 (9+4)	P5 (3+8)	B11 +B8	B4 + B7	B1 + B5	B2 + B6	D5 + D2	D7 + D8
PID Reading (Non-Lab Field Measurement)													
PID Vapour Reading	ppm	0.1	-	2.9	2.1	2.6	4.1	8.6	4.9	10	8.5	7.6	13.3
Moisture Content	%	1	-	3.4	3.2	3.0	3.5	----	2.9	4.2	3.3	----	3.5
Arsenic	mg/kg	5	20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cadmium	mg/kg	1	3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium	mg/kg	2	400	16	16	17	16	13	13	17	16	16	17
Copper	mg/kg	5	60	12	12	13	13	10	10	13	31	11	13
Lead	mg/kg	5	300	17	11	7	8	13	13	10	12	12	9
Nickel	mg/kg	2	60	9	9	10	11	8	8	10	10	9	10
Zinc	mg/kg	5	200	30	31	26	28	25	24	28	26	27	28
Mercury	mg/kg	0.1	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C6 - C10 Fraction	mg/kg	10	65	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
C6 - C10 Fraction minus BTEX (F1)	mg/kg	10	65	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50	1000	<50	<50	<50	<50	220	<50	130	150	110	50
>C16 - C34 Fraction (F3)	mg/kg	100	1000	<100	<100	<100	<100	830	<100	480	640	520	230
>C34 - C40 Fraction (F4)	mg/kg	100	1000	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C10 - C40 Fraction (sum)	mg/kg	50	1000	<50	<50	<50	<50	1050	<50	610	790	630	280
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50	1000	<50	<50	<50	<50	220	<50	130	150	110	50

Analyte grouping /Analyte	Unit	LOR	Acceptable Threshold	Sample ID										
				P5 (2+7)	P5 (1+5)	P5 (9+4)	P5 (3+8)	B11+B8	B4+B7	B1+B5	B2+B6	D5+D2	D7+D8	
Benzene	mg/kg	0.2	1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	0.5	1.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	0.5	3.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	mg/kg	0.5	14	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	mg/kg	0.5	14	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Xylenes	mg/kg	0.5	14	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sum of BTEX	mg/kg	0.2	19.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	mg/kg	1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum of PAH	mg/kg	0.5	5	-	-	-	-	-	<0.5	-	-	-	<0.5	-

The yellow highlighted result of **1050mg/kg** for TRH >C10 - C40 Fraction (sum) in diesel sample **B11 + B8** is the only value to exceed the “acceptable threshold” criteria.

8. DISCUSSION OF RESULTS

8.1. SOIL SAMPLES

Metals:

Contamination by leaded fuels can result in elevated levels of heavy metals, such as lead, at fuel station sites. All results for heavy metals in soil samples from this site were at low level. Although zinc and total chromium levels were slightly elevated compared to the control sample, all levels are within NEPM 2013 environmental screening levels (ESLs) and health investigation levels (HILs) and do not pose a risk to human health or the environment at these levels

Total Recoverable Hydrocarbons (TRH):

Hydrocarbons were detected at low levels in the Opal petrol pit, high levels in the diesel pit, and no hydrocarbons were detected above LOR in the old petrol pit. The hydrocarbons in the soil samples from the diesel system were primarily made up of longer chain C10-C34 carbon chain fraction, which is consistent with diesel fuel. Hydrocarbons in the soil samples from the petrol system were primarily made up of short C6-C16 carbon chain fraction, which is consistent with petrol fuel.

Several of the samples from the bottom of the diesel pit namely B10, B13, D11 and D17 had very high hydrocarbon concentrations above 20,000 mg/kg total TRH. This concentration is above NEPM 2013 hydrocarbon management limit concentrations. Several of the stockpile samples from around the diesel pit also had hydrocarbon concentrations above management limit concentrations. Samples from the bottom of the Opal petrol system pit were much lower with a hydrocarbon concentration below 200 mg/kg TRH. When also considering the PID and laboratory results from the previous site investigations the laboratory analysis results for hydrocarbons in the Opal petrol pit soil samples had similarly been low even though their PID readings were high. Laboratory analysis concentrations were below NEPM 2013 hydrocarbon management limit concentrations for all Opal tank pit samples except for 2 samples adjacent to the tank in the preliminary site investigation (refer to *Glen Helen PSI Report*).

None of the ten (10) drilled soil samples analysed from beyond the pit detected levels of hydrocarbons above LOR. However, the sample from the base of the diesel system had a very high hydrocarbon concentration of 62,300 mg/kg total TRH, and the pit sample from the petrol system had low a hydrocarbon concentration of 110 mg/kg total

Benzene, Toluene, Ethylbenzene, Xylene (BTEXN):

Petrol (unleaded and premium unleaded) contains significant quantities of BTEX, and diesel fuel usually has low concentrations of BTEXs (CRC Care). No BTEXN was detected in the soil samples from the old petrol tank pit, but BTEXN was detected at low levels in samples from the diesel pit and opal petrol pit. Xylenes, Ethylbenzene and Toluene levels were all below NEPM ESLs and HSLs for public open space areas.

8.2. FINKE RIVER WATER SAMPLES:

Laboratory results detected no levels of TRH or BTEXN above LOR in any of the groundwater samples.

8.3. SOIL VAPOUR PASSIVE SAMPLERS:

Sample SV4 was the only sample that the laboratory analysis detected high levels of TRH vapour contamination. This sample was in direct proximity to the backfilled opal petrol pit. Sample SV1 detected the lower levels of TRH vapour contamination but higher levels of VOC's. This sample was in direct proximity to the backfilled diesel pit. The laboratory results for all other samples located away from the pits detected no-low levels of hydrocarbon vapour which were all below HSL's.

*Refer to Appendix L for Schedule B1 NEPM 2013 Guidelines

9. CONTAMINATION RISK ASSESSMENT AND ACTION UNDERTAKEN

The National Environmental Protection Measure (NEPM, 2013) recommends assessing extent and concentration of soil contamination to determine any risks the contamination may pose to human health and the environment. The NEPM includes concentration and management limits for hydrocarbons, heavy metals contamination on sites, recognizing the potential for the contamination to be detrimental on underground services or infrastructure. For assessment purposes the site is generally classified as Public Open Space with surrounding National Park identified as an Area of Ecological Significance.

Contamination Extent

The soil immediately surrounding the diesel pit remains at a high contamination level from approximately 1.5 m below ground level down to bed rock layer at approximately three (3) metres, however contamination does not extend to surrounding drill sample holes H 6 (~8 m S), H 7 (~5.5 m NE) or H 8 (~7 m NW) (refer Figure 15). The soil immediately surrounding the petrol pit is at a low contamination level from 1.5 m bgl down to a rock layer at ~3 m and does not extend to surrounding drill holes H 5 (~10 m NE) and H 8 (~7 m SE) or the old petrol tank pit to the west. There is no contamination in the vicinity of the old petrol tank pit. All contaminated soil excavated from the diesel and petrol tank pit was transported off-site for appropriate disposal. Soil excavated from the pits had varying levels of contamination, with higher levels in the stockpiles surrounding the diesel fuel pit and lower levels in the stockpiles around the petrol fuel pit.

After the analysis of the lateral and vertical extents of the contamination undertaken on the 28th of April, it was determined that there was no indication that the contamination from either fuel tanks has migrated into the surrounding environment. Bedrock at around 2.7 mbgl would prevent hydrocarbons from seeping to greater depths (Figure 16). The contamination has remained localized in soil in immediate proximity to the fuel tank pits probably because clay soils do not transport hydrocarbons easily. Groundwater samples collected from shallow bore holes adjacent to the Finke River were not contaminated, confirming that fuel has not migrated into the Finke River. Now that the source of contamination has been removed, it is unlikely that the fuel contamination in the soil poses further risk in this ecologically significant area. The location of identified soil contamination in relation to its commercial and ecological surrounds is presented in Figures 12 – 14.

None of the surrounding drilled soil samples recorded hydrocarbons (TRH) at levels detectable in the laboratory analysis and were all below the NEPM hydrocarbon management limits. Soils in the

immediate area of the diesel bowser and tank had significant diesel/hydrocarbon contamination exceeding the NEPM management limits within the depth bgl (1.2m) for potential impact to existing services or installation of new services or trenching in the future. This soil was removed for off-site disposal and there will be no residual contaminated soil within 1.2m of ground level as the tank pits have been backfilled with clean soil. Possible residual contaminated soil at greater depths than 1.2m is not considered a concern for management at this site for the proposed use of the area of the backfilled tank pits. The clay soils will ensure that there is little migration of hydrocarbons from the pit area.

Excavated Soil

The *Waste Management and Pollution Control Act 1988* (NT) (WMPC Act) states that stockpiled soils contaminated with hydrocarbons are classified as a listed waste and unauthorised burial of waste is an offence under the WMPC Act. A determination of contamination status is presented below for soil stockpiles at the site.

Diesel Pit Excavated Soil

The excavated soil of greatest contamination was from the bottom of the diesel pit. All this soil, with high concentrations of hydrocarbons, was transported by Cleanaway for disposal/treatment in South Australia. The excavated soil from shallower parts of the diesel pit had much lower concentrations of hydrocarbons, and was accepted by Alice Springs Town Council as “General Fill” for disposal of at the Alice Springs RWMF.

Opal Petrol Pit Soil Stockpiles

The stockpiles surrounding the Opal petrol pit had much lower levels of hydrocarbon contamination compared to the diesel stockpiles. Stockpiles 4 and 6 to the south and west of the Opal petrol pit did not exhibit any hydrocarbon contamination based on observations, PID readings and laboratory analysis. Although stockpile 5, to the north of the Opal petrol pit did contain low levels of hydrocarbons, but they were within the limits and were accepted by Alice Springs Town Council as “General Fill” and disposed of at the Alice Springs RWMF.

Pit Backfilling and Site Reinstatement

- Uncontaminated soil from stockpiles 4 and 6 were used elsewhere on site.
- Both the Opal and Diesel pits were backfilled to ground level with imported clean fill material suitable for intended use of the area as a carpark.

- When backfilling, suitable soil moisture content was contained and appropriate compaction methods were used to reduce future subsidence.
- Perforated vent pipes, rocks and geofabric was installed in the bottom of each pit to aid aeration and promote biodegradation of hydrocarbons.

Residual contaminated soil in situ

Given assessment of potential risks and likelihood, , active remediation or removal and disposal of the residual localised contaminated soil off-site is not required to manage site risks. Natural Source Zone Depletion of residual contaminated soil in situ is proposed. This avoids both the high economic and environmental costs such as use of fossil fuels and generation of greenhouse gases associated with active remediation or disposal of this soil offsite. A flow chart adapted from NEPM 2013 showing the decision process for the assessment and proposed remediation is included in Appendix O. It is suggested that 4-6 samples be taken of the residual soils at a depth of about 2.5m bgl to establish a baseline for hydrocarbon levels in the residual soil surrounding the pits.



Figure 12: Aerial view showing location and surrounding ecological features of residual contamination ((NR Maps).

The Finke River is >100m away from the contaminated soil locations and Glen Helen Gorge is >400m away from the contaminated soil locations.



Figure 13: Site overview map showing contamination locations in relation to Glen Helen Lodge and associated infrastructures ((NR Maps)) .

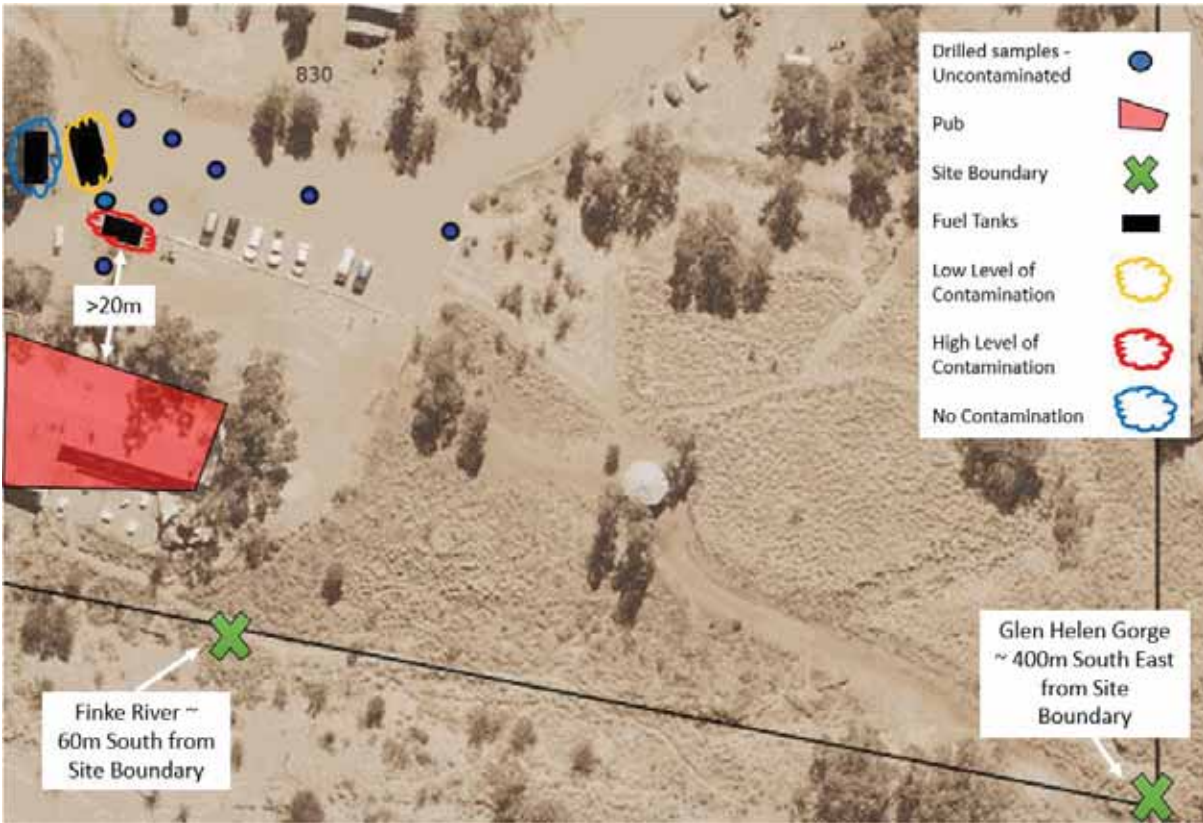


Figure 14: CMS showing location, extent and level of contamination at the UPSS and surrounding areas of interest (NR Maps)

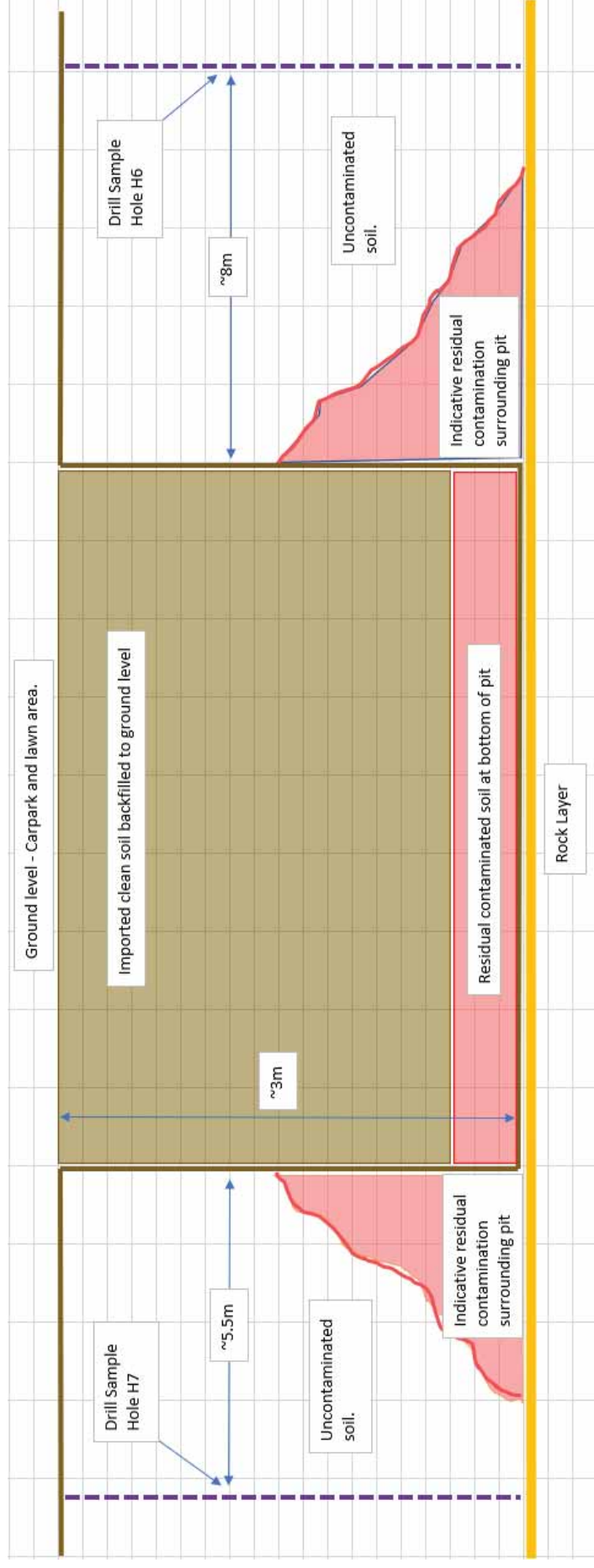


Figure 15: Conceptual Site Model – Diesel Pit

The CSM for the Opal pit is similar but has low level hydrocarbon contamination within acceptable limits.

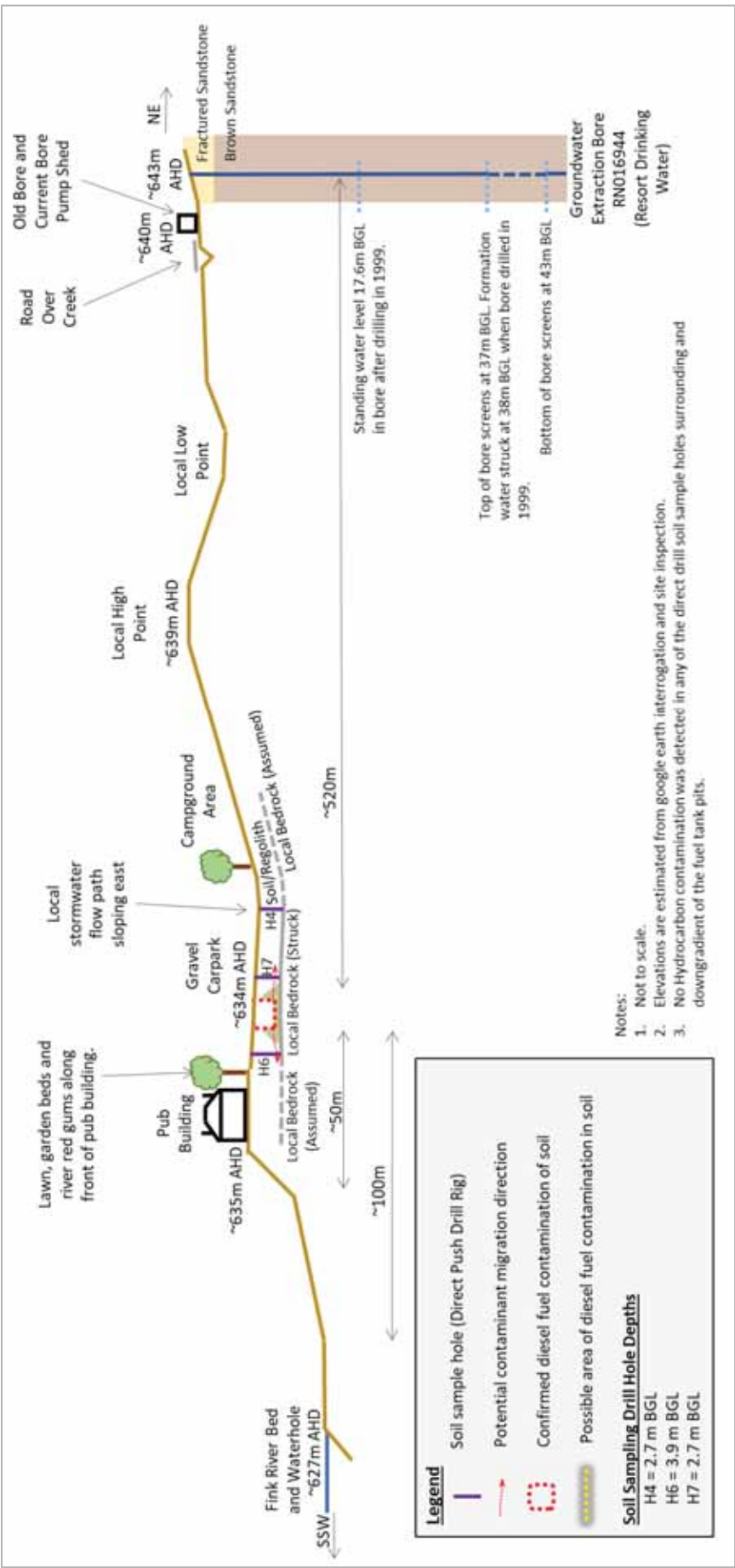


Figure 16: Cross Section for the CSM at the Glen Helen Lodge and surrounding areas of interest.

9.1. HUMAN HEALTH CONSIDERATIONS AND RISKS

Direct contact

There is no contamination on the surface now that the diesel bowser and surrounding surface soil has been removed and the fuel tank pits have been backfilled with clean topsoil. Therefore there is no direct contact risk at the surface. The only potential for direct contact with the contamination is maintenance staff doing intrusive work at depth.

However, the contaminant level for the residual soil are below the values for an intrusive maintenance worker tabled in CRC CARE Tech Report 10. The levels also meet the criteria in the HSL application checklist.

Vapour intrusion

If there is no vapour barrier and there is contaminated soil underneath nearby buildings, people occupying the buildings could be affected. This vapour intrusion risk is unlikely to be of concern in public open spaces, such as the area around the fuel systems, carpark, and lawns at Glen Helen. The closest building, the pub ~20 m south of the diesel system, and is considered a commercial use building. Soil vapour passive samples taken near the pub show that some fuel vapour was detected but in very low amounts. The levels are well below CRC and NEPM 2013 HSLs for soil vapour exposure to public open space occupants and intrusive maintenance workers. (Appendix K and L). Vapour concentrations of concern were only detected in sample locations >20m away from buildings taken directly over the contamination fuel pit sites. Therefore, spread of fuel vapour contamination towards the pub is negligible so the vapour poses no risk to people.

Workers / occupants of buildings at the lodge (vapour intrusion). The only plausible exposure pathway is indirect exposure via vapour intrusion. The results reported in the vapour survey were well below the applicable soil vapour health screening levels that were adopted from the ASC NEPM 2013 guidelines and also met the criteria in the HSL application checklist.

Intrusive maintenance workers (vapour intrusion). The fuel vapour levels for the residual soils are well below the respective screening levels for an intrusive maintenance worker (vapour intrusion) tabled in CRC CARE Tech Report 10. BTEXN results are below reporting limits and the screening values for TPH fractions were not limiting (i.e.. the maximum theoretical concentration in soil doesn't generate a vapour level of potential concern). The results also adhere to the HSL application checklist.

Groundwater

Local groundwater was not encountered in any of the hand auger sample holes or drill holes at the site. Groundwater extraction for drinking water is from bores approximately 1070 m northeast above the depth of the fuel systems and is therefore, unlikely to become contaminated. No official wells or bores are located immediately around the Lodge, so independent assessment of groundwater availability in the vicinity of the fuel tanks is not available. The nearest Finke River water hole is 120 m south with a sub crop rocky ridge between the bowser area and the river. People are unlikely to drink the river water as the Finke River is renowned as a river of salt, (Arrernte name Larapinta River-Salt). Shallow groundwater samples collected from hand dug bore holes adjacent to the riverbank, the laboratory analysis did not reveal any levels of hydrocarbons indicating that no fuel has migrated into the Finke River waterhole. Therefore, there is no risk of fuel contamination for people undertaking leisure activities near and in the river.

Refer Appendix K for CRC CARE Tech Report 10 Screening Levels, Appendix L for NEPM 2013 Screening Levels and refer Appendix R for CLC CARE HSL application checklist.

9.2. ECOLOGICAL CONSIDERATIONS AND RISKS

The site is surrounded by the West MacDonnell National Park and adjacent to the Finke River and near the Glen Helen Gorge and associated waterhole. The site is in an area of ecological significance with sensitive ecological features nearby. Given the setting, the potential ecological risks are perhaps of most concern for this type of fuel leak.

The key receptor of concern is the Finke River and downstream Finke River Gorge. Various lines of evidence have been collected indicating that neither the waterway nor the downstream gorge have been impacted by the fuel leakage from the former tank / bowser area at the lodge and risk of future impacts is likely to be negligible. The lines of evidence include:-

1. the relatively localized area of remaining impacts (lateral delineation of impacts in soils with no impacts reported beyond the immediate extent of the former diesel tank);
2. The presence of a bedrock layer at approx. 3-4 m depth beneath the impacted area would limit downward infiltration of any historical fuel leakage;
3. the relatively significant depth to the water table (no shallow / perched groundwater found in the area investigated, and the drilling log for the Glen Helen Lodge supply bore indicates that groundwater was struck at approximately 38m depth);

4. absence of any direct connection between groundwater at the lodge site and the adjacent Finke River as suggested by the ephemeral nature of flows in this section of the river, and water table in the area being significantly deeper than the adjacent portion of river;
5. No impacts to vegetation or trees either on the site or the surrounding area have been identified that could be attributed to the historical fuel leak.

Given that, after possibly 20 years of fuel delivery plumbing (S Murdoch, 2021), only a limited amount of fuel contaminated soil, localised to the immediate proximity of the Diesel and Opal tank pits, it is unlikely that the residual fuel contamination in the soil poses a risk on site or in the surrounding area of ecological significance.

Ecological risk in the localised area of the tank pits, where residual contamination exists, depends on the current and planned use of this part of the Glen Helen Lodge site. Ecological Screening Levels (ESLs) for contaminated soil are generally applicable to the top 2 m of soil; however, greater depths should be considered in arid areas such as Glen Helen (NEPM 2013). The current use of this area is as a carpark and lawn area, and the proposed masterplan for the site indicates this will continue. The localised residual contamination will therefore not pose a risk to the ecological values on the site. If, in the near future, certain vegetation such as river red gums were to be planted above the localised contaminated soil there may be impacts on the health of these deep-rooted plants. Such planting would not be recommended as River Red Gums are a groundwater dependent species, and as there is no groundwater in this location, the trees would require irrigation from the surface which would encourage shallow rooting. In addition, low concentrations of decaying hydrocarbons are a source of nutrients for microbes, and they will increase the rate of decay of the hydrocarbons. However, it is advised that any future planting in this small area should consider shallower rooted plant species until residual contamination is depleted.

A dead tree stump was noted immediately south of the diesel system, but it is unknown why or when this large tree was cut down. Review of historical Google Earth satellite images and historical photos indicate that there were four large trees in a row near the diesel system in the past, three of which died and were removed between 2004 and 2012, the fourth tree being the stump noted above. It was reported that the irrigation for these trees had also been altered during this time. There are multiple reasons that could have led to the deaths of these trees. However, as groundwater dependant species, River Red Gum would have died without irrigation during the dry period in the late 2000s. Other nearby trees appear healthy. The drill hole samples taken near where the trees once grew showed no

presence of contaminant hydrocarbons, which indicates it was likely an alternate factor, such as lack of that caused the death of these trees.

9.3. HYDROCARBON MANAGEMENT CONSIDERATIONS

Petroleum hydrocarbon 'management limits' used to consider the potential effects of light non-aqueous phase liquid (LNAPL) related hazards are applied after consideration of relevant ESLs and HSLs (NEPM 2013). These management limits are set also to recognise the potential for hydrocarbon contamination in soil to negatively impact on underground services or infrastructure.

Residual soil samples analysed from D11, D3 and D17 in the diesel pit recorded hydrocarbon (TRH) levels above the NEPM hydrocarbon management limits for commercial sites. They were taken at depth from 1.5 m to 3.5 m bgl, which is deeper than the 1 m generally used for potential impact to existing services, future installation of services or trenching. Soil from Phase 1 samples taken from the excavators bucket or from the stockpiles with levels above the NEPM hydrocarbon management limits for commercial sites are not relevant, as all of this soil was removed from site. The top 3 m of highly contaminated soil was removed from both the Diesel and Petrol Pit and backfilled with clean fill and the adjacent residual contaminated soil is deeper than 1.2 m below ground surface (refer Figure 15).

The site specific consideration of the results with regard to the CSM for the site and aspects covered by the TPH management limits are noted below.-

1. Formation of NAPL. In the vicinity of the tank and bowser areas, no evidence of NAPL has been identified in the various phases of fieldwork, including during the tank removal process or the subsequent soil investigations.
2. Fire / explosion risk. The soils remaining pose negligible risk of a fire / explosion based on the concentration depth of contaminants (>1.2 m), and absence of any plausible link to any ignition sources.
3. Impacts on buried infrastructure. There is no buried infrastructure in the vicinity of the contaminated zone, and future impacts are also considered unlikely based on the depth (>1.2 m) and low concentration of contaminants
4. Aesthetic / odour. No aesthetics impacts such as odour have been noted during the investigations and site visits completed since the tanks and bowzers were removed.
5. Future management. A management plan is recommended. This will ensure the remaining impacted zone is flagged for the future owners / operators so that site use and development can be planned appropriately.

10.CONCLUSIONS

The findings from each phase of this investigation indicate that the movement of fuel hydrocarbons contamination off site is not occurring. There is no evidence of contamination beyond the pits, as all proximal soil and water samples were uncontaminated. The source of the fuel leak has been removed, pits have been lined, the consistent layer of bedrock at ~2.7 mbgl and the clay soils will limit movement of the residual hydrocarbon contamination. Hence the ecological risk is negligible.

Furthermore, there is no risk to human health from the residual in-situ contaminated soil in the open car park area in which the tank pits are located, given the contaminated soil is deeper than 1.2 mbgl. This was confirmed by low vapour levels that would not pose health risks to persons inside nearby buildings or to intrusive maintenance workers. The residual contaminated soil is also not considered a concern for future management of the area over the backfilled tank pits, as any trenching for services will be shallower.

The lateral and vertical extent of the residual localized contamination will not pose a risk to human health, the environment, or management of the site, given that the current and proposed medium-term future use of the site is as a carpark and lawn area

11.FUTURE MONITORING AND RECOMMENDATIONS

1. Prepare a management plan, which should include the following actions as conditions:
 - no flow water sampling from the Finke river,
 - inspection for sheen and/or vapour,
 - soil samples taken from the residual soil at 2.5 – 3 mbgl to establish a base line for hydrocarbon levels in-situ,
 - repeated sampling events to monitor hydrocarbon breakdown .

Potential factors for further monitoring include:

- signs of ecological distress,
 - erosion
 - or other observations deemed relevant by qualified consultants.
2. Given the localised nature of the fuel contamination and the area being currently below a carpark and lawn space, no further site management measures are currently considered necessary. However, if in future, the context and use of the site is altered, the residual contamination should be considered in planning of the works.
 3. Until no levels of concern are detected in the monitoring program, any future planting in this small area should consider shallower rooted plant species.

12. REFERENCES

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13. APPENDICIES

APPENDIX A - PHOTOGRAPHS TAKEN DURING SITE INVESTIGATIONS 28/04/2021.

	Image 1. Portable Mini Rae 3000 Photoionisation Detector (PID) instrument used for vapour testing of soil samples on site.
	Image 2. Bottom of northwest corner of diesel pit.



Image 3.
Bottom of diesel pit where sample D3 was taken from the northwest wall of the pit after scraping back with a shovel.



Image 4.
Opal petrol pit with surrounding stockpiles (4, 5 and 6).



Image 5.

Diesel pit with surrounding stockpiles (1, 2 and 3).



Image 6.

Largest diesel stockpile (Stockpile 1).

	Image 7. 3 Geoprobe drill Rig soil tube samples from drill hole 2. The sample tube furthest away is soil from 0.0m – 1.0m deep. The middle sample tube is soil from 1.0-2.0m deep and the closest sample tube shows the soil from 2.0m to refusal, in this case 2.7m deep. The soil was taken from varying sections of the tube to enable targeted sampling at specific depths of interest.
	Image 8. The sampling and PID analysis in process. Where specific soil is obtained from sample tube and placed in airtight ziplock bag. Sample ID and Depth was recorded on bag, the sample was left for 10 minutes as to allow time for any present gases to vaporise. The PID instrument was then used to penetrate the bag and record the vapour present. This gives a representation of the volatile nature of the sample.



Image 9.
Groundwater
sampling location
W3 adjacent to the
Finke river.



Image 10.
Groundwater
sampling bore W2
adjacent to the
Finke river.



Image 11.
Diesel pit location
after it had been
backfilled with clean
imported soil.



Image 12.
Opal petrol pit
location after it had
been backfilled with
clean imported soil
with visibly exposed
vent pipes.



Image 13.
Soil vapour passive
sample SV2
location, covered by
a cone marker.



Image 14.
Soil vapour passive
sample deployment
SV1. Membrane vial
is positioned inside
the metal coil and
deployed in 1.5m
auger hole.



Image 14.
Contaminated excavated soil in storage pods and IBCs prior to disposal.

APPENDIX B - Geoprobe Technical Drilling Machine.

GEOPROBE 6610DT

The design of the Geoprobe 6610DT ~~direct push~~ machine offers the complete package. The rig includes auxiliary power and compressor source capabilities, along with a workhorse hammer, a specially designed push probe head, two-speed high torque head, auger, auto SPT, and more. The rubber tracks allow this versatile machine to be used on concrete and pavement as well as off-road and rugged terrain. The dimensions along with remote control operation allow for excellent access to tight locations, creating safe and effective work areas. The 6610DT Geoprobe has all the modern safety features suitable for mine sites and can flexibly switch from environmental to geotechnical work including diamond coring with little time and effort.



- Solid Auger – 50m
- Hollow Flight Auger – 30m
- SPT – 20m
- PQ (114.3mm), HQ (88.9mm), NQ (69.9mm), BQ (55.6mm) – 50 meters
- Push Probe, Air Core RC, Rotary Flush – 50 metres

APPENDIX C - SUMMARY LABORATORY ANALYSIS RESULTS FOR SOIL SAMPLES 23/03/2021

Section 1: 1-12 analytes

			Sample ID: Glen Helen 23/03/2021											
Analyte grouping/Analyte	Unit	LOR	P6 0.5m	B1 above	B3 above	B5 above	B7 above	B9 above	P9 0.5m filler sand	D11 south of tank	B10	D1 0.1m	D5 0.1m	D0 0.1m
PID Reading (Non-Lab Field Measurement)														
PID Vapour Reading	ppm	0.1												
Moisture Content	%	1	4.5	8.6	10.4	9.7	7.6	8.7	5.8	5.5	7.9	13.2	6.6	18.8
EG005(ED093) T: Total Metals by ICP-AES														
Arsenic	mg/kg	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cadmium	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium	mg/kg	2	18	11	11	10	10	16	4	16	15	15	7	13
Copper	mg/kg	5	13	8	8	6	6	10	<5	10	10	10	9	10
Lead	mg/kg	5	9	19	21	6	<5	10	<5	8	6	7	7	12
Nickel	mg/kg	2	10	7	7	6	6	9	3	9	9	9	5	8
Zinc	mg/kg	5	27	32	30	23	74	28	9	23	21	40	18	37
EG035T: Total Recoverable Mercury by FIMS														
Mercury	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EP080/071: Total Petroleum Hydrocarbons														
C6 - C9 Fraction	mg/kg	10	<10	<10	<10	<10	<10	<10	<10	44	286	<10	<10	<10
C10 - C14 Fraction	mg/kg	50	110	250	450	<50	<50	1910	<50	5220	9170	<50	<50	1920
C15 - C28 Fraction	mg/kg	100	<100	2100	3280	<100	<100	8920	<100	15300	17700	<100	120	13400
C29 - C36 Fraction	mg/kg	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
C10 - C36 Fraction (sum)	mg/kg	50	110	2350	3730	<50	<50	10800	<50	20500	26900	<50	120	15300
EP080S: TPH(V)/BTEX Surrogates														
1,2-Dichloroethane-D4	%	0.2	113	105	111	100	101	110	114	117	104	109	114	100
Toluene-D8	%	0.2	105	98.8	106	98.0	84.1	107	110	116	108	113	108	92.4

Sample ID: Glen Helen 23/03/2021															
Analyte grouping/Analyte	Unit	LOR	EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions												
			P6 0.5m	B1 above	B3 above	B5 above	B7 above	B9 above	p9 0.5m filler sand	D11 south of tank	B10	D1 0.1m	D5 0.1m	D0 0.1m	
4-Bromofluorobenzene	%	0.2	107	95.3	104	99.2	93.5	102	111	108	106	112	107	88.1	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions															
C6 - C10 Fraction	mg/kg	<10	<10	23	<10	117	435	<10	<10	<10	<10	<10	<10	<10	
C6 - C10 Fraction minus BTEX (F1)	mg/kg	10	<10	<10	<10	<10	<10	23	<10	117	435	<10	<10	<10	
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50	<10	<10	<10	<10	<10	23	<10	114	415	<10	<10	<10	
>C16 - C34 Fraction (F3)	mg/kg	100	80	790	1090	<50	<50	4960	<50	9580	15800	<50	<50	4920	
>C34 - C40 Fraction (F4)	mg/kg	100	<100	1640	2740	<100	<100	6040	<100	11000	11000	<100	<100	10600	
>C10 - C40 Fraction (sum)	mg/kg	50	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50	80	2430	3830	<50	<50	11000	<50	20600	26800	<50	<50	15500	
EP080: BTEXN															
Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
Toluene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.4	<0.5	<0.5	<0.5	
Ethylbenzene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.8	<0.5	<0.5	<0.5	
meta- & para-Xylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.1	8.4	<0.5	<0.5	<0.5	
ortho-Xylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.7	8.2	<0.5	<0.5	<0.5	
Total Xylenes	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.8	16.6	<0.5	<0.5	<0.5	
Sum of BTEX	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	2.8	19.8	<0.2	<0.2	<0.2	
Naphthalene	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	

Section 2: 13-24 analytes

			Sample ID: Glen Helen 23/03/2021											
Analyte grouping/Analyte	Unit	LOR	D9	P17	B20	B15	P11	P13	P14	P29	P30	P31	B13	D17
			1.0m	surface			2.5m	2.3m	2.3m	3.5m	3.5m	3.7m		0.5m below tank
PID Reading (Non-Lab Field Measurement)														
PID Vapour Reading	ppm	0.1												
Moisture Content	%	1	8.0	6.1	6.9	6.8	9.5	7.7	8.0	7.4	7.7	7.4	10.8	4.3
EG005(ED093) T: Total Metals by ICP-AES														
Arsenic	mg/kg	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cadmium	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium	mg/kg	2	11	15	17	14	15	14	8	9	8	15	10	17
Copper	mg/kg	5	7	8	12	10	10	9	6	9	6	10	7	12
Lead	mg/kg	5	8	24	9	34	6	27	<5	<5	<5	8	6	12
Nickel	mg/kg	2	7	9	11	8	9	8	5	6	5	9	6	10
Zinc	mg/kg	5	39	23	27	25	21	17	10	13	9	26	12	32
EG035T: Total Recoverable Mercury by FIMS														
Mercury	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EP080/071: Total Petroleum Hydrocarbons														
C6 - C9 Fraction	mg/kg	10	<10	<10	<10	<10	<10	<10	395	61	490	185	223	<10
C10 - C14 Fraction	mg/kg	50	<50	290	110	<50	<50	<50	80	160	340	8360	9840	150
C15 - C28 Fraction	mg/kg	100	<100	2900	610	<100	<100	<100	<100	<100	110	17700	18600	100
C29 - C36 Fraction	mg/kg	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
C10 - C36 Fraction (sum)	mg/kg	50	<50	3190	720	<50	<50	<50	80	160	450	26100	28400	250
EP080S: TPH(V)/BTEX Surrogates														
1,2-Dichloroethane-D4	%	0.2	102	101	110	120	88.7	97.4	108	98.0	90.9	93.6	84.0	95.1
Toluene-D8	%	0.2	95.9	95.9	110	111	89.4	102	113	104	109	115	102	112
4-Bromofluorobenzene	%	0.2	97.0	93.2	107	116	86.5	96.8	112	105	114	117	99.1	113

Sample ID: Glen Helen 23/03/2021													
Analyte grouping/Analyte	Unit	LOR	D9 1.0m	P17 surface	B20	B15	P11 2.5m	P13 2.3m	P14 2.3m	P29 3.5m	P30 3.5m	P31 3.7m	D17 0.5m below tank
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions													
C6 - C10 Fraction	mg/kg	10	<10	<10	<10	<10	<10	<10	<10	489	97	592	420
C6 - C10 Fraction minus BTEX (F1)	mg/kg	10	<10	<10	<10	<10	<10	<10	<10	469	93	569	370
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50	1070	<50	1030	240	<50	<50	<50	60	130	270	14900
>C16 - C34 Fraction (F3)	mg/kg	100	3130	<100	2260	500	<100	<100	<100	<100	<100	<100	13100
>C34 - C40 Fraction (F4)	mg/kg	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C10 - C40 Fraction (sum)	mg/kg	50	4200	<50	3290	740	<50	<50	<50	60	130	270	28000
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50	1070	<50	1030	240	<50	<50	<50	60	130	270	14900
EP080: BTEXN													
Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2
Toluene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	3.3	<0.5	4.9	6.7
Ethylbenzene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	3.3	0.8	4.7	7.2
meta- & para-Xylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8.6	1.7	8.6	22.4
ortho-Xylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	4.9	1.1	4.8	14.1
Total Xylenes	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	13.5	2.8	13.4	36.5
Sum of BTEX	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	20.1	3.6	23.2	50.4
Naphthalene	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	1	2	1	1

APPENDIX D - FULL LABORATORY ANALYSIS RESULTS FOR SOIL SAMPLES 28/04/2021

Sample ID: Glen Helen 28/04/2021														
Analyte grouping/Analyte	Unit	LOR	D3 – 0.1m	P2 – 0.1m	H1 – 2.3m	H2 – 2.6m	H3 – 0.0m	H3 – 2.2- 2.7m	H4 – 1.0m	H5 – 3.0m	H6 – 0.0	H6 – 2.0	H7 – 2.0	H8 – 1.0
PID Reading (Non-Lab Field Measurement)														
PID Vapour Reading	ppm	0.1	389	1863	0.1	5.6	4.2	3.5	4.8	10.6	4.5	5.5	5.1	11.4
Moisture Content		%	1	6.9	7.8	10.3	5.1	9.8	4.2	3.6	6.4	9.1	9.2	8.4
EG005(ED093) T: Total Metals by ICP-AES														
Arsenic	mg/kg	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cadmium	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium	mg/kg	2	12	16	12	12	6	17	5	12	10	12	17	12
Copper	mg/kg	5	9	10	8	10	<5	12	<5	8	7	9	12	9
Lead	mg/kg	5	6	8	<5	7	<5	8	<5	6	<5	5	7	6
Nickel	mg/kg	2	7	9	7	10	4	10	3	8	6	8	10	7
Zinc	mg/kg	5	17	21	13	22	8	26	6	20	14	17	26	17
EG035T: Total Recoverable Mercury by FIMS														
Mercury	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EP080/071: Total Petroleum Hydrocarbons														
C6 - C9 Fraction	mg/kg	10	274	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
C10 - C14 Fraction	mg/kg	50	16900	90	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
C15 - C28 Fraction	mg/kg	100	45400	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
C29 - C36 Fraction	mg/kg	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
C10 - C36 Fraction (sum)	mg/kg	50	62300	90	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
EP080S: TPH(V)/BTX Surrogates														
1,2-Dichloroethane-D4	%	0.2	127	106	92.3	99.2	106	103	102	103	102	90.9	94.6	113
Toluene-D8	%	0.2	120	119	99.9	94.1	118	114	112	114	117	99.2	108	128
4-Bromofluorobenzene	%	0.2	117	120	101	108	119	118	110	115	112	103	109	124
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions														
C6 - C10 Fraction	mg/kg	10	703	42	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

Glen Helen Fuel Contamination: Investigation and Remediation Report V8

Sample ID: Glen Helen 28/04/2021														
Analyte grouping/Analyte	Unit	LOR	D3 –	P2 –	H1 –	H2 –	H3 –	H3 –	H4 –	H5 –	H6 –	H6 –	H7 –	H8 –
			0.1m	0.1m	2.3m	2.6m	0.0m	2.2-2.7m	1.0m	3.0m	0.0	2.0	1.0	
C6 - C10 Fraction minus BTEX (F1)	mg/kg	10	660	42	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50	32000	110	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
>C16 - C34 Fraction (F3)	mg/kg	100	30500	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C34 - C40 Fraction (F4)	mg/kg	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C10 - C40 Fraction (sum)	mg/kg	50	62500	110	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50	32000	110	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
EP080: BTEXN														
Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	0.5	1.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	0.5	5.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	mg/kg	0.5	21.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	mg/kg	0.5	14.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Xylenes	mg/kg	0.5	35.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sum of BTEX	mg/kg	0.2	42.8	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	mg/kg	1	6	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

**QUALITY CONTROL REPORT****Work Order : ES2111527**

Page : 1 of 9

Client : **LOW ECOLOGICAL SERVICES**

Contact : MR BILL LOW

Address : PO BOX 3130

ALICE SPRINGS NT, AUSTRALIA 0871

Telephone : +61 08 89 555 222

Project : Glen Helen - Soil Testing Around Fuel Systems

Order number : ----

C-O-C number : ----

Sampler : Bill Low, Danesh Antia

Site : ----

Quote number : EN/333

No. of samples received : 29

No. of samples analysed : 29

Laboratory

Contact

Address

Telephone

Date Samples Received : 30-Mar-2021

Date Analysis Commenced : 01-Apr-2021

Issue Date : 07-Apr-2021

: Environmental Division Sydney

: Customer Services ES

: 277-289 Woodpark Road Smithfield NSW Australia 2164

: +61-2-8784 8555

: 30-Mar-2021

: 01-Apr-2021

: 07-Apr-2021

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Alex Rossi	Organic Chemist	Sydney Inorganics, Smithfield, NSW
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Sanjeshni Jyoti	Senior Chemist Volatiles	Sydney Organics, Smithfield, NSW



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Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Soil Testing Around Fuel Systems

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot

CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

RPD = Relative Percentage Difference

= Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: SOIL

Sub-Matrix: SOIL			Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 3598488)									
ES2110965-001	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	7	9	21.7	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	24	26	7.27	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
ES2111527-003	B3 above ground	EG005T: Chromium	7440-47-3	2	mg/kg	11	15	30.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	7	9	23.3	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	8	10	26.4	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	21	42	66.7	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	30	41	32.8	No Limit
		EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 3598493)							
		ES2111527-013	Control 1 0.1m (100m north)	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1
EG005T: Chromium	7440-47-3			2	mg/kg	10	10	0.00	No Limit
EG005T: Nickel	7440-02-0			2	mg/kg	5	5	0.00	No Limit
EG005T: Arsenic	7440-38-2			5	mg/kg	<5	<5	0.00	No Limit
EG005T: Copper	7440-50-8			5	mg/kg	<5	5	0.00	No Limit
EG005T: Lead	7439-92-1			5	mg/kg	8	10	22.0	No Limit
EG005T: Zinc	7440-66-6			5	mg/kg	10	11	10.4	No Limit
EG005T: Cadmium	7440-43-9			1	mg/kg	<1	<1	0.00	No Limit
ES2111527-023	P14 2.3m	EG005T: Chromium	7440-47-3	2	mg/kg	14	13	0.00	No Limit
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Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)	
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 3598493) - continued										
ES2111527-023	P14 2.3m	EG005T: Nickel	7440-02-0	2	mg/kg	8	7	0.00	No Limit	
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit	
		EG005T: Copper	7440-50-8	5	mg/kg	9	8	15.8	No Limit	
		EG005T: Lead	7439-92-1	5	mg/kg	27	18	40.1	No Limit	
		EG005T: Zinc	7440-66-6	5	mg/kg	17	16	9.41	No Limit	
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3598498)										
ES2111027-001	Anonymous	EA055: Moisture Content	----	0.1	%	11.5	13.8	18.1	0% - 50%	
ES2111527-007	P9 0.5m filler sand	EA055: Moisture Content	----	0.1	%	5.8	6.0	3.47	No Limit	
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3598499)										
ES2111527-016	D8 1.0m (NE of bowser)	EA055: Moisture Content	----	0.1	%	9.0	8.9	0.00	No Limit	
ES2111527-027	B13	EA055: Moisture Content	----	0.1	%	7.4	7.8	5.48	No Limit	
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3598489)										
ES2110965-001	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit	
ES2111527-003	B3 above ground	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit	
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3598494)										
ES2111527-013	Control 1 0.1m (100m north)	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit	
ES2111527-023	P14 2.3m	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit	
EP080/074: Total Petroleum Hydrocarbons (QC Lot: 3596766)										
ES2111527-001	P6 0.5m	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit	
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit	
		EP071: C10 - C14 Fraction	----	50	mg/kg	110	110	0.00	No Limit	
		EP071: C15 - C28 Fraction	----	100	mg/kg	120	100	18.1	No Limit	
ES2111527-011	D5 0.1m	EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit	
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit	
EP080/074: Total Petroleum Hydrocarbons (QC Lot: 3596768)										
ES2111527-021	P11 2.5m	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit	
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit	
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit	
EP080/074: Total Petroleum Hydrocarbons (QC Lot: 3597590)										
ES2111527-001	P6 0.5m	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.00	No Limit	
ES2111527-011	D5 0.1m	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.00	No Limit	
EP080/074: Total Petroleum Hydrocarbons (QC Lot: 3597602)										
ES2111157-001	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.00	No Limit	
ES2111527-021	P11 2.5m	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.00	No Limit	
EP080/074: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3596766)										
ES2111527-001	P6 0.5m	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit	
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit	



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Sub-Matrix: SOIL			Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3596766) - continued									
ES2111527-001	P6 0.5m	EP071: >C10 - C16 Fraction	----	50	mg/kg	80	90	0.00	No Limit
ES2111527-011	D5 0.1m	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3596768)									
ES2111527-021	P11 2.5m	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3597590)									
ES2111527-001	P6 0.5m	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.00	No Limit
ES2111527-011	D5 0.1m	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.00	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3597602)									
ES2111157-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.00	No Limit
ES2111527-021	P11 2.5m	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.00	No Limit
EP080: BTEXN (QC Lot: 3597590)									
ES2111527-001	P6 0.5m	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
	EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.00	No Limit	
	EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.00	No Limit	
	D5 0.1m	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
EP080: ortho-Xylene		95-47-6	0.5	mg/kg	<0.5	<0.5	0.00	No Limit	
EP080: Naphthalene		91-20-3	1	mg/kg	<1	<1	0.00	No Limit	
EP080: BTEXN (QC Lot: 3597602)									
ES2111157-001	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
ES2111527-021	P11 2.5m	EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.00	No Limit
		EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit

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Sub-Matrix: SOIL			Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP080: BTEXN (QC Lot: 3597602) - continued									
ES2111527-021	P11 2.5m	EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.00	No Limit



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Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL		Method Blank (MB) Report				Laboratory Control Spike (LCS) Report				
Method: Compound		CAS Number	LOR	Unit	Result	Spike Concentration	Spike Recovery (%)		Acceptable Limits (%)	
							LCS	Low	High	
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3598488)										
EG005T: Arsenic		7440-38-2	5	mg/kg	<5	121.1 mg/kg	91.5		88.0	113
EG005T: Cadmium		7440-43-9	1	mg/kg	<1	0.74 mg/kg	94.2		70.0	130
EG005T: Chromium		7440-47-3	2	mg/kg	<2	20.2 mg/kg	103		68.0	132
EG005T: Copper		7440-50-8	5	mg/kg	<5	52.9 mg/kg	98.0		89.0	111
EG005T: Lead		7439-92-1	5	mg/kg	<5	62.1 mg/kg	91.8		82.0	119
EG005T: Nickel		7440-02-0	2	mg/kg	<2	15.4 mg/kg	96.0		80.0	120
EG005T: Zinc		7440-66-6	5	mg/kg	<5	162 mg/kg	72.1		66.0	133
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3598493)										
EG005T: Arsenic		7440-38-2	5	mg/kg	<5	121.1 mg/kg	91.7		88.0	113
EG005T: Cadmium		7440-43-9	1	mg/kg	<1	0.74 mg/kg	104		70.0	130
EG005T: Chromium		7440-47-3	2	mg/kg	<2	20.2 mg/kg	101		68.0	132
EG005T: Copper		7440-50-8	5	mg/kg	<5	52.9 mg/kg	95.6		89.0	111
EG005T: Lead		7439-92-1	5	mg/kg	<5	62.1 mg/kg	93.9		82.0	119
EG005T: Nickel		7440-02-0	2	mg/kg	<2	15.4 mg/kg	94.7		80.0	120
EG005T: Zinc		7440-66-6	5	mg/kg	<5	162 mg/kg	74.8		66.0	133
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3598489)										
EG035T: Mercury		7439-97-6	0.1	mg/kg	<0.1	0.073 mg/kg	128		70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3598494)										
EG035T: Mercury		7439-97-6	0.1	mg/kg	<0.1	0.073 mg/kg	112		70.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3596766)										
EP071: C10 - C14 Fraction		----	50	mg/kg	<50	300 mg/kg	109		75.0	129
EP071: C15 - C28 Fraction		----	100	mg/kg	<100	450 mg/kg	99.7		77.0	131
EP071: C29 - C36 Fraction		----	100	mg/kg	<100	300 mg/kg	97.3		71.0	129
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3596768)										
EP071: C10 - C14 Fraction		----	50	mg/kg	<50	300 mg/kg	99.3		75.0	129
EP071: C15 - C28 Fraction		----	100	mg/kg	<100	450 mg/kg	97.5		77.0	131
EP071: C29 - C36 Fraction		----	100	mg/kg	<100	300 mg/kg	95.1		71.0	129
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3597590)										
EP080: C6 - C9 Fraction		----	10	mg/kg	<10	26 mg/kg	106		68.4	128
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3597602)										
EP080: C6 - C9 Fraction		----	10	mg/kg	<10	26 mg/kg	84.5		68.4	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3596766)										
EP071: >C10 - C16 Fraction		----	50	mg/kg	<50	375 mg/kg	104		Page 218 of 657	125



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report				Laboratory Control Spike (LCS) Report			
Method: Compound	CAS Number	LOR	Unit	Result	Spike Concentration	Spike Recovery (%)		Acceptable Limits (%)			
						LCS	High	Low	High		
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3596766) - continued											
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	525 mg/kg	98.6		74.0	138		
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	225 mg/kg	80.5		63.0	131		
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3596768)											
EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	375 mg/kg	96.9		77.0	125		
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	525 mg/kg	97.9		74.0	138		
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	225 mg/kg	80.5		63.0	131		
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3597590)											
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	105		68.4	128		
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3597602)											
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	83.9		68.4	128		
EP080: BTEXN (QCLot: 3597590)											
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	106		62.0	116		
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	110		67.0	121		
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	109		65.0	117		
EP080: meta- & para-Xylene	108-38-3	0.5	mg/kg	<0.5	2 mg/kg	108		66.0	118		
	106-42-3										
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	105		68.0	120		
EP080: Naphthalene	91-20-3	1	mg/kg	<1	1 mg/kg	114		63.0	119		
EP080: BTEXN (QCLot: 3597602)											
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	85.0		62.0	116		
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	84.7		67.0	121		
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	82.8		65.0	117		
EP080: meta- & para-Xylene	108-38-3	0.5	mg/kg	<0.5	2 mg/kg	86.1		66.0	118		
	106-42-3										
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	86.8		68.0	120		
EP080: Naphthalene	91-20-3	1	mg/kg	<1	1 mg/kg	103		63.0	119		

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL		Matrix Spike (MS) Report							
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Spike		SpikeRecovery(%)		Acceptable Limits (%)	
				Concentration	MS	Low	High		
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3598488)									
ES2110965-001	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	87.9	70.0	130		
		EG005T: Cadmium	7440-43-9	50 mg/kg	91.5	70.0	130		
		EG005T: Chromium	7440-47-3	50 mg/kg	92.3	65.7	132		



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL			Matrix Spike (MS) Report						
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Spike		SpikeRecovery(%)		Acceptable Limits (%)	
				Concentration	MS	Low	High		
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3598488) - continued									
ES2110965-001	Anonymous	EG005T: Copper	7440-50-8	250 mg/kg	90.4	70.0	130		
		EG005T: Lead	7439-92-1	250 mg/kg	91.3	70.0	130		
		EG005T: Nickel	7440-02-0	50 mg/kg	89.5	70.0	130		
		EG005T: Zinc	7440-66-6	250 mg/kg	88.1	66.0	133		
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3598493)									
ES2111527-013	Control 1 0.1m (100m north)	EG005T: Arsenic	7440-38-2	50 mg/kg	92.6	70.0	130		
		EG005T: Cadmium	7440-43-9	50 mg/kg	95.6	70.0	130		
		EG005T: Chromium	7440-47-3	50 mg/kg	93.4	68.0	132		
		EG005T: Copper	7440-50-8	250 mg/kg	93.7	70.0	130		
		EG005T: Lead	7439-92-1	250 mg/kg	94.8	70.0	130		
		EG005T: Nickel	7440-02-0	50 mg/kg	92.3	70.0	130		
		EG005T: Zinc	7440-66-6	250 mg/kg	92.3	66.0	133		
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3598489)									
ES2110965-001	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	80.4	70.0	130		
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3598494)									
ES2111527-013	Control 1 0.1m (100m north)	EG035T: Mercury	7439-97-6	5 mg/kg	83.3	70.0	130		
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3596766)									
ES2111527-001	P6 0.5m	EP071: C10 - C14 Fraction	-----	523 mg/kg	86.1	73.0	137		
		EP071: C15 - C28 Fraction	-----	2319 mg/kg	105	53.0	131		
		EP071: C29 - C36 Fraction	-----	1714 mg/kg	116	52.0	132		
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3596768)									
ES2111527-021	P11 2.5m	EP071: C10 - C14 Fraction	-----	523 mg/kg	94.0	73.0	137		
		EP071: C15 - C28 Fraction	-----	2319 mg/kg	115	53.0	131		
		EP071: C29 - C36 Fraction	-----	1714 mg/kg	113	52.0	132		
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3597590)									
ES2111527-001	P6 0.5m	EP080: C6 - C9 Fraction	-----	32.5 mg/kg	124	70.0	130		
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3597602)									
ES2111157-001	Anonymous	EP080: C6 - C9 Fraction	-----	32.5 mg/kg	129	70.0	130		
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3596766)									
ES2111527-001	P6 0.5m	EP071: >C10 - C16 Fraction	-----	860 mg/kg	99.1	73.0	137		
		EP071: >C16 - C34 Fraction	-----	3223 mg/kg	112	53.0	131		
		EP071: >C34 - C40 Fraction	-----	1058 mg/kg	85.6	52.0	132		
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3596768)									
ES2111527-021	P11 2.5m	EP071: >C10 - C16 Fraction	-----	860 mg/kg	105	73.0	137		
		EP071: >C16 - C34 Fraction	-----	3223 mg/kg	115	53.0	131		
		EP071: >C34 - C40 Fraction	-----	1058 mg/kg	91.0	52.0	132		

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Sub-Matrix: SOIL				Matrix Spike (MS) Report			
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Spike Concentration	Spike Recovery(%)	Acceptable Limits (%)	
EP080/074: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3597590)							
ES2111527-001	P6 0.5m	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	126	70.0	130
EP080/074: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3597602)							
ES2111157-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	126	70.0	130
EP080: BTEXN (QCLot: 3597590)							
ES2111527-001	P6 0.5m	EP080: Benzene	71-43-2	2.5 mg/kg	113	70.0	130
		EP080: Toluene	108-88-3	2.5 mg/kg	107	70.0	130
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	109	70.0	130
		EP080: meta- & para-Xylene	108-38-3	2.5 mg/kg	104	70.0	130
			106-42-3				
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	109	70.0	130
		EP080: Naphthalene	91-20-3	2.5 mg/kg	102	70.0	130
EP080: BTEXN (QCLot: 3597602)							
ES2111157-001	Anonymous	EP080: Benzene	71-43-2	2.5 mg/kg	104	70.0	130
		EP080: Toluene	108-88-3	2.5 mg/kg	104	70.0	130
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	109	70.0	130
		EP080: meta- & para-Xylene	108-38-3	2.5 mg/kg	106	70.0	130
			106-42-3				
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	111	70.0	130
		EP080: Naphthalene	91-20-3	2.5 mg/kg	101	70.0	130



QA/QC Compliance Assessment to assist with Quality Review

Work Order	: ES2111527	Page	: 1 of 7
Client	: LOW ECOLOGICAL SERVICES	Laboratory	: Environmental Division Sydney
Contact	: MR BILL LOW	Telephone	: +61-2-8784 8555
Project	: Glen Helen - Soil Testing Around Fuel Systems	Date Samples Received	: 30-Mar-2021
Site	: ----	Issue Date	: 07-Apr-2021
Sampler	: Bill Low, Danesh Antia	No. of samples received	: 29
Order number	: ----	No. of samples analysed	: 29

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- NO Method Blank value outliers occur.
- NO Duplicate outliers occur.
- NO Laboratory Control outliers occur.
- NO Matrix Spike outliers occur.
- For all regular sample matrices, NO surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- NO Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- NO Quality Control Sample Frequency Outliers exist.



Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: SOIL

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method		Sample Date		Extraction / Preparation		Analysis			
Container / Client Sample ID(s)				Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content									
Soil Glass Jar - Unpreserved (EA055)		23-Mar-2021					01-Apr-2021	06-Apr-2021	✓
P6 0.5m, B3 above ground, B7 above ground, P9 0.5m filler sand, B10, D5 0.1m, Control 1 0.1m (100m north), P4 0.1m, D9 1.0m, B15, P11 2.5m, P14 2.3m, P30 3.5m, B13, BP13		B1 above ground, B5 above ground, B9 above ground, D11 south of tank, D1 0.1m, D0 0.1m, P2 0.5m, D8 1.0m (NE of bowser), B20, P17 surface, P13 2.3m, P29 3.5m, P31 3.7m, D 0.5m below tank,							



Matrix: **SOIL** Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method		Sample Date		Extraction / Preparation		Analysis		
Container / Client Sample ID(s)				Date extracted	Due for extraction	Date analysed	Due for analysis	Evaluation
EG005(ED093)T: Total Metals by ICP-AES								
Soil Glass Jar - Unpreserved (EG005T)								
P6 0.5m, B3 above ground, B7 above ground, P9 0.5m filler sand, B10, D5 0.1m, Control 1 0.1m (100m north), P4 0.1m, D9 1.0m, B15, P11 2.5m, P14 2.3m, P30 3.5m, B13, BP13		23-Mar-2021	01-Apr-2021	19-Sep-2021	✓	01-Apr-2021	19-Sep-2021	✓
B1 above ground, B5 above ground, B9 above ground, D11 south of tank, D1 0.1m, D0 0.1m, P2 0.5m, D8 1.0m (NE of bowser), B20, P17 surface, P13 2.3m, P29 3.5m, P31 3.7m, D 0.5m below tank, BP13								
EG035T: Total Recoverable Mercury by FIMS								
Soil Glass Jar - Unpreserved (EG035T)								
P6 0.5m, B3 above ground, B7 above ground, P9 0.5m filler sand, B10, D5 0.1m, Control 1 0.1m (100m north), P4 0.1m, D9 1.0m, B15, P11 2.5m, P14 2.3m, P30 3.5m, B13, BP13		23-Mar-2021	01-Apr-2021	20-Apr-2021	✓	06-Apr-2021	20-Apr-2021	✓
B1 above ground, B5 above ground, B9 above ground, D11 south of tank, D1 0.1m, D0 0.1m, P2 0.5m, D8 1.0m (NE of bowser), B20, P17 surface, P13 2.3m, P29 3.5m, P31 3.7m, D 0.5m below tank, BP13								



Matrix: **SOIL** Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method		Sample Date		Extraction / Preparation		Analysis	
Container / Client Sample ID(s)				Date extracted	Due for extraction	Date analysed	Due for analysis
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080)		23-Mar-2021	01-Apr-2021	06-Apr-2021	06-Apr-2021	06-Apr-2021	06-Apr-2021
P6 0.5m, B3 above ground, B7 above ground, P9 0.5m filler sand, B10, D5 0.1m, Control 1 0.1m (100m north), P4 0.1m, D9 1.0m, B15, P11 2.5m, P14 2.3m, P30 3.5m, B13, BP13					✓		✓
B1 above ground, B5 above ground, B9 above ground, D11 south of tank, D1 0.1m, D0 0.1m, P2 0.5m, D8 1.0m (NE of bowser), B20, P17 surface, P13 2.3m, P29 3.5m, P31 3.7m, D 0.5m below tank,							
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP080)		23-Mar-2021	01-Apr-2021	06-Apr-2021	06-Apr-2021	06-Apr-2021	06-Apr-2021
P6 0.5m, B3 above ground, B7 above ground, P9 0.5m filler sand, B10, D5 0.1m, Control 1 0.1m (100m north), P4 0.1m, D9 1.0m, B15, P11 2.5m, P14 2.3m, P30 3.5m, B13, BP13					✓		✓
B1 above ground, B5 above ground, B9 above ground, D11 south of tank, D1 0.1m, D0 0.1m, P2 0.5m, D8 1.0m (NE of bowser), B20, P17 surface, P13 2.3m, P29 3.5m, P31 3.7m, D 0.5m below tank,							



Matrix: **SOIL** Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method		Sample Date	Extraction / Preparation		Analysis	
Container / Client Sample ID(s)			Date extracted	Due for extraction	Date analysed	Due for analysis
EP080: BTEXN						
Soil Glass Jar - Unpreserved (EP080)		23-Mar-2021	01-Apr-2021	06-Apr-2021	06-Apr-2021	✓
P6 0.5m, B3 above ground, B7 above ground, P9 0.5m filler sand, B10, D5 0.1m, Control 1 0.1m (100m north), P4 0.1m, D9 1.0m, B15, P11 2.5m, P14 2.3m, P30 3.5m, B13, BP13						
B1 above ground, B5 above ground, B9 above ground, D11 south of tank, D1 0.1m, D0 0.1m, P2 0.5m, D8 1.0m (NE of bowser), B20, P17 surface, P13 2.3m, P29 3.5m, P31 3.7m, D 0.5m below tank,						



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: **x** = Quality Control frequency not within specification ; **✓** = Quality Control frequency within specification.

Quality Control Sample Type		Method	Count		Rate (%)		Quality Control Specification
Analytical Methods			QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)							
Moisture Content		EA055	4	35	11.43	10.00	✓
Total Mercury by FIMS		EG035T	4	35	11.43	10.00	✓
Total Metals by ICP-AES		EG005T	4	36	11.11	10.00	✓
TRH - Semivolatile Fraction		EP071	3	30	10.00	10.00	✓
TRH Volatiles/BTEX		EP080	4	40	10.00	10.00	✓
Laboratory Control Samples (LCS)							
Total Mercury by FIMS		EG035T	2	35	5.71	5.00	✓
Total Metals by ICP-AES		EG005T	2	36	5.56	5.00	✓
TRH - Semivolatile Fraction		EP071	2	30	6.67	5.00	✓
TRH Volatiles/BTEX		EP080	2	40	5.00	5.00	✓
Method Blanks (MB)							
Total Mercury by FIMS		EG035T	2	35	5.71	5.00	✓
Total Metals by ICP-AES		EG005T	2	36	5.56	5.00	✓
TRH - Semivolatile Fraction		EP071	2	30	6.67	5.00	✓
TRH Volatiles/BTEX		EP080	2	40	5.00	5.00	✓
Matrix Spikes (MS)							
Total Mercury by FIMS		EG035T	2	35	5.71	5.00	✓
Total Metals by ICP-AES		EG005T	2	36	5.56	5.00	✓
TRH - Semivolatile Fraction		EP071	2	30	6.67	5.00	✓
TRH Volatiles/BTEX		EP080	2	40	5.00	5.00	✓



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
TRH - Semivolatile Fraction	EP071	SOIL	In house: Referenced to USEPA SW 846 - 8015 Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM Schedule B(3).
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM Schedule B(3) amended.
Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na ₂ SO ₄ and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.

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NT, AUSTRALIA 0871

Work Order	Project / Overall Description	Site	Order number	C-O-C number	Contact
ES2111527	Glen Helen - Soil Testing Around Fuel Systems / --- -	----	----	----	MR BILL LOW

Issue Date	: 07-Apr-2021	Taxable value	: AUD\$	1,820.02
		Tax Incurred (GST)	: AUD\$	182.00
Due Date	: 08-May-2021	Amount Payable	: AUD\$	2,002.02

Work Order Breakdown

Method	Sale Item Descriptions	Quantity	Unit Value (AUD\$)	Value (AUD\$)	GST (AUD\$)	Line Total (AUD\$)
Work Order: ES2111527		Quote number: EN/333		Submatrix summary: 29 SOILS		
*Misc	Workorder Admin Fee	1.00	40.00	40.00	4.00	44.00
S-05	TRH/BTEXN/8 Metals	29.00	68.20	1,977.80	197.78	2,175.58
Workorder Additional Volume Based Discount					197.78 (net)	
* denotes non-discountable item						
● Please direct all queries to Environmental Division Sydney on +61-2-8784 8555.						

REMITTANCE ADVICE

POST TO: Australian Laboratory Services Pty Ltd
P.O. Box 66 Everton Park
QLD 4053 Australia

EMAIL TO: remittances@alsglobal.com

Vendor bank details

Bank: **Commonwealth Bank**
BSB: **064 000**
Account: **12672843**
Swift Code: **CTBAU2S**

or **Cheque**

Payable to Australian Laboratory Services Pty Ltd

or **Credit Card**

Visa
Mastercard
American Express

Amount Payable

AUD\$ 2,002.02

ALS Client Reference

LOWECO

TAX INVOICE

1151261867

**CERTIFICATE OF ANALYSIS**

Work Order	: ES2111527	Page	: 1 of 15
Client	: LOW ECOLOGICAL SERVICES	Laboratory	: Environmental Division Sydney
Contact	: MR BILL LOW	Contact	: Customer Services ES
Address	: PO BOX 3130 ALICE SPRINGS NT, AUSTRALIA 0871 : +61 08 89 555 222	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 08 89 555 222	Telephone	: +61-2-8784 8555
Project	: Glen Helen - Soil Testing Around Fuel Systems	Date Samples Received	: 30-Mar-2021 11:20
Order number	: ----	Date Analysis Commenced	: 01-Apr-2021
C-O-C number	: ----	Issue Date	: 07-Apr-2021 17:15
Sampler	: Bill Low, Danesh Antia	 	
Site	: ----		
Quote number	: EN/333		
No. of samples received	: 29		
No. of samples analysed	: 29		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Alex Rossi	Organic Chemist	Sydney Inorganics, Smithfield, NSW
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Sanjeshni Jyoti	Senior Chemist Volatiles	Sydney Organics, Smithfield, NSW



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key :

CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		Sampling date / time		P6 0.5m		B1 above ground		B3 above ground		B5 above ground		B7 above ground	
Compound	CAS Number	LOR	Unit	ES2111527-001		ES2111527-002		ES2111527-003		ES2111527-004		ES2111527-005		ES2111527-005	
				Result		Result		Result		Result		Result			
EA055: Moisture Content															
Moisture Content		----	1.0	%	4.5		8.6		10.4		9.7		7.6		
EG005(ED093)T: Total Metals by ICP-AES															
Arsenic	7440-38-2	5	mg/kg	<5		<5		<5		<5		<5		<5	
Cadmium	7440-43-9	1	mg/kg	<1		<1		<1		<1		<1		<1	
Chromium	7440-47-3	2	mg/kg	18		11		11		10		10		10	
Copper	7440-50-8	5	mg/kg	13		8		8		6		6		6	
Lead	7439-92-1	5	mg/kg	9		19		21		6		6		<5	
Nickel	7440-02-0	2	mg/kg	10		7		7		6		6		6	
Zinc	7440-66-6	5	mg/kg	27		32		30		23		74		74	
EG035T: Total Recoverable Mercury by FIMS															
Mercury	7439-97-6	0.1	mg/kg	<0.1		<0.1		<0.1		<0.1		<0.1		<0.1	
EP080/071: Total Petroleum Hydrocarbons															
C6 - C9 Fraction	----	10	mg/kg	<10		<10		<10		<10		<10		<10	
C10 - C14 Fraction	----	50	mg/kg	110		250		450		<50		<50		<50	
C15 - C28 Fraction	----	100	mg/kg	<100		2100		3280		<100		<100		<100	
C29 - C36 Fraction	----	100	mg/kg	<100		<100		<100		<100		<100		<100	
^ C10 - C36 Fraction (sum)	----	50	mg/kg	110		2350		3730		<50		<50		<50	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions															
C6 - C10 Fraction	C6_C10	10	mg/kg	<10		<10		<10		<10		<10		<10	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10		<10		<10		<10		<10		<10	
>C10 - C16 Fraction	----	50	mg/kg	80		790		1090		<50		<50		<50	
>C16 - C34 Fraction	----	100	mg/kg	<100		1640		2740		<100		<100		<100	
>C34 - C40 Fraction	----	100	mg/kg	<100		<100		<100		<100		<100		<100	
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	80		2430		3830		<50		<50		<50	
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	80		790		1090		<50		<50		<50	
EP080: BTEXN															
Benzene	71-43-2	0.2	mg/kg	<0.2		<0.2		<0.2		<0.2		<0.2		<0.2	
Toluene	108-88-3	0.5	mg/kg	<0.5		<0.5		<0.5		<0.5		<0.5		<0.5	
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5		<0.5		<0.5		<0.5		<0.5		<0.5	
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5		<0.5		<0.5		<0.5		<0.5		<0.5	
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5		<0.5		<0.5		<0.5		<0.5		<0.5	
^ Sum of BTEX	----	0.2	mg/kg	<0.2		<0.2		<0.2		<0.2		<0.2		<0.2	

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Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		P6 0.5m		B1 above ground		B3 above ground		B5 above ground		B7 above ground	
Compound	CAS Number	LOD	Sampling date / time	Unit	Result	Result	Result	Result	Result	Result	Result	Result	Result
EP080: BTEXN - Continued													
^ Total Xylenes	---	0.5		mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1		mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1
EP080S: TPH(V)/BTEX Surrogates													
1,2-Dichloroethane-D4	17060-07-0	0.2		%	113	105	111	100	101	100	100	101	101
Toluene-D8	2037-26-5	0.2		%	105	98.8	106	98.0	84.1	98.0	98.0	84.1	84.1
4-Bromofluorobenzene	460-00-4	0.2		%	107	95.3	104	99.2	93.5	99.2	99.2	93.5	93.5



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		Sampling date / time		B9 above ground		P9 0.5m filler sand		D11 south of tank		B10		D1 0.1m	
Compound	CAS Number	LOR	Unit	Result	ES2111527-006	ES2111527-007	ES2111527-008	ES2111527-009	ES2111527-010	Result	Result	Result	Result	Result	Result
EA055: Moisture Content															
Moisture Content	----	1.0	%		8.7	5.8	5.5	7.9	13.2						
EG005(ED093)T: Total Metals by ICP-AES															
Arsenic	7440-38-2	5	mg/kg		<5	<5	<5	<5	<5						
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1						
Chromium	7440-47-3	2	mg/kg		16	4	16	15	15						
Copper	7440-50-8	5	mg/kg		10	<5	10	10	10						
Lead	7439-92-1	5	mg/kg		10	<5	8	6	7						
Nickel	7440-02-0	2	mg/kg		9	3	9	9	9						
Zinc	7440-66-6	5	mg/kg		28	9	23	21	40						
EG035T: Total Recoverable Mercury by FIMS															
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1						
EP080/071: Total Petroleum Hydrocarbons															
C6 - C9 Fraction	----	10	mg/kg		<10	<10	44	286	<10						
C10 - C14 Fraction	----	50	mg/kg		1910	<50	5220	9170	<50						
C15 - C28 Fraction	----	100	mg/kg		8920	<100	15300	17700	<100						
C29 - C36 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100						
^ C10 - C36 Fraction (sum)	----	50	mg/kg		10800	<50	20500	26900	<50						
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions															
C6 - C10 Fraction	C6_C10	10	mg/kg		23	<10	117	435	<10						
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		23	<10	114	415	<10						
>C10 - C16 Fraction	----	50	mg/kg		4960	<50	9580	15800	<50						
>C16 - C34 Fraction	----	100	mg/kg		6040	<100	11000	11000	<100						
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100						
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		11000	<50	20600	26800	<50						
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		4960	<50	9580	15800	<50						
EP080: BTEXN															
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2						
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	1.4	<0.5						
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	1.8	<0.5						
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	1.1	8.4	<0.5						
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	1.7	8.2	<0.5						
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	2.8	19.8	<0.2						



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		B9 above ground		P9 0.5m filler sand		D11 south of tank		B10		D1 0.1m	
Compound	CAS Number	LOD	Sampling date / time	Unit	Result	Result	Result	Result	Result	Result	Result	Result	Result
EP080: BTEXN - Continued													
^ Total Xylenes	---	0.5		mg/kg	<0.5								
Naphthalene	91-20-3	1		mg/kg	<1			2.8		16.6		<0.5	
EP080S: TPH(V)/BTEX Surrogates													
1,2-Dichloroethane-D4	17060-07-0	0.2		%	110			117		104		109	
Toluene-D8	2037-26-5	0.2		%	107			116		108		113	
4-Bromofluorobenzene	460-00-4	0.2		%	102			108		106		112	



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID		Sampling date / time		D5 0.1m		D0 0.1m		Control 1 0.1m (100m north)		P2 0.5m		P4 0.1m	
Compound	CAS Number	LOR	Unit				Result	ES2111527-011	Result	ES2111527-012	Result	ES2111527-013	Result	ES2111527-014	Result	ES2111527-015
EA055: Moisture Content																
Moisture Content	----	1.0	%				6.6		18.8		10.4		13.0		11.4	
EG005(ED093)T: Total Metals by ICP-AES																
Arsenic	7440-38-2	5	mg/kg				<5		<5		<5		<5		<5	
Cadmium	7440-43-9	1	mg/kg				<1		<1		<1		<1		<1	
Chromium	7440-47-3	2	mg/kg				7		13		10		9		12	
Copper	7440-50-8	5	mg/kg				9		10		<5		5		7	
Lead	7439-92-1	5	mg/kg				7		12		8		6		7	
Nickel	7440-02-0	2	mg/kg				5		8		5		5		7	
Zinc	7440-66-6	5	mg/kg				18		37		10		20		25	
EG035T: Total Recoverable Mercury by FIMS																
Mercury	7439-97-6	0.1	mg/kg				<0.1		<0.1		<0.1		<0.1		<0.1	
EP080/071: Total Petroleum Hydrocarbons																
C6 - C9 Fraction	----	10	mg/kg				<10		<10		<10		<10		<10	
C10 - C14 Fraction	----	50	mg/kg				<50		1920		<50		<50		<50	
C15 - C28 Fraction	----	100	mg/kg				120		13400		<100		<100		<100	
C29 - C36 Fraction	----	100	mg/kg				<100		<100		<100		<100		<100	
^ C10 - C36 Fraction (sum)	----	50	mg/kg				120		15300		<50		<50		<50	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions																
C6 - C10 Fraction	C6_C10	10	mg/kg				<10		<10		<10		<10		<10	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg				<10		<10		<10		<10		<10	
>C10 - C16 Fraction	----	50	mg/kg				<50		4920		<50		<50		<50	
>C16 - C34 Fraction	----	100	mg/kg				<100		10600		<100		<100		<100	
>C34 - C40 Fraction	----	100	mg/kg				<100		<100		<100		<100		<100	
^ >C10 - C40 Fraction (sum)	----	50	mg/kg				<50		15500		<50		<50		<50	
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg				<50		4920		<50		<50		<50	
EP080: BTEXN																
Benzene	71-43-2	0.2	mg/kg				<0.2		<0.2		<0.2		<0.2		<0.2	
Toluene	108-88-3	0.5	mg/kg				<0.5		<0.5		<0.5		<0.5		<0.5	
Ethylbenzene	100-41-4	0.5	mg/kg				<0.5		<0.5		<0.5		<0.5		<0.5	
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg				<0.5		<0.5		<0.5		<0.5		<0.5	
ortho-Xylene	95-47-6	0.5	mg/kg				<0.5		<0.5		<0.5		<0.5		<0.5	
^ Sum of BTEX	----	0.2	mg/kg				<0.2		<0.2		<0.2		<0.2		<0.2	

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Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		Sampling date / time		D5 0.1m		D0 0.1m		Control 1 0.1m (100m north)		P2 0.5m		P4 0.1m	
Compound	CAS Number	LOR	Unit	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
EP080: BTEXN - Continued															
^ Total Xylenes	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
EP080S: TPH(V)/BTEX Surrogates															
1,2-Dichloroethane-D4	17060-07-0	0.2	%	114	100	102	111	107	102	98.2	106	103	107	102	103
Toluene-D8	2037-26-5	0.2	%	108	92.4	97.6	104	102	98.2	97.6	106	103	107	102	103
4-Bromofluorobenzene	460-00-4	0.2	%	107	88.1	97.6	106	103	97.6	97.6	106	103	107	102	103



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		Sampling date / time		D8 1.0m (NE of bowser)		D9 1.0m		P17 surface		B20		B15	
Compound	CAS Number	LOR	Unit	Result		Result		Result		Result		Result		Result	
EA055: Moisture Content															
Moisture Content				----	1.0	%	9.0	5.3	8.0	6.1	6.9				
EG005(ED093)T: Total Metals by ICP-AES															
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	17	17	18	17	18	17	11	15	15	17	17	17
Copper	7440-50-8	5	mg/kg	12	12	12	12	12	7	7	8	8	12	12	12
Lead	7439-92-1	5	mg/kg	142	142	207	8	24	9	24	24	24	9	9	9
Nickel	7440-02-0	2	mg/kg	10	10	11	7	9	11	7	9	9	11	11	11
Zinc	7440-66-6	5	mg/kg	28	28	27	39	23	27	39	23	23	27	27	27
EG035T: Total Recoverable Mercury by FIMS															
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EP080/071: Total Petroleum Hydrocarbons															
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	120	120	250	<50	290	110	290	290	290	110	110	110
C15 - C28 Fraction	----	100	mg/kg	3200	3200	3770	<100	2900	610	2900	2900	2900	610	610	610
C29 - C36 Fraction	----	100	mg/kg	170	170	130	<100	<100	<100	<100	<100	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	3490	3490	4150	<50	3190	720	3190	3190	3190	720	720	720
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions															
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	490	490	1070	<50	1030	240	1030	1030	1030	240	240	240
>C16 - C34 Fraction	----	100	mg/kg	3010	3010	3130	<100	2260	500	2260	2260	2260	500	500	500
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	3500	3500	4200	<50	3290	740	3290	3290	3290	740	740	740
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	490	490	1070	<50	1030	240	1030	1030	1030	240	240	240
EP080: BTEXN															
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		D8 1.0m (NE of bowser)		D9 1.0m		P17 surface		B20		B15	
Compound	CAS Number	LOR	Sampling date / time	Unit	Result	Result	Result	Result	Result	Result	Result	Result	Result
EP080: BTEXN - Continued													
^ Total Xylenes	91-20-3	0.5		mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene		1		mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1
EP080S: TPH(V)/BTEX Surrogates													
1,2-Dichloroethane-D4	17060-07-0	0.2		%	111	112	102	102	101	110	110	110	110
Toluene-D8	2037-26-5	0.2		%	102	108	95.9	95.9	95.9	110	110	110	110
4-Bromofluorobenzene	460-00-4	0.2		%	100.0	104	97.0	97.0	93.2	107	107	107	107



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		Sampling date / time		P11 2.5m		P13 2.3m		P14 2.3m		P29 3.5m		P30 3.5m		
Compound	CAS Number	LOR	Unit	Result		ES2111527-021		ES2111527-022		ES2111527-023		ES2111527-024		ES2111527-025		
EA055: Moisture Content																
Moisture Content				----	1.0	%	6.8		9.5		7.7		8.0		7.4	
EG005(ED093)T: Total Metals by ICP-AES																
Arsenic	7440-38-2	5	mg/kg	<5		<5		<5		<5		<5		<5		
Cadmium	7440-43-9	1	mg/kg	<1		<1		<1		<1		<1		<1		
Chromium	7440-47-3	2	mg/kg	14		15		14		14		8		9		
Copper	7440-50-8	5	mg/kg	10		10		10		9		6		9		
Lead	7439-92-1	5	mg/kg	34		6		6		27		<5		<5		
Nickel	7440-02-0	2	mg/kg	8		9		9		8		5		6		
Zinc	7440-66-6	5	mg/kg	25		21		21		17		10		13		
EG035T: Total Recoverable Mercury by FIMS																
Mercury	7439-97-6	0.1	mg/kg	<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		
EP080/071: Total Petroleum Hydrocarbons																
C6 - C9 Fraction	----	10	mg/kg	<10		<10		<10		<10		395		61		
C10 - C14 Fraction	----	50	mg/kg	<50		<50		<50		<50		80		160		
C15 - C28 Fraction	----	100	mg/kg	<100		<100		<100		<100		<100		<100		
C29 - C36 Fraction	----	100	mg/kg	<100		<100		<100		<100		<100		<100		
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50		<50		<50		<50		80		160		
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions																
C6 - C10 Fraction	C6_C10	10	mg/kg	<10		<10		<10		<10		489		97		
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10		<10		<10		<10		469		93		
>C10 - C16 Fraction	----	50	mg/kg	<50		<50		<50		<50		60		130		
>C16 - C34 Fraction	----	100	mg/kg	<100		<100		<100		<100		<100		<100		
>C34 - C40 Fraction	----	100	mg/kg	<100		<100		<100		<100		<100		<100		
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50		<50		<50		<50		60		130		
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50		<50		<50		<50		60		130		
EP080: BTEXN																
Benzene	71-43-2	0.2	mg/kg	<0.2		<0.2		<0.2		<0.2		<0.2		<0.2		
Toluene	108-88-3	0.5	mg/kg	<0.5		<0.5		<0.5		<0.5		3.3		<0.5		
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5		<0.5		<0.5		<0.5		3.3		0.8		
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5		<0.5		<0.5		<0.5		8.6		1.7		
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5		<0.5		<0.5		<0.5		4.9		1.1		
^ Sum of BTEX	----	0.2	mg/kg	<0.2		<0.2		<0.2		<0.2		20.1		3.6		



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		P11 2.5m		P13 2.3m		P14 2.3m		P29 3.5m		P30 3.5m	
Compound	CAS Number	LOD	Sampling date / time	Unit	Result	Result	Result	Result	Result	Result	Result	Result	Result
EP080: BTEXN - Continued													
^ Total Xylenes	---	0.5		mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	13.5	13.5	2.8	2.8
Naphthalene	91-20-3	1		mg/kg	<1	<1	<1	<1	<1	1	1	2	2
EP080S: TPH(V)/BTEX Surrogates													
1,2-Dichloroethane-D4	17060-07-0	0.2		%	120	88.7	88.7	97.4	97.4	108	108	98.0	98.0
Toluene-D8	2037-26-5	0.2		%	111	89.4	89.4	102	102	113	113	104	104
4-Bromofluorobenzene	460-00-4	0.2		%	116	86.5	86.5	96.8	96.8	112	112	105	105



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		P31 3.7m		B13		D 0.5m below tank		BP13	
		Sampling date / time		23-Mar-2021 10:00		23-Mar-2021 18:19		23-Mar-2021 15:15		23-Mar-2021 15:15	
Compound	CAS Number	LOR	Unit	ES2111527-026		ES2111527-027		ES2111527-028		ES2111527-029	
				Result	Result	Result	Result				
EA055: Moisture Content											
Moisture Content		1.0	%	7.7		7.4		10.8		4.3	
EG005(ED093)T: Total Metals by ICP-AES											
Arsenic	7440-38-2	5	mg/kg	<5		<5		<5		<5	
Cadmium	7440-43-9	1	mg/kg	<1		<1		<1		<1	
Chromium	7440-47-3	2	mg/kg	8		15		10		17	
Copper	7440-50-8	5	mg/kg	6		10		7		12	
Lead	7439-92-1	5	mg/kg	<5		8		6		12	
Nickel	7440-02-0	2	mg/kg	5		9		6		10	
Zinc	7440-66-6	5	mg/kg	9		26		12		32	
EG035T: Total Recoverable Mercury by FIMS											
Mercury	7439-97-6	0.1	mg/kg	<0.1		<0.1		<0.1		<0.1	
EP080/071: Total Petroleum Hydrocarbons											
C6 - C9 Fraction		10	mg/kg	490		185		223		<10	
C10 - C14 Fraction		50	mg/kg	340		8360		9840		150	
C15 - C28 Fraction		100	mg/kg	110		17700		18600		100	
C29 - C36 Fraction		100	mg/kg	<100		<100		<100		<100	
^ C10 - C36 Fraction (sum)		50	mg/kg	450		26100		28400		250	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions											
C6 - C10 Fraction	C6_C10	10	mg/kg	592		421		420		<10	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	569		403		370		<10	
>C10 - C16 Fraction		50	mg/kg	270		15000		14900		180	
>C16 - C34 Fraction		100	mg/kg	<100		10900		13100		<100	
>C34 - C40 Fraction		100	mg/kg	<100		<100		<100		<100	
^ >C10 - C40 Fraction (sum)		50	mg/kg	270		25900		28000		180	
^ >C10 - C16 Fraction minus Naphthalene (F2)		50	mg/kg	270		15000		14900		180	
EP080: BTEXN											
Benzene	71-43-2	0.2	mg/kg	0.2		<0.2		<0.2		<0.2	
Toluene	108-88-3	0.5	mg/kg	4.9		1.2		6.7		<0.5	
Ethylbenzene	100-41-4	0.5	mg/kg	4.7		1.8		7.2		<0.5	
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	8.6		8.2		22.4		<0.5	
ortho-Xylene	95-47-6	0.5	mg/kg	4.8		6.8		14.1		<0.5	
^ Sum of BTEX		0.2	mg/kg	23.2		18.0		50.4		<0.2	



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		P31 3.7m		B13		D 0.5m below tank		BP13	
Sampling date / time				23-Mar-2021 10:00		23-Mar-2021 18:19		23-Mar-2021 15:15		23-Mar-2021 15:15	
Compound	CAS Number	LOR	Unit	ES2111527-026		ES2111527-027		ES2111527-028		ES2111527-029	
				Result		Result		Result		Result	
EP080: BTEXN - Continued											
^ Total Xylenes	91-20-3	0.5	mg/kg	13.4		15.0		36.5		<0.5	
Naphthalene	91-20-3	1	mg/kg	1		1		1		<1	
EP080S: TPH(V)/BTEX Surrogates											
1,2-Dichloroethane-D4	17060-07-0	0.2	%	90.9		93.6		84.0		95.1	
Toluene-D8	2037-26-5	0.2	%	109		115		102		112	
4-Bromofluorobenzene	460-00-4	0.2	%	114		117		99.1		113	



Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130



Environmental

CERTIFICATE OF ANALYSIS

Work Order : **ES2115572**

Client : **LOW ECOLOGICAL SERVICES**

Contact : **MR BILL LOW**

Address : **PO BOX 3130**

ALICE SPRINGS NT, AUSTRALIA 0871

: 4h1 08 85 + + + 222

Project : **Glen Helen - Soil Testing - Drill holes**

Order number : **----**

C-O-C number : **----**

Sample : **----**

Site : **----**

Footnote number : **EN033**

No. of samples received : **12**

No. of samples analysed : **12**

Page : 1 of 5

Laboratory : Environmental Division Sydney

Contact : Customer Services ES

Address : 277-285 Woodgarp Road Smitfield NSW Australia 21h6

Telephone : 4h1-2-8786 8+++

Date Samples Received : 0+-May-2021 13:00

Date Analysis Commenced : 07-May-2021

Issue Date : 13-May-2021 1+-31



Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report su9ersedes any 9previous re9ort(3/ (itk tkis reference. Results a99ly to tke sam9le(3/ as submitted, unless tke sam9ing (as conducted by ALS. Tkis document shall not be re9roduced, e)ce9t in full.

This Certificate of Analysis contains tke follo(ing information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance (itk 9rocedures s9pecified in 21 CzR Part 11.

Signatories	Position	Accreditation Category
Ale) Rossi	Organic Chemist	Sydney Inorganics, Smitfield, NSW
Ale) Rossi	Organic Chemist	Sydney Organics, Smitfield, NSW
Anpit Joski	Inorganic Chemist	Sydney Inorganics, Smitfield, NSW
Ed(andy zadjar	Organic Coordinator	Sydney Organics, Smitfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smitfield, NSW



Page : 2 of 5
Work Order : ES211hh52
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Soil Testing - Drill holes

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry (weight) basis.

Where a reported result is higher than the LOR, this may be due to primary sample contamination and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample deducted (weight employed or matrix) interference.

When sampling time information is not provided by the client, sampling dates are shown (without a time component). In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key :

CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.



Analytical Results

Sub-Matrix) : SOIL Matrix) : SOIL-		Sample ID													
		Sampling date / time													
Compound	CAS Number	LOR	Unit	(3 P6.1		02 P6.1		B1 P2.3		B2 P2.5		B3 P6.6			
				28-A9r-2021 05:61	28-A9r-2021 05:6h	28-A9r-2021 10:63	28-A9r-2021 11:02	28-A9r-2021 11:21							
				Result	ES2115572R661	Result	ES2115572R662	Result	ES2115572R663	Result	ES2115572R66M	Result	ES2115572R664		
EA644: 8 oisture Content															
8 oisture Content		1.0	%	5.7	9.D	16.3	4.1	1.5							
EG664E(673-T: Total 8 etals by IC0FAES															
Arsenic	7660-38-2	+	mg/kg	<+	<+	<+	<+	<+	<+	<+	<+	<+	<+	<+	
Cadmium	7660-63-5	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Chromium	7660-67-3	2	mg/kg	7	12	15	12	15	12	15	12	15	12	12	
Copper	7660-+0-8	+	mg/kg	9	7	16	7	16	D	16	D	16	16	16	
Lead	7635-52-1	+	mg/kg	<+	5	D	5	D	<+	<+	<+	9	9	9	
Nickel	7660-02-0	2	mg/kg	5	9	7	9	7	9	9	9	16	16	16	
Zinc	7660-hh-h	+	mg/kg	12	19	21	13	22	13	22	13	22	22	22	
EG634T: Total Recoverable 8 ercury by F18 S															
8 ercury	7635-57-h	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
E06D6/691: Total 0etroleum Bydrocarbons															
C5 PC7 Fraction	----	10	mg/kg	29M	16	<10	<10	<10	<10	<10	<10	<10	<10	<10	
C16 PC1MFraction	----	+0	mg/kg	15766	76	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0	
C14 PC2DFraction	----	100	mg/kg	M4M66	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	
C27 PC35 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	
^ C16 PC35 Fraction)sum-	----	+0	mg/kg	52366	76	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0	
E06D6/691: Total Recoverable Bydrocarbons PNE08 2613 Fractions															
C5 PC16 Fraction	Ch_C10	10	mg/kg	963	M2	<10	<10	<10	<10	<10	<10	<10	<10	<10	
^ C5 PC16 Fraction minus HTEX)F1-	Ch_C10-BTEX	10	mg/kg	556	M2	<10	<10	<10	<10	<10	<10	<10	<10	<10	
>C16 PC15 Fraction	----	+0	mg/kg	32666	116	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0	
>C15 PC3MFFraction	----	100	mg/kg	36466	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	
>C3MPC1M6 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	
^ >C16 PC1M6 Fraction)sum-	----	+0	mg/kg	52466	116	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0	
^ >C16 PC15 Fraction minus Naphthalene)F2-	----	+0	mg/kg	32666	116	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0	
E06D6: HTEXN															
Henzene	71-63-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
Toluene	108-88-3	0.+	mg/kg	1.7	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	
Ethylbenzene	100-61-6	0.+	mg/kg	4.2	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	
metaP& paraPKylene	108-38-3 10h-62-3	0.+	mg/kg	21.5	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	
orthoPKylene	5+-67-h	0.+	mg/kg	1M1	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	
^ Sum of HTEX	----	0.2	mg/kg	M2.D	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	

Sub-Matri): SOIL
)Matri): SOIL-

Sub-Matrix) : SOIL Matrix) : SOIL-		Sample ID		02 P6.1		B1 P2.3		B2 P2.5		B3 P6.6	
		Sampling date / time		28-Agr-2021 05:61		28-Agr-2021 10:63		28-Agr-2021 11:02		28-Agr-2021 11:21	
Compound	CAS Number	LOR	Unit	ES2115572R61		ES2115572R62		ES2115572R63		ES2115572R64	
				Result		Result		Result		Result	
E06D8: HTEXN PContinued											
^ Total Xylenes		0. +	mg/kg	34.9		<0. +		<0. +		<0. +	
Naphthalene	51-20-3	1	mg/kg	5		1		<1		<1	
E06D8S: T0BJV-/HTEX Surrogates											
1,2,4-trichlorobenzene	170h0-07-0	0.2	%	129		165		72.3		77.2	165
Toluene	2037-2h-+	0.2	%	126		117		71.7		7M1	11D
1,2,4-trichlorobenzene	6h0-00-6	0.2	%	119		126		161		16D	117



Analytical Results

Sub-Matrix) : SOIL Matrix) : SOIL-		Sample ID		B3 P2.2/2.9		BMP1.6		B5 P3.6		B5 P1.6		B5 P2.6	
		Sampling date / time		28-A9r-2021 11:3+		28-A9r-2021 12:02		28-A9r-2021 12:30		28-A9r-2021 13:30		28-A9r-2021 13:33	
Compound	CAS Number	LOR	Unit	Result	ES2115572R665	ES2115572R669	ES2115572R66D	ES2115572R667	ES2115572R616	Result	Result	Result	Result
EA644: 8 oisture Content													
8 oisture Content		----	1.0	%	7.D	M2	3.5	5.M	7.1				
EG664J(E) 673-T: Total 8 etals by IC0PAES													
Arsenic	7660-38-2	+	mg/kg	<+	<+	<+	<+	<+	<+	<+	<+	<+	<+
Cadmium	7660-63-5	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium	7660-67-3	2	mg/kg	5	19	4	12	16	9	5	26	1M	
Copper	7660-+0-8	+	mg/kg	<+	<+	<+	<+	<+	<+	<+	<+	<+	<+
Lead	7635-52-1	+	mg/kg	M	16	3	5	D	5	D	5	5	5
Nickel	7660-02-0	2	mg/kg	D	25	5							
Zinc	7660-hh-h	+	mg/kg										
EG634T: Total Recoverable 8 ercury by F18 S													
8 ercury	7635-57-h	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
E06D6/691: Total 0etroleum Bydrocarbons													
C5 PC7 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
C16 PC1MFraction	----	+0	mg/kg	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
C14 PC2DFraction	----	100	mg/kg	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
C27 PC35 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
^ C16 PC35 Fraction)sum-	----	+0	mg/kg	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0
E06D6/691: Total Recoverable Bydrocarbons PNE08 2613 Fractions													
C5 PC16 Fraction	Ch_C10	10	mg/kg	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
^ C5 PC16 Fraction minus HTEX)F1-	Ch_C10-BTEX	10	mg/kg	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
>C16 PC15 Fraction	----	+0	mg/kg	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0
>C15 PC3MFFraction	----	100	mg/kg	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C3MPC1M6 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
^ >C16 PC1M6 Fraction)sum-	----	+0	mg/kg	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0
^ >C16 PC15 Fraction minus Naphthalene)F2-	----	+0	mg/kg	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0	<+0
E06D6: HTEXN													
Henzene	71-63-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.+	mg/kg	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+
Ethylbenzene	100-61-6	0.+	mg/kg	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+
metaP& paraP&ylene	108-38-3 10h-62-3	0.+	mg/kg	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+
orthoP&ylene	5+-67-h	0.+	mg/kg	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+	<0.+
^ Sum of HTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2



Analytical Results

Sub-Matrix): SOIL)Matrix): SOIL-		Sample ID		B3 P2.2/2.9		BMP1.6		B5 P3.6		B5 P1.6		B5 P2.6	
Compound		CAS Number	LOR	Sampling date / time	Unit	B3 P2.2/2.9		BMP1.6		B5 P3.6		B5 P1.6	
						28-A9r-2021 11:3+	ES2115572R65	28-A9r-2021 12:02	ES2115572R69	28-A9r-2021 12:30	ES2115572R6D	28-A9r-2021 13:30	ES2115572R16
						Result		Result		Result		Result	
E06D8: HTEXN PContinued													
^ Total Xylenes		---	0. +		mg/kg	<0. +		<0. +		<0. +		<0. +	
Naphthalene		51-20-3	1		mg/kg	<1		<1		<1		<1	
E06D8S: T0BIV-/HTEX Surrogates													
1.2R 1chloroethaneR M		170h0-07-0	0.2		%	163		162		163		162	
TolueneR D		2037-2h-+	0.2		%	11M		112		11M		119	
M1romofluorobenzene		6h0-00-6	0.2		%	11D		116		114		112	
													76.7
													77.2
													163



Analytical Results

Sub-Matrix) : SOIL Matrix) : SOIL-		Sample ID		Sampling date / time		B9 P2.6		BD P1.6		RPP		RPP		RPP	
Compound	CAS Number	LOR		Unit	Result	ES2115572R11		ES2115572R12		RPP		RPP		RPP	
						Result		Result							
EA644: 8 oisture Content															
8 oisture Content		1.0		%		7.2		D.M		RPP		RPP		RPP	
EG664E(673-T: Total 8 etals by IC0 PAES															
Arsenic	7660-38-2	+		mgøøø		<+		<+		RPP		RPP		RPP	
Cadmium	7660-63-5	1		mgøøø		<1		<1		RPP		RPP		RPP	
Chromium	7660-67-3	2		mgøøø		12		19		RPP		RPP		RPP	
Copper	7660-+0-8	+		mgøøø		7		12		RPP		RPP		RPP	
Lead	7635-52-1	+		mgøøø		4		9		RPP		RPP		RPP	
Nickel	7660-02-0	2		mgøøø		D		16		RPP		RPP		RPP	
Zinc	7660-hh-h	+		mgøøø		19		25		RPP		RPP		RPP	
EG634T: Total Recoverable 8 ercury by F18 S															
8 ercury		0.1		mgøøø		<0.1		<0.1		RPP		RPP		RPP	
E06D6(691: Total 0etroleum Bydrocarbons															
C5 PC7 Fraction		10		mgøøø		<10		<10		RPP		RPP		RPP	
C16 PC1MFraction		+0		mgøøø		<+0		<+0		RPP		RPP		RPP	
C14 PC2DFraction		100		mgøøø		<100		<100		RPP		RPP		RPP	
C27 PC35 Fraction		100		mgøøø		<100		<100		RPP		RPP		RPP	
^ C16 PC35 Fraction)sum-		+0		mgøøø		<+0		<+0		RPP		RPP		RPP	
E06D6(691: Total Recoverable Bydrocarbons PNE08 2613 Fractions															
C5 PC16 Fraction		Ch_C10 10		mgøøø		<10		<10		RPP		RPP		RPP	
^ C5 PC16 Fraction minus HTEX)F1-		Ch_C10-BTEX 10		mgøøø		<10		<10		RPP		RPP		RPP	
>C16 PC15 Fraction		+0		mgøøø		<+0		<+0		RPP		RPP		RPP	
>C15 PC3MFFraction		100		mgøøø		<100		<100		RPP		RPP		RPP	
>C3MPCM6 Fraction		100		mgøøø		<100		<100		RPP		RPP		RPP	
^ >C16 PCM6 Fraction)sum-		+0		mgøøø		<+0		<+0		RPP		RPP		RPP	
^ >C16 PC15 Fraction minus Naphthalene)F2-		+0		mgøøø		<+0		<+0		RPP		RPP		RPP	
E06D6: HTEXN															
Benzene		71-63-2 0.2		mgøøø		<0.2		<0.2		RPP		RPP		RPP	
Toluene		108-88-3 0.+		mgøøø		<0.+		<0.+		RPP		RPP		RPP	
Ethylbenzene		100-61-6 0.+		mgøøø		<0.+		<0.+		RPP		RPP		RPP	
metaP& paraXylene		108-38-3 10h-62-3 0.+		mgøøø		<0.+		<0.+		RPP		RPP		RPP	
orthoXylene		5+-67-h 0.+		mgøøø		<0.+		<0.+		RPP		RPP		RPP	
^ Sum of HTEX		0.2		mgøøø		<0.2		<0.2		RPP		RPP		RPP	



Page : 8 of 5
Work Order : ES211hh52
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Soil Testing - Drill holes

Analytical Results

Sub-Matrix) : SOIL Matrix) : SOIL-		Sample ID		B9 P2.6		BD P1.6		RPP		RPP		RPP	
		Sampling date / time		28-A9r-2021 16:03		28-A9r-2021 16:28		RPP		RPP		RPP	
Compound	CAS Number	LOR	Unit	ES2115572R11		ES2115572R12		RPP		RPP		RPP	
				Result		Result							
E06D6: HTEXN PContinued													
^ Total Xylenes	51-20-3	0. +	mg/kg	<0. +		<0. +		RPP		RPP		RPP	
Naphthalene	51-20-3	1	mg/kg	<1		<1		RPP		RPP		RPP	
E06D6S: T0B)V-/HTEX Surrogates													
1.2R 1chloroethaneR M	170h0-07-0	0.2	%	7M5		113		RPP		RPP		RPP	
TolueneR D	2037-2h-+	0.2	%	16D		12D		RPP		RPP		RPP	
MHromofluorobenzene	6h0-00-6	0.2	%	167		12M		RPP		RPP		RPP	



Surrogate Control Limits

Sub-Matrix) : SOIL			Recovery Limits (%)	
Compound	CAS Number		Low	High
E06D6S: T0B)V-/HTEX Surrogates				
1,2R 1chloroethane M	170h0-07-0		73	133
Toluene D	2037-2h-+		76	132
M1romofluorobenzene	6h0-00-6		72	130



Environmental

QUALITY CONTROL REPORT

Work Order : **ES2115572**

Page : 1 of 9

Client : **LOW ECOLOGICAL SERVICES**
Contact : MR BILL LOW
Address : PO BOX 3130
ALICE SPRINGS NT, AUSTRALIA 0981
Telephone : +61 09 9- 555 777
Project : Glen Helen 2 Soil Testing 2Drill holes
Order number : 222
C2D2 number : 222
Sampler : 222
Site : 222
wuoite number : EN333
No. of samples received : 17
No. of samples analysed : 17

Laboratory : Environmental Division Sydney
Contact : Customer Services ES
Address : 78829- Woodpark Road Smithfield NSW Australia 7164
Telephone : +61 2 29894 9555
Date Samples Received : 05/2May/2071
Date Analysis Commenced : 08/2May/2071
Issue Date : 13/2May/2071



Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report/s() ith this reference. Results apply to the sample/s(as submitted, unless the sampling) as conducted by ALS. This document shall not be reproduced, except in full.

This wuality Control Report contains the follo) ing information:

- Laboratory Duplicate /DUP(Report; Relative Percentage Difference /RPD(and Acceptance Limits
- Method Blank /MB(and Laboratory Control Spike /LCS(Report; Recovery and Acceptance Limits
- Matrix Spike /MS(Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below) . Electronic signing is carried out in compliance) ith procedures specified in 71 CFR Part 11.

Signatories	Position	Accreditation Category
Alex Rossi	Organic Chemist	Sydney Inorganics, Smithfield, NSW
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ed) andy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW



Page : 7 of 9
Work Order : ES71166- 7
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen 2Soil Testing 2Drill holes

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry () eight basis.

Where a reported less than /< result is higher than the LOR, this may be due to primary sample extraction/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the wC process lot

CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

RPD = Relative Percentage Difference

= Indicates failed wC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method W12EN09 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 70 times LOR: 0% 250%; Result > 70 times LOR: 0% 270%.

SubMatrix: SOIL

Sub2Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG00(E9 073)T: Total Metals by ICP-AES IQC Lot: 3558827									
ES7115- 70258	Anonymous	EG005T: Cadmium	84402432	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	84402483	7	mg/kg	16	15	0.0	No Limit
		EG005T: Nickel	84402072	7	mg/kg	7	7	0.0	No Limit
		EG005T: Arsenic	84402397	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	84402509	5	mg/kg	13	13	0.0	No Limit
		EG005T: Lead	843- 2 721	5	mg/kg	1-	18	10.1	No Limit
		EG005T: Zinc	84402666	5	mg/kg	76	73	10.1	No Limit
ES71166- 7204	H7 27.6	EG005T: Cadmium	84402432	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	84402483	7	mg/kg	17	13	14.3	No Limit
		EG005T: Nickel	84402072	7	mg/kg	8	-	73.3	No Limit
		EG005T: Arsenic	84402397	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	84402509	5	mg/kg	9	10	0.0	No Limit
		EG005T: Lead	843- 2 721	5	mg/kg	<5	6	0.0	No Limit
		EG005T: Zinc	84402666	5	mg/kg	13	15	15.0	No Limit
EG00(E9 073)T: Total Metals by ICP-AES IQC Lot: 3558831									
ES71166- 72017	H9 21.0	EG005T: Cadmium	84402432	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	84402483	7	mg/kg	18	18	0.0	No Limit
		EG005T: Nickel	84402072	7	mg/kg	10	11	0.0	No Limit
		EG005T: Arsenic	84402397	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	84402509	5	mg/kg	17	13	0.0	No Limit
		EG005T: Lead	843- 2 721	5	mg/kg	8	9	0.0	No Limit
		EG005T: Zinc	84402666	5	mg/kg	76	78	0.0	No Limit
EA0((: Moisture Content 10(-110C) IQC Lot: 3558833)									
ES7115- 70260	Anonymous	EA055: Moisture Content	222	0.1	%	71.1	1- .6	8.4	0% 270%



Page : 3 of 9
Work Order : ES71166- 7
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen 2Soil Testing 2Drill holes

SubMatrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA01 (: Moisture Content by oven drying at 10(-110°C) DQC Lot: 3558833) - @nt4nced									
ES71166- 72008	H4 21.0	EA055: Moisture Content	2222	0.1	%	4.7	4.8	10.5	No Limit
EG03(T: Total Releasable Mercury by vIMS DQC Lot: 3558830)									
ES7115- 70258	Anonymous	EG035T: Mercury	843- 2 826	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
ES71166- 72004	H7 27.6	EG035T: Mercury	843- 2 826	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP0F0/081: Total Petroleum Hydrocarbons DQC Lot: 3556156)									
ES71166- 72007	P7 20.1	EP090: C6 2C- Fraction	2222	10	mg/kg	10	10	0.0	No Limit
ES71166- 72017	H9 21.0	EP090: C6 2C- Fraction	2222	10	mg/kg	<10	<10	0.0	No Limit
EP0F0/081: Total Petroleum Hydrocarbons DQC Lot: 35561F5)									
ES71164- 520-	Anonymous	EP090: C6 2C- Fraction	2222	10	mg/kg	<10	<10	0.0	No Limit
ES7116982008	Anonymous	EP090: C6 2C- Fraction	2222	10	mg/kg	<10	<10	0.0	No Limit
EP0F0/081: Total Petroleum Hydrocarbons DQC Lot: 3556(02)									
ES71166- 72001	D3 20.1	EP081: C15 2C79 Fraction	2222	100	mg/kg	45400	44700	7.8	0% 270%
		EP081: C7- 2C36 Fraction	2222	100	mg/kg	<100	<100	0.0	No Limit
		EP081: C10 2C14 Fraction	2222	50	mg/kg	16- 00	18700	1.9	0% 270%
ES71166- 72011	H8 27.0	EP081: C15 2C79 Fraction	2222	100	mg/kg	<100	<100	0.0	No Limit
		EP081: C7- 2C36 Fraction	2222	100	mg/kg	<100	<100	0.0	No Limit
		EP081: C10 2C14 Fraction	2222	50	mg/kg	<50	<50	0.0	No Limit
EP0F0/081: Total Releasable Hydrocarbons - NEPM 2013 vracarbons DQC Lot: 3556156)									
ES71166- 72007	P7 20.1	EP090: C6 2C10 Fraction	C6_C10	10	mg/kg	47	46	- 7	No Limit
ES71166- 72017	H9 21.0	EP090: C6 2C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP0F0/081: Total Releasable Hydrocarbons - NEPM 2013 vracarbons DQC Lot: 35561F5)									
ES71164- 520-	Anonymous	EP090: C6 2C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
ES7116982008	Anonymous	EP090: C6 2C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP0F0/081: Total Releasable Hydrocarbons - NEPM 2013 vracarbons DQC Lot: 3556(02)									
ES71166- 72001	D3 20.1	EP081: >C16 2C34 Fraction	2222	100	mg/kg	30500	7- 100	4.5	0% 270%
		EP081: >C34 2C40 Fraction	2222	100	mg/kg	<100	<100	0.0	No Limit
		EP081: >C10 2C16 Fraction	2222	50	mg/kg	37000	37500	1.8	0% 270%
ES71166- 72011	H8 27.0	EP081: >C16 2C34 Fraction	2222	100	mg/kg	<100	<100	0.0	No Limit
		EP081: >C34 2C40 Fraction	2222	100	mg/kg	<100	<100	0.0	No Limit
		EP081: >C10 2C16 Fraction	2222	50	mg/kg	<50	<50	0.0	No Limit
EP0F0: BTEXN DQC Lot: 3556156)									
ES71166- 72007	P7 20.1	EP090: Benzene	8124327	0.7	mg/kg	<0.7	<0.7	0.0	No Limit
		EP090: Toluene	1092923	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP090: Ethylbenzene	10024124	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP090: meta2& paraXylene	1092923	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
			10624723						
		EP090: orthoXylene	- 524826	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP090: Naphthalene	- 127023	1	mg/kg	1	1	0.0	No Limit
ES71166- 72017	H9 21.0	EP090: Benzene	8124327	0.7	mg/kg	<0.7	<0.7	0.0	No Limit



SubMatrix: SOIL			Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP0F0: BTEXN IDC Lot: 3556156) - @nt4ced									
ES71166- 72017	H9 21.0	EP090: Toluene	1092923	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP090: Ethylbenzene	10024124	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP090: meta2& paraXylene	10923923	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
			10624723						
	EP090: orthoXylene	- 524826	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
	EP090: Naphthalene	- 127023	1	mg/kg	<1	<1	0.0	No Limit	
EP0F0: BTEXN IDC Lot: 35561F5)									
ES71164- 5200-	Anonymous	EP090: Benzene	8124327	0.7	mg/kg	<0.7	<0.7	0.0	No Limit
		EP090: Toluene	1092923	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP090: Ethylbenzene	10024124	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP090: meta2& paraXylene	10923923	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
			10624723						
		EP090: orthoXylene	- 524826	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
ES7116998208	Anonymous	EP090: Naphthalene	- 127023	1	mg/kg	<1	<1	0.0	No Limit
		EP090: Benzene	8124327	0.7	mg/kg	<0.7	<0.7	0.0	No Limit
		EP090: Toluene	1092923	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP090: Ethylbenzene	10024124	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP090: meta2& paraXylene	10923923	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
			10624723						
		EP090: orthoXylene	- 524826	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP090: Naphthalene	- 127023	1	mg/kg	<1	<1	0.0	No Limit



Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method Q Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this wC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample /LCS(refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this wC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

SubMatrix: SOIL

Sub2Matrix: SOIL		Method Blank (MB) Report				Laboratory Control Spike (LCS) Report			
						Spike Recovery (%)		Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High	
EG000 (E9 073)T: Total Metals by ICP-AES IDCLot: 3558827)									
EG005T: Arsenic	8440239Z	5	mg/kg	<5	171.1 mg/kg	- 5.3	99.0	113	
EG005T: Cadmium	8440243Z	1	mg/kg	<1	0.84 mg/kg	9.0	80.0	130	
EG005T: Chromium	8440248Z	7	mg/kg	<7	1.6 mg/kg	- 9.9	69.0	137	
EG005T: Copper	8440250Z	5	mg/kg	<5	57.6 mg/kg	- 9.0	9.0	111	
EG005T: Lead	843- 2 721	5	mg/kg	<5	60.9 mg/kg	- 7.6	97.0	111	
EG005T: Nickel	8440272Z	7	mg/kg	<7	15.3 mg/kg	- 3.5	90.0	170	
EG005T: Zinc	8440262Z	5	mg/kg	<5	13.3 mg/kg	96.9	66.0	133	
EG000 (E9 073)T: Total Metals by ICP-AES IDCLot: 3558831)									
EG005T: Arsenic	8440239Z	5	mg/kg	<5	171.1 mg/kg	- .5	99.0	113	
EG005T: Cadmium	8440243Z	1	mg/kg	<1	0.84 mg/kg	- 4.5	80.0	130	
EG005T: Chromium	8440248Z	7	mg/kg	<7	1.6 mg/kg	103	69.0	137	
EG005T: Copper	8440250Z	5	mg/kg	<5	57.6 mg/kg	101	9.0	111	
EG005T: Lead	843- 2 721	5	mg/kg	<5	60.9 mg/kg	- 8.3	97.0	111	
EG005T: Nickel	8440272Z	7	mg/kg	<7	15.3 mg/kg	- 9.0	90.0	170	
EG005T: Zinc	8440262Z	5	mg/kg	<5	13.3 mg/kg	- 0.6	66.0	133	
EG03 (T: Total Recoverable Mercury by vIMS IDCLot: 3558830)									
EG035T: Mercury	843- 2 826	0.1	mg/kg	<0.1	0.083 mg/kg	118	80.0	130	
EP0F0/081: Total Petroleum Hydrocarbons IDCLot: 3556156)									
EP090: C6 2C- Fraction	222	10	mg/kg	<10	76 mg/kg	108	69.4	179	
EP0F0/081: Total Petroleum Hydrocarbons IDCLot: 35561F5)									
EP090: C6 2C- Fraction	222	10	mg/kg	<10	76 mg/kg	- 5.6	69.4	179	
EP0F0/081: Total Petroleum Hydrocarbons IDCLot: 3556 (02)									
EP081: C10 2C14 Fraction	222	50	mg/kg	<50	300 mg/kg	- 3.1	85.0	171	
EP081: C15 2C79 Fraction	222	100	mg/kg	<100	450 mg/kg	- 5.5	88.0	131	
EP081: C7- 2C36 Fraction	222	100	mg/kg	<100	300 mg/kg	- 6.7	81.0	171	
EP0F0/081: Total Recoverable Hydrocarbons - NEPM 2013 vracarbons IDCLot: 3556156)									
EP090: C6 2C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	109	69.4	179	
EP0F0/081: Total Recoverable Hydrocarbons - NEPM 2013 vracarbons IDCLot: 35561F5)									
EP090: C6 2C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	88.3	69.4	179	
EP0F0/081: Total Recoverable Hydrocarbons - NEPM 2013 vracarbons IDCLot: 3556 (02)									
EP081: >C10 2C16 Fraction	222	50	mg/kg	<50	385 mg/kg	- 7.5	88.0	175	
EP081: >C16 2C34 Fraction	222	100	mg/kg	<100	575 mg/kg	- 6.5	84.0	139	
EP081: >C34 2C40 Fraction	222	100	mg/kg	<100	775 mg/kg	- 3.0	88.0	131	



SubMatrix: SOIL				Laboratory Control Spike (LCS) Report							
Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report		Spike Concentration	Spike Recovery (%)		Acceptable Limits (%)		
				Result			LCS	Low	High		
EP0F0: BTEXN IDCLot: 3556156)											
EP090: Benzene	81243Z	0.7	mg@g	<0.7		1 mg@g	110		67.0	116	
EP090: Toluene	10929Z	0.5	mg@g	<0.5		1 mg@g	116		68.0	171	
EP090: Ethylbenzene	100241	0.5	mg@g	<0.5		1 mg@g	117		65.0	118	
EP090: meta2& paraXylene	10929Z	0.5	mg@g	<0.5		7 mg@g	110		66.0	119	
	106247Z										
EP090: orthoXylene	-5248Z	0.5	mg@g	<0.5		1 mg@g	117		69.0	170	
EP090: Naphthalene	-1Z0Z	1	mg@g	<1		1 mg@g	109		63.0	11-	
EP0F0: BTEXN IDCLot: 35561F5)											
EP090: Benzene	81243Z	0.7	mg@g	<0.7		1 mg@g	103		67.0	116	
EP090: Toluene	10929Z	0.5	mg@g	<0.5		1 mg@g	103		68.0	171	
EP090: Ethylbenzene	100241	0.5	mg@g	<0.5		1 mg@g	104		65.0	118	
EP090: meta2& paraXylene	10929Z	0.5	mg@g	<0.5		7 mg@g	- - .6		66.0	119	
	106247Z										
EP090: orthoXylene	-5248Z	0.5	mg@g	<0.5		1 mg@g	108		69.0	170	
EP090: Naphthalene	-1Z0Z	1	mg@g	<1		1 mg@g	109		63.0	11-	

Matrix Spike (MS) Report

The quality control term Matrix Spike /MS(refers to an intralaboratory split sample spiked) ith a representative set of target analytes. The purpose of this wC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data wuality Objectives /DwOs(ideal recovery ranges stated may be) aived in the event of sample matrix interference.

SubMatrix: SOIL

SubMatrix: SOIL				Matrix Spike (MS) Report					
				Spike		SpikeRecovery(%)		Acceptable Limits (%)	
				Concentration	MS	Low	High		
Laboratory sample ID	Sample ID	Method: Compound	CAS Number						
EG00(IE9073)T: Total Metals by ICP-AES IDCLot: 3558827)									
ES7115- 70258	Anonymous	EG005T: Arsenic	8440239Z	50 mg0g	- 1.6	80.0	130		
		EG005T: Cadmium	8440243Z	50 mg0g	- 5.8	80.0	130		
		EG005T: Chromium	8440248Z	50 mg0g	- 6.0	69.0	137		
		EG005T: Copper	8440250Z	750 mg0g	- 6.5	80.0	130		
		EG005T: Lead	843- 2 7Z1	750 mg0g	- 5.8	80.0	130		
		EG005T: Nickel	8440272D	50 mg0g	- 4.9	80.0	130		
		EG005T: Zinc	8440262Z	750 mg0g	- 6.8	66.0	133		
EG00(IE9073)T: Total Metals by ICP-AES IDCLot: 3558831)									
ES71166- 72017	H9 21.0	EG005T: Arsenic	8440239Z	50 mg0g	- 4.0	80.0	130		
		EG005T: Cadmium	8440243Z	50 mg0g	- 5.6	80.0	130		
		EG005T: Chromium	8440248Z	50 mg0g	- 1.8	69.0	137		
		EG005T: Copper	8440250Z	750 mg0g	- 9.6	80.0	130		
		EG005T: Lead	843- 2 7Z1	750 mg0g	- 8.4	80.0	130		
		EG005T: Nickel	8440272D	50 mg0g	- 5.1	80.0	130		

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Page : 8 of 9
Work Order : ES71166- 7
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen 2Soil Testing 2Drill holes

SubMatrix: SOIL

SubMatrix: SOIL				Matrix Spike (MS) Report			
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Spike Concentration	SpikeRecovery(%) MS	Acceptable Limits (%) Low	High
EG00(IE9073)T: Total Metals by ICP-AES IQLot: 3558831) - @nt4nced							
ES71166- 72017	H9 21.0	EG005T: Zinc	84402626	750 mg0g	- 4.4	66.0	133
EG03(T: Total Re@°erable Mer@ry by vIMS IQLot: 3558830)							
ES7115- 70258	Anonymous	EG035T: Mercury	843- 2 826	5 mg0g	91.-	80.0	130
EP0F0/081: Total Petroleum Hydro@rbons IQLot: 3556156)							
ES71166- 72007	P7 20.1	EP090: C6 2C- Fraction	222	37.5 mg0g	110	80.0	130
EP0F0/081: Total Petroleum Hydro@rbons IQLot: 35561F5)							
ES71164- 5200-	Anonymous	EP090: C6 2C- Fraction	222	37.5 mg0g	101	80.0	130
EP0F0/081: Total Petroleum Hydro@rbons IQLot: 3556(02)							
ES71166- 72001	D3 20.1	EP081: C10 2C14 Fraction	222	573 mg0g	# Not Determined	83.0	138
		EP081: C15 2C79 Fraction	222	731- mg0g	# Not Determined	53.0	131
		EP081: C7- 2C36 Fraction	222	1814 mg0g	174	57.0	137
EP0F0/081: Total Re@°erable Hydro@rbons - NEPM 2013 vra@4bns IQLot: 3556156)							
ES71166- 72007	P7 20.1	EP090: C6 2C10 Fraction	C6_C10	38.5 mg0g	11-	80.0	130
EP0F0/081: Total Re@°erable Hydro@rbons - NEPM 2013 vra@4bns IQLot: 35561F5)							
ES71164- 5200-	Anonymous	EP090: C6 2C10 Fraction	C6_C10	38.5 mg0g	- 9.8	80.0	130
EP0F0/081: Total Re@°erable Hydro@rbons - NEPM 2013 vra@4bns IQLot: 3556(02)							
ES71166- 72001	D3 20.1	EP081: >C10 2C16 Fraction	222	960 mg0g	# Not Determined	83.0	138
		EP081: >C16 2C34 Fraction	222	3773 mg0g	# Not Determined	53.0	131
		EP081: >C34 2C40 Fraction	222	1059 mg0g	104	57.0	137
EP0F0: BTEXN IQLot: 3556156)							
ES71166- 72007	P7 20.1	EP090: Benzene	8124327	7.5 mg0g	107	80.0	130
		EP090: Toluene	10929923	7.5 mg0g	10-	80.0	130
		EP090: Ethylbenzene	10024124	7.5 mg0g	114	80.0	130
		EP090: meta2& para2Xylene	10929923	7.5 mg0g	117	80.0	130
		EP090: ortho2Xylene	10624723	7.5 mg0g	113	80.0	130
		EP090: Naphthalene	- 127023	7.5 mg0g	117	80.0	130
EP0F0: BTEXN IQLot: 35561F5)							
ES71164- 5200-	Anonymous	EP090: Benzene	8124327	7.5 mg0g	90.-	80.0	130
		EP090: Toluene	10929923	7.5 mg0g	99.5	80.0	130
		EP090: Ethylbenzene	10024124	7.5 mg0g	96.7	80.0	130



SubMatrix: SOIL		Matrix Spike (MS) Report				
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Spike Concentration	SpikeRecovery(%) MS	Acceptable Limits (%) Low High
EP0F0: BTEXN IDCLot: 35561F5) - @nt4nced						
ES71164- 5200-	Anonymous	EP090: meta2& para2Xylene	10923923 10621723	7.5 mg0g	9- .4	80.0 130
		EP090: ortho2Xylene	- 521826	7.5 mg0g	99.8	80.0 130
		EP090: Naphthalene	- 127023	7.5 mg0g	98.-	80.0 130



QA/QC Compliance Assessment to assist with Quality Review

Work Order	: ES2116692	Page	: 1 of 6
Client	: LOW ECOLOGICAL SERVICES	Laboratory	: Environmental Division Sydney
Contact	: MR BILL LOW	Telephone	: +61-2-8784 8555
Project	: Glen Helen - Soil Testing - Drill holes	Date Samples Received	: 05-May-2021
Site	: ----	Issue Date	: 13-May-2021
Sampler	: ----	No. of samples received	: 12
Order number	: ----	No. of samples analysed	: 12

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- NO Method Blank value outliers occur.
- NO Duplicate outliers occur.
- NO Laboratory Control outliers occur.
- Matrix Spike outliers exist - please see following pages for full details.
- For all regular sample matrices, NO surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- NO Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- NO Quality Control Sample Frequency Outliers exist.



Page : 2 of 6
Work Order : ES2116692
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Soil Testing - Drill holes

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: SOIL

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EP080/071: Total Petroleum Hydrocarbons	ES2116692--001	D3 - 0.1	C10 - C14 Fraction	----	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EP080/071: Total Petroleum Hydrocarbons	ES2116692--001	D3 - 0.1	C15 - C28 Fraction	----	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EP080/071: Total Recoverable Hydrocarbons - NEPM 2 ES2116692--001	ES2116692--001	D3 - 0.1	>C10 - C16 Fraction	----	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EP080/071: Total Recoverable Hydrocarbons - NEPM 2 ES2116692--001	ES2116692--001	D3 - 0.1	>C16 - C34 Fraction	----	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: SOIL

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method		Sample Date		Extraction / Preparation		Analysis			
Container / Client Sample ID(s)				Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content									
Soil Glass Jar - Unpreserved (EA055)		28-Apr-2021		----	----	----	10-May-2021	12-May-2021	✓
D3 - 0.1, H1 - 2.3, H3 - 0.0, H4 - 1.0, H6 - 1.0, H7 - 2.0,		P2 - 0.1, H2 - 2.6, H3 - 2.2/2.7, H6 - 3.0, H6 - 2.0, H8 - 1.0							



Page : 3 of 6
 Work Order : ES2116692
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen - Soil Testing - Drill holes

Matrix: **SOIL** Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method		Sample Date	Extraction / Preparation		Evaluation	Analysis	
Container / Client Sample ID(s)			Date extracted	Due for extraction		Date analysed	Due for analysis
EG005(ED093)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T)							
D3 - 0.1, H1 - 2.3, H3 - 0.0, H4 - 1.0, H6 - 1.0, H7 - 2.0,		28-Apr-2021	10-May-2021	25-Oct-2021	✓	11-May-2021	25-Oct-2021
P2 - 0.1, H2 - 2.6, H3 - 2.2/2.7, H6 - 3.0, H6 - 2.0, H8 - 1.0							✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T)							
D3 - 0.1, H1 - 2.3, H3 - 0.0, H4 - 1.0, H6 - 1.0, H7 - 2.0,		28-Apr-2021	10-May-2021	26-May-2021	✓	12-May-2021	26-May-2021
P2 - 0.1, H2 - 2.6, H3 - 2.2/2.7, H6 - 3.0, H6 - 2.0, H8 - 1.0							✓
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP071)							
D3 - 0.1, H1 - 2.3, H3 - 0.0, H4 - 1.0, H6 - 1.0, H7 - 2.0,		28-Apr-2021	07-May-2021	12-May-2021	✓	10-May-2021	16-Jun-2021
P2 - 0.1, H2 - 2.6, H3 - 2.2/2.7, H6 - 3.0, H6 - 2.0, H8 - 1.0							✓
Soil Glass Jar - Unpreserved (EP080)							
D3 - 0.1, H1 - 2.3, H3 - 0.0, H4 - 1.0, H6 - 1.0, H7 - 2.0,		28-Apr-2021	07-May-2021	12-May-2021	✓	11-May-2021	12-May-2021
P2 - 0.1, H2 - 2.6, H3 - 2.2/2.7, H6 - 3.0, H6 - 2.0, H8 - 1.0							✓



Matrix: **SOIL** Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method		Sample Date	Extraction / Preparation		Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Due for analysis	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP071)		28-Apr-2021	07-May-2021	12-May-2021	✓	10-May-2021	
D3 - 0.1,							16-Jun-2021
H1 - 2.3,							
H3 - 0.0,							
H4 - 1.0,							
H6 - 1.0,							
H6 - 2.0,							
H8 - 1.0							✓
Soil Glass Jar - Unpreserved (EP080)		28-Apr-2021	07-May-2021	12-May-2021	✓	11-May-2021	
D3 - 0.1,							12-May-2021
H1 - 2.3,							
H3 - 0.0,							
H4 - 1.0,							
H6 - 1.0,							
H6 - 2.0,							
H7 - 2.0,							✓
H8 - 1.0							
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080)		28-Apr-2021	07-May-2021	12-May-2021	✓	11-May-2021	
D3 - 0.1,							12-May-2021
H1 - 2.3,							
H3 - 0.0,							
H4 - 1.0,							
H6 - 1.0,							
H6 - 2.0,							
H7 - 2.0,							✓
H8 - 1.0							



Page : 5 of 6
Work Order : ES2116692
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Soil Testing - Drill holes

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: **x** = Quality Control frequency not within specification ; **✓** = Quality Control frequency within specification.

Quality Control Sample Type		Method	Count		Rate (%)		Quality Control Specification
Analytical Methods			QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)							
Moisture Content		EA055	2	19	10.53	10.00	✓
Total Mercury by FIMS		EG035T	2	19	10.53	10.00	✓
Total Metals by ICP-AES		EG005T	3	21	14.29	10.00	✓
TRH - Semivolatile Fraction		EP071	2	13	15.38	10.00	✓
TRH Volatiles/BTEX		EP080	4	38	10.53	10.00	✓
Laboratory Control Samples (LCS)							
Total Mercury by FIMS		EG035T	1	19	5.26	5.00	✓
Total Metals by ICP-AES		EG005T	2	21	9.52	5.00	✓
TRH - Semivolatile Fraction		EP071	1	13	7.69	5.00	✓
TRH Volatiles/BTEX		EP080	2	38	5.26	5.00	✓
Method Blanks (MB)							
Total Mercury by FIMS		EG035T	1	19	5.26	5.00	✓
Total Metals by ICP-AES		EG005T	2	21	9.52	5.00	✓
TRH - Semivolatile Fraction		EP071	1	13	7.69	5.00	✓
TRH Volatiles/BTEX		EP080	2	38	5.26	5.00	✓
Matrix Spikes (MS)							
Total Mercury by FIMS		EG035T	1	19	5.26	5.00	✓
Total Metals by ICP-AES		EG005T	2	21	9.52	5.00	✓
TRH - Semivolatile Fraction		EP071	1	13	7.69	5.00	✓
TRH Volatiles/BTEX		EP080	2	38	5.26	5.00	✓



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
TRH - Semivolatile Fraction	EP071	SOIL	In house: Referenced to USEPA SW 846 - 8015 Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM Schedule B(3).
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM Schedule B(3) amended.
Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na ₂ SO ₄ and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.



CHAIN OF CUSTODY

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Fax: 416-496-1111 E: info@sydney.com Website: www.sydney.com

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 10. *Department of Health and Human Services, 2012*
 11. *Department of Health and Human Services, 2013*
 12. *Department of Health and Human Services, 2014*
 13. *Department of Health and Human Services, 2015*
 14. *Department of Health and Human Services, 2016*
 15. *Department of Health and Human Services, 2017*
 16. *Department of Health and Human Services, 2018*
 17. *Department of Health and Human Services, 2019*
 18. *Department of Health and Human Services, 2020*
 19. *Department of Health and Human Services, 2021*
 20. *Department of Health and Human Services, 2022*

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Journal of Internal Medicine 260: 395–402

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Australian Laboratory Services Pty Ltd ABN 84 009 936 029. An ALS Limited Company

TAX INVOICE: 1151284081

LOW ECOLOGICAL SERVICES

MR BILL LOW

PO BOX 3130

ALICE SPRINGS

NT, AUSTRALIA 0871

Work Order	Project / Overall Description	Site	Order number	C-O-C number	Contact
ES21155H2	Glen g elen - Soil TestinF - Drill yoles / ----	----	----	----	MR BILL LOW

Issue Date	: 13-May-2021	Taxable value	: AUD\$	817.48
		Tax Incurred (GST)	: AUD\$	81.75
Due Date	: 13-Jun-2021	Amount Payable	: AUD\$	899.23

Work Order Breakdown

Metyod	Sale Item Descriptions	Quantith	Unit Value (AUD\$)	Value (AUD\$)	GST (AUD\$)	Line Total (AUD\$)
Work Order: ES2116692		Quote number: EN/333		Submatrix summarh: 12 SOILS		
*Misc	Workorder Admin 9ee	1.00	40.00	40.00	4.00	44.00
S-06	TRg /BTEXN/8 Metals	12.00	58.20	818.40	81.84	H00.24
Workorder Additional Volume Based Discount					40.92 (net)	
* denotes non-discountable item						
• Please direct all queries to Environmental Division Sydnev on +61-2-8784 8555.						

REMITTANCE ADVICE

POST TO: Australian Laboratorh Services Pth Ltd
P.O. Box 55 Everton Park
QLD 4063 Australia

EMAIL TO: remittances@alsflobal.com

Vendor bank details

Bank: **Commonwealth Bank** or Credit Card
BSB: **064 000** Visa
Account: **12672843** Mastercard
Swift Code: **CTBAAU2S** American Express

or Cyeque

Pahable to Australian Laboratorh Services Pth Ltd

Amount Payable

AUD\$ 899.23

ALS Client Reference

LOWECO

TAX INVOICE

1151284081

**QUALITY CONTROL REPORT****Work Order** : **ES2132493**

Page : 1 of 6

Client : **LOW ECOLOGICAL SERVICES****Contact** : MR BILL LOW**Address** : PO BOX 3130

ALICE SPRINGS NT, AUSTRALIA 0871

Telephone : +61 08 89 555 222**Project** : Glen Helen Fuel Systems**Order number** : KG20210906**C-O-C number** : ----**Sampler** : KRISTEN GRANT**Site** : ----**Quote number** : EN/333**No. of samples received** : 7**No. of samples analysed** : 4**Laboratory** : Environmental Division Sydney**Contact** : Customer Services ES**Address** : 277-289 Woodpark Road Smithfield NSW Australia 2164**Telephone** : +61-2-8784 8555**Date Samples Received** : 08-Sep-2021**Date Analysis Commenced** : 08-Sep-2021**Issue Date** : 14-Sep-2021Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Sanjeshni Jyoti	Senior Chemist Volatiles	Sydney Organics, Smithfield, NSW



Page : 2 of 6
Work Order : ES2132493
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen Fuel Systems

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot

CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

RPD = Relative Percentage Difference

= Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA005P: pH by PC Titrator (QC Lot: 3890912)									
ES2132468-001	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	8.04	8.05	0.1	0% - 20%
ES2132468-010	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	7.70	7.69	0.1	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 3890905)									
ES2132254-020	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	345	347	0.6	0% - 20%
ES2132499-004	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	106	106	0.0	0% - 20%
ES2132254-011	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	350	350	0.0	0% - 20%
ES2132499-008	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	83	83	0.0	0% - 20%
ES2131866-001	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	2150	2030	5.6	0% - 20%
ES2131870-002	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	92	92	0.0	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 3890911)									
ES2132466-007	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	<1	0.0	No Limit
EW2103789-004	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	49	48	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	49	48	0.0	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 3893911)									
ES2132624-007	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	11	11	0.0	0% - 50%
ES2132493-002	W2	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	360	359	0.0	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 3893912)									
ES2132493-002	W2	ED045G: Chloride	16887-00-6	1	mg/L	989	992	0.2	Page 273 of 277 20%



Page : 3 of 6
Work Order : ES2132493
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen Fuel Systems

Sub-Matrix: **WATER**

Sub-Matrix: WATER			Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
ED045G: Chloride by Discrete Analyser (QC Lot: 3893912) - continued									
WN2110184-002	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	55	54	0.0	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 3894848)									
ES2132492-008	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	61	60	0.0	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	33	33	0.0	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	26	26	0.0	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	2	1	0.0	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 3890909)									
ES2132466-007	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.0	No Limit
EW2103789-004	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3893893)									
ES2132493-001	W1	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
ES2132611-001	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3893893)									
ES2132493-001	W1	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
ES2132611-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
EP080: BTEXN (QC Lot: 3893893)									
ES2132493-001	W1	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3	2	µg/L	<2	<2	0.0	No Limit
			106-42-3						
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
ES2132611-001	Anonymous	EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
		EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3	2	µg/L	<2	<2	0.0	No Limit
			106-42-3						
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit



Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report				Laboratory Control Spike (LCS) Report			
Method: Compound		CAS Number	LOR	Unit	Result	Spike Concentration		Spike Recovery (%)		Acceptable Limits (%)	
EA005P: pH by PC Titrator (QCLot: 3890912)											
EA005-P: pH Value		-----	-----	pH Unit	-----	4 pH Unit		100		98.8	
					-----	7 pH Unit		100		99.2	
EA010P: Conductivity by PC Titrator (QCLot: 3890905)											
EA010-P: Electrical Conductivity @ 25°C		-----	1	µS/cm	<1	220 µS/cm		95.3		91.1	
					<1	2100 µS/cm		102		93.2	
					<1	58301 µS/cm		102		93.3	
ED037P: Alkalinity by PC Titrator (QCLot: 3890911)											
ED037-P: Total Alkalinity as CaCO3		-----	-----	mg/L	-----	200 mg/L		97.0		81.0	
					-----	50 mg/L		112		80.0	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3893911)											
ED041G: Sulfate as SO4 - Turbidimetric		14808-79-8	1	mg/L	<1	25 mg/L		98.3		82.0	
					<1	500 mg/L		92.4		82.0	
ED045G: Chloride by Discrete Analyser (QCLot: 3893912)											
ED045G: Chloride		16887-00-6	1	mg/L	<1	50 mg/L		92.8		80.9	
					<1	1000 mg/L		99.4		80.9	
ED093F: Dissolved Major Cations (QCLot: 3894848)											
ED093F: Calcium		7440-70-2	1	mg/L	<1	50 mg/L		104		80.0	
ED093F: Magnesium		7439-95-4	1	mg/L	<1	50 mg/L		98.8		90.0	
ED093F: Sodium		7440-23-5	1	mg/L	<1	50 mg/L		98.5		82.0	
ED093F: Potassium		7440-09-7	1	mg/L	<1	50 mg/L		93.2		85.0	
EK040P: Fluoride by PC Titrator (QCLot: 3890909)											
EK040P: Fluoride		16984-48-8	0.1	mg/L	<0.1	5 mg/L		101		82.0	
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3890939)											
EP071: C10 - C14 Fraction		-----	50	µg/L	<50	400 µg/L		87.1		55.8	
EP071: C15 - C28 Fraction		-----	100	µg/L	<100	600 µg/L		82.2		71.6	
EP071: C29 - C36 Fraction		-----	50	µg/L	<50	400 µg/L		94.8		56.0	
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3893893)											
EP080: C6 - C9 Fraction		-----	20	µg/L	<20	260 µg/L		94.2		75.0	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3890939)											
EP071: >C10 - C16 Fraction		-----	100	µg/L	<100	500 µg/L		85.8		57.9	
EP071: >C16 - C34 Fraction		-----	100	µg/L	<100	700 µg/L		77.0		62.5	
EP071: >C34 - C40 Fraction		-----	100	µg/L	<100	300 µg/L		89.3		61.5	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3893893)											
Page 275 of 657											



Sub-Matrix: **WATER**

Method: Compound				Method Blank (MB) Report		Laboratory Control Spike (LCS) Report			
CAS Number				Unit	Result	Spike Concentration	Spike Recovery (%)	Acceptable Limits (%)	
LOR							LCS	Low	High
EP080/074: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3893893) - continued									
EP080: C6 - C10 Fraction	C6_C10	20		µg/L	<20	310 µg/L	97.0	75.0	127
EP080: BTEXN (QCLot: 3893893)									
EP080: Benzene	71-43-2	1		µg/L	<1	10 µg/L	99.2	70.0	122
EP080: Toluene	108-88-3	2		µg/L	<2	10 µg/L	101	69.0	123
EP080: Ethylbenzene	100-41-4	2		µg/L	<2	10 µg/L	100.0	70.0	120
EP080: meta- & para-Xylene	108-38-3	2		µg/L	<2	10 µg/L	96.3	69.0	121
	106-42-3								
EP080: ortho-Xylene	95-47-6	2		µg/L	<2	10 µg/L	98.3	72.0	122
EP080: Naphthalene	91-20-3	5		µg/L	<5	10 µg/L	89.2	70.0	120

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Sub-Matrix: WATER			Matrix Spike (MS) Report				
			Spike	SpikeRecovery(%)	Acceptable Limits (%)		
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3893911)							
ES2132493-002	W2	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	# Not Determined	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 3893912)							
ES2132493-002	W2	ED045G: Chloride	16887-00-6	50 mg/L	# Not Determined	70.0	130
EK040P: Fluoride by PC Titrator (QCLot: 3890909)							
ES2131870-001	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	94.8	70.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3893893)							
ES2132493-001	W1	EP080: C6 - C9 Fraction	----	325 µg/L	94.4	70.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3893893)							
ES2132493-001	W1	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	91.9	70.0	130
EP080: BTEXN (QCLot: 3893893)							
ES2132493-001	W1	EP080: Benzene	71-43-2	25 µg/L	93.1	70.0	130
		EP080: Toluene	108-88-3	25 µg/L	101	70.0	130
		EP080: Ethylbenzene	100-41-4	25 µg/L	95.4	70.0	130
		EP080: meta- & para-Xylene	108-38-3	25 µg/L	92.3	70.0	130
			106-42-3				
		EP080: ortho-Xylene	95-47-6	25 µg/L	91.4	70.0	130
		EP080: Naphthalene	91-20-3	25 µg/L	75.6	70.0	130





QA/QC Compliance Assessment to assist with Quality Review

Work Order	: ES2132493	Page	: 1 of 6
Client	: LOW ECOLOGICAL SERVICES	Laboratory	: Environmental Division Sydney
Contact	: MR BILL LOW	Telephone	: +61-2-8784 8555
Project	: Glen Helen Fuel Systems	Date Samples Received	: 08-Sep-2021
Site	: ----	Issue Date	: 14-Sep-2021
Sampler	: KRISTEN GRANT	No. of samples received	: 7
Order number	: KG20210906	No. of samples analysed	: 4

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- NO Method Blank value outliers occur.
- NO Duplicate outliers occur.
- NO Laboratory Control outliers occur.
- Matrix Spike outliers exist - please see following pages for full details.
- For all regular sample matrices, NO surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers exist - please see following pages for full details.



Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	ES2132493--002	W2	Sulfate as SO4 - Turbidimetric	14808-79-8	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
ED045G: Chloride by Discrete Analyser	ES2132493--002	W2	Chloride	16887-00-6	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method Container / Client Sample ID(s)	Extraction / Preparation		Analysis	
	Date extracted	Due vor extraction	Date analysed	Due vor analysis
EA005P: pH by PC Titrator				
Clear Plastic Bottle - Natural W2	----	----	08-Sep-2021	03-Sep-2021
Days overdue				
				5

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type Method	Count		Rate (%)		Quality Control Specification	
	QC	Regular	Actual	Expected		
Laboratory Duplicates (DUP)						
TRH - Semivolatle Fraction	0	8	0.00	10.00	NEPM 2013 B3 & ALS QC Standard	
Matrix Spikes (MS)						
TRH - Semivolatle Fraction	0	8	0.00	5.00	NEPM 2013 B3 & ALS QC Standard	

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date		Extraction / Preparation		Analysis	
	Date extracted	Due vor extraction	Ef aluation	Date analysed	Due vor analysis	Ef aluation
EA005P: pH by PC Titrator						
Clear Plastic Bottle - Natural (EA005-P) W2	03-Sep-2021	----	----	08-Sep-2021	03-Sep-2021	*



Page : 3 of 6
Work Order : ES2132493
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen Fuel Systems

Matrix: **WATER** Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method		Sample Date	Extraction / Preparation		Evaluation	Analysis		
Container / Client Sample ID(s)	Date extracted		Due for extraction	Date analysed		Due for analysis	Evaluation	
EA010P: Conductivity by PC Titrator								
Clear Plastic Bottle - Natural (EA010-P) W2		03-Sep-2021	-----	-----	-----	08-Sep-2021	01-Oct-2021	✓
EA065: Total Hardness as CaCO3								
Clear Plastic Bottle - Natural (ED093F) W2		03-Sep-2021	-----	-----	-----	10-Sep-2021	10-Sep-2021	✓
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural (ED037-P) W2		03-Sep-2021	-----	-----	-----	08-Sep-2021	17-Sep-2021	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Clear Plastic Bottle - Natural (ED041G) W2		03-Sep-2021	-----	-----	-----	09-Sep-2021	01-Oct-2021	✓
ED045G: Chloride by Discrete Analyser								
Clear Plastic Bottle - Natural (ED045G) W2		03-Sep-2021	-----	-----	-----	09-Sep-2021	01-Oct-2021	✓
ED093F: Dissolved Major Cations								
Clear Plastic Bottle - Natural (ED093F) W2		03-Sep-2021	-----	-----	-----	10-Sep-2021	10-Sep-2021	✓
EK040P: Fluoride by PC Titrator								
Clear Plastic Bottle - Natural (EK040P) W2		03-Sep-2021	-----	-----	-----	08-Sep-2021	01-Oct-2021	✓
EP080/071: Total Petroleum Hydrocarbons								
Amber Glass Bottle - Unpreserved (EP071) W1, W3, W4	W2, W4	03-Sep-2021	08-Sep-2021	10-Sep-2021	✓	10-Sep-2021	18-Oct-2021	✓
Amber VOC Vial - Sulfuric Acid (EP080) W1, W3, W4	W2, W4	03-Sep-2021	10-Sep-2021	17-Sep-2021	✓	10-Sep-2021	17-Sep-2021	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
Amber Glass Bottle - Unpreserved (EP071) W1, W3, W4	W2, W4	03-Sep-2021	08-Sep-2021	10-Sep-2021	✓	10-Sep-2021	18-Oct-2021	✓
Amber VOC Vial - Sulfuric Acid (EP080) W1, W3, W4	W2, W4	03-Sep-2021	10-Sep-2021	17-Sep-2021	✓	10-Sep-2021	17-Sep-2021	✓
EP080: BTEXN								
Amber VOC Vial - Sulfuric Acid (EP080) W1, W3, W4	W2, W4	03-Sep-2021	10-Sep-2021	17-Sep-2021	✓	10-Sep-2021	17-Sep-2021	✓



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Method	Count		Actual	Rate (%)		Evaluation	Quality Control Specification
Analytical Methods			QC	Regular		Expected			
Laboratory Duplicates (DUP)									
Alkalinity by PC Titrator	ED037-P	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Chloride by Discrete Analyser	ED045G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Conductivity by PC Titrator	EA010-P	6	56	10.71	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Fluoride by PC Titrator	EK040P	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Major Cations - Dissolved	ED093F	1	9	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
pH by PC Titrator	EA005-P	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
TRH - Semivolatile Fraction	EP071	0	8	0.00	10.00	✗	NEPM 2013 B3 & ALS QC Standard		
TRH Volatiles/BTEX	EP080	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Laboratory Control Samples (LCS)									
Alkalinity by PC Titrator	ED037-P	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Chloride by Discrete Analyser	ED045G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Conductivity by PC Titrator	EA010-P	5	56	8.93	8.33	✓	NEPM 2013 B3 & ALS QC Standard		
Fluoride by PC Titrator	EK040P	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
Major Cations - Dissolved	ED093F	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
pH by PC Titrator	EA005-P	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard		
TRH - Semivolatile Fraction	EP071	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
TRH Volatiles/BTEX	EP080	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
Method Blanks (MB)									
Chloride by Discrete Analyser	ED045G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
Conductivity by PC Titrator	EA010-P	1	56	1.79	1.67	✓	NEPM 2013 B3 & ALS QC Standard		
Fluoride by PC Titrator	EK040P	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
Major Cations - Dissolved	ED093F	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
TRH - Semivolatile Fraction	EP071	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
TRH Volatiles/BTEX	EP080	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
Matrix Spikes (MS)									
Chloride by Discrete Analyser	ED045G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
Fluoride by PC Titrator	EK040P	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard		
TRH - Semivolatile Fraction	EP071	0	8	0.00	5.00	✗	NEPM 2013 B3 & ALS QC Standard		
TRH Volatiles/BTEX	EP080	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard		



Page : 5 of 6
 Work Order : ES2132493
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen Fuel Systems

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH by PC Titrator	EA005-P	WATER	In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM Schedule B(3)
Conductivity by PC Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM Schedule B(3)
Calculated TDS (from Electrical Conductivity)	EA016	WATER	In house: Calculation from Electrical Conductivity (APHA 2510 B) using a conversion factor specified in the analytical report. This method is compliant with NEPM Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm APHA seal method 2 017-1-L
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-ENED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Fluoride by PC Titrator	EK040P	WATER	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM Schedule B(3)
TRH - Semivolatle Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015 The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions



Preparation Methods		Method	Matrix	Method Descriptions
Separatory Funnel Extraction of Liquids		ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation		ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.

Fadi Soro

From: Helen Simpson
Sent: Tuesday, 7 September 2021 2:28 PM
To: Jason Dighton; Fadi Soro; Wael Saleh; Vishal Patel; Soy Stepho
Subject: RE: [EXTERNAL] - Water Samples arriving today for TRIH/BTEXN analysis - COC and additional instructions

Samples that are marked with an "X", should be logged as a separate sample numbers. (less confusion for the lab).

Kind Regards,

Helen Simpson
Sample Admin, Environmental
Sydney



T +61 2 8784 8555
F +61 2 8784 8500
helen.simpson@alsglobal.com
277-289 Woodpark Road
Smithfield NSW 2164 AUSTRALIA

Subscribe    

W1 X amber x1 - 5
W3 X amber x1 - 6
W4 X VOC x1 - 7
? → W4 X amber x2 ↑

From: Jason Dighton <jason.dighton@ALSGlobal.com>
Sent: Tuesday, 7 September 2021 1:19 PM
To: Helen Simpson <helen.simpson@alsglobal.com>; Fadi Soro <fadi.soro@alsglobal.com>; Wael Saleh <Wael.Saleh@alsglobal.com>; Vishal Patel <vishal.patel@ALSGlobal.com>
Subject: FW: [EXTERNAL] - Water Samples arriving today for TRIH/BTEXN analysis - COC and additional instructions

Hi Team,

Story below summarised:

- CoC for samples coming in

- Samples not marked with an X should be used for analysis first.

If they arrive and are not clear, let me know and I'll reach out to the client.

Best regards,

Please note that I am working remotely and can be contacted directly on (02) 8784 8509.

Jason Dighton

Client Services Officer, Environmental
Sydney



D +61 2 8784 8509
E +61 2 8784 8500

jason.dighton@alsglobal.com
277-289 Woodpark Road
Smithfield NSW 2164 AUSTRALIA

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From: Kristen Grant [<mailto:kristen@lowecol.com.au>]

Sent: Tuesday, 7 September 2021 1:08 PM

To: ALSEnviro Sydney <ALSEnviro.Sydney@ALSglobal.com>

Cc: Bill Low <lowecol@lowecol.com.au>

Subject: [EXTERNAL] - Water Samples arriving today for TRH/BTEXN analysis – COC and additional instructions

•CAUTION: This email originated from outside of ALS. Do not click links or open attachments unless you recognize the sender and are sure content is relevant to you.

Hi,

We have an esky of water samples that should arrive at the lab today.
COC is attached and a copy is inside the esky also.

There are 2 x Orange TRH (C10-40) bottles and 2 x purple (C6-10) TRH/BTEXN bottles for each sample location/ID. Some of the samples are marked with an (X) in addition to the Sample location/ID. The samples that are not marked with an (X) should be used for analysis in preference to the samples marked with an (X). This is because there was an issue during sample storage that meant the bottles marked with an (X) were not strictly stored in conditions as recommended for these samples. The samples marked with an (X) can still (and should) be used for analysis if required for repeat analysis etc.

Please give me a call to discuss if this is not clear.

Thanks

Kristen Grant

Environmental Consultant

Low Ecological Services P/L

Phone (08) 8955 5222



Environmental

CERTIFICATE OF ANALYSIS

Work Order : **ES2132493**

Client : **LOW ECOLOGICAL SERVICES**

Contact : **MR BILL LOW**

Address : **PO BOX 3130**

ALICE SPRINGS NT, AUSTRALIA 0871

Telephone : **+61 08 89 555 222**

Project : **Glen Helen Fuel Systems**

Order number : **KG20210906**

C-O-C number : **----**

Sampler : **KRISTEN GRANT**

Site : **----**

Quote number : **EN/333**

No. of samples received : **7**

No. of samples analysed : **4**

Page : 1 of 5

Laboratory : Environmental Division Sydney

Contact : Customer Services ES

Address : 277-289 Woodpark Road Smithfield NSW Australia 2164

Telephone : +61-2-8784 8555

Date Samples Received : 08-Sep-2021 06:40

Date Analysis Commenced : 08-Sep-2021

Issue Date : 14-Sep-2021 16:03



Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Sanjeshni Jyoti	Senior Chemist Volatiles	Sydney Organics, Smithfield, NSW



Page : 2 of 5
Work Order : ES2132493
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen Fuel Systems

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the Chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.
- EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Sample ID					
		Sampling date / time		W1	W2	W3	W4
Compound	CAS Number	LOR	Unit	Result	Result	Result	Result
EA005P: pH by PC Titrator							
pH Value		0.01	pH Unit		7.61		
EA010P: Conductivity by PC Titrator							
Electrical Conductivity @ 25°C		1	µS/cm		3790		
EA016: Calculated TDS (from Electrical Conductivity)							
Total Dissolved Solids (Calc.)		1	mg/L		2460		
EA065: Total Hardness as CaCO3							
Total Hardness as CaCO3		1	mg/L		716		
ED037P: Alkalinity by PC Titrator							
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1		
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1		
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		235		
Total Alkalinity as CaCO3		1	mg/L		235		
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		360		
ED045G: Chloride by Discrete Analyser							
Chloride	16887-00-6	1	mg/L		989		
ED093F: Dissolved Major Cations							
Calcium	7440-70-2	1	mg/L		191		
Magnesium	7439-95-4	1	mg/L		58		
Sodium	7440-23-5	1	mg/L		584		
Potassium	7440-09-7	1	mg/L		26		
EK040P: Fluoride by PC Titrator							
Fluoride	16984-48-8	0.1	mg/L		0.4		
EN055: Ionic Balance							
∅ Total Anions		0.01	meq/L		40.1		
∅ Total Cations		0.01	meq/L		40.4		
∅ Ionic Balance		0.01	%		0.35		
EP080/071: Total Petroleum Hydrocarbons							
C6 - C9 Fraction		20	µg/L	<20	<20	<20	<20
C10 - C14 Fraction		50	µg/L	<50	<50	<50	<50
C15 - C28 Fraction		100	µg/L	<100	<100	<100	<100
C29 - C36 Fraction		50	µg/L	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)		50	µg/L	<50	<50	<50	<50



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Sample ID		W1	W2	W3	W4	
Compound	CAS Number	LOR	Sampling date / time	Unit	Result	Result	Result	Result
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20		µg/L	<20	<20	<20	-----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20		µg/L	<20	<20	<20	-----
>C10 - C16 Fraction		100		µg/L	<100	<100	<100	-----
>C16 - C34 Fraction		100		µg/L	<100	<100	<100	-----
>C34 - C40 Fraction		100		µg/L	<100	<100	<100	-----
^ >C10 - C40 Fraction (sum)		100		µg/L	<100	<100	<100	-----
^ >C10 - C16 Fraction minus Naphthalene (F2)		100		µg/L	<100	<100	<100	-----
EP080: BTEXN								
Benzene	71-43-2	1		µg/L	<1	<1	<1	-----
Toluene	108-88-3	2		µg/L	<2	<2	<2	-----
Ethylbenzene	100-41-4	2		µg/L	<2	<2	<2	-----
meta- & para-Xylene	108-38-3	2		µg/L	<2	<2	<2	-----
ortho-Xylene	95-47-6	2		µg/L	<2	<2	<2	-----
^ Total Xylenes		2		µg/L	<2	<2	<2	-----
^ Sum of BTEX		1		µg/L	<1	<1	<1	-----
Naphthalene	91-20-3	5		µg/L	<5	<5	<5	-----
EP080S: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	2		%	100.0	109	104	-----
Toluene-D8	2037-26-5	2		%	119	111	121	-----
4-Bromofluorobenzene	460-00-4	2		%	111	117	113	-----



Surrogate Control Limits

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128



STATEMENT OF QA/QC PERFORMANCE

ME322526 R0

CLIENT DETAILS

Contact Kristen Grant
 Client LOW ECOLOGICAL SERVICES PTY LTD
 Address PO BOX 3130
 ALICE SPRINGS NT 0870

Telephone 61 8 89555222
 Facsimile (Not specified)
 Email kristen@lowecol.com.au

Project Glen Helen Fuel Systems
 Order Number COD - Paid EFT 14-9
 Samples 6

LABORATORY DETAILS

Manager Adam Atkinson
 Laboratory SGS Melbourne EH&S
 Address 10/585 Blackburn Road
 Notting Hill Victoria 3168

Telephone +61395743200
 Facsimile +61395743399
 Email Au.SampleReceipt.Melbourne@sgs.com

SGS Reference ME322526 R0
 Date Received 09 Sep 2021
 Date Reported 16 Sep 2021

COMMENTS

All the laboratory data for each environmental matrix was compared to SGS' stated Data Quality Objectives (DQO). Comments arising from the comparison were made and are reported below.

The data relating to sampling was taken from the Chain of Custody document.

This QA/QC Statement must be read in conjunction with the referenced Analytical Report.

The Statement and the Analytical Report must not be reproduced except in full.

All Data Quality Objectives were met (within the SGS Melbourne EH&S laboratory).

SAMPLE SUMMARY



HOLDING TIME SUMMARY

ME322526 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the

TRH in air MA-30.AIR.01

Method: MA30

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
SV1 AN-LU-20-1518	ME322526.001	LB044377	03 Sep 2021	09 Sep 2021	17 Sep 2021	13 Sep 2021	11 Oct 2021	16 Sep 2021
SV2 AN-LU-20-1516	ME322526.002	LB044377	03 Sep 2021	09 Sep 2021	17 Sep 2021	13 Sep 2021	11 Oct 2021	16 Sep 2021
SV3 AN-LU-20-1520	ME322526.003	LB044377	03 Sep 2021	09 Sep 2021	17 Sep 2021	13 Sep 2021	11 Oct 2021	16 Sep 2021
SV4 AN-LU-20-1514	ME322526.004	LB044377	03 Sep 2021	09 Sep 2021	17 Sep 2021	13 Sep 2021	11 Oct 2021	16 Sep 2021
SV5 AN-LU-20-1519	ME322526.005	LB044377	03 Sep 2021	09 Sep 2021	17 Sep 2021	13 Sep 2021	11 Oct 2021	16 Sep 2021
SV6 AN-LU-20-1517	ME322526.006	LB044377	03 Sep 2021	09 Sep 2021	17 Sep 2021	13 Sep 2021	11 Oct 2021	16 Sep 2021

VOC in Waterloo Samplers MA-5.WL.LU

Method: MA5

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
SV1 AN-LU-20-1518	ME322526.001	LB044377	03 Sep 2021	09 Sep 2021	03 Oct 2021	13 Sep 2021	03 Oct 2021	15 Sep 2021
SV2 AN-LU-20-1516	ME322526.002	LB044377	03 Sep 2021	09 Sep 2021	03 Oct 2021	13 Sep 2021	03 Oct 2021	15 Sep 2021
SV3 AN-LU-20-1520	ME322526.003	LB044377	03 Sep 2021	09 Sep 2021	03 Oct 2021	13 Sep 2021	03 Oct 2021	15 Sep 2021
SV4 AN-LU-20-1514	ME322526.004	LB044377	03 Sep 2021	09 Sep 2021	03 Oct 2021	13 Sep 2021	03 Oct 2021	15 Sep 2021
SV5 AN-LU-20-1519	ME322526.005	LB044377	03 Sep 2021	09 Sep 2021	03 Oct 2021	13 Sep 2021	03 Oct 2021	15 Sep 2021
SV6 AN-LU-20-1517	ME322526.006	LB044377	03 Sep 2021	09 Sep 2021	03 Oct 2021	13 Sep 2021	03 Oct 2021	15 Sep 2021



SURROGATES

ME322526 R0

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA/QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifier when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No surrogates were required for this job.

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

TRH in air MA-30.AIR.01

Method: MA30

Sample Number	Parameter	Units	LOR	Result
LB044377.001	C6-C10	mg/m³	-	<0.86
	C6-C10 less BTEX (F1)	mg/m³	-	<0.86
	>C10-C16	mg/m³	-	<0.36
	>C10-C16 less naphthalene (F2)	mg/m³	-	<0.36

VOC in Waterloo Samplers MA-5.WL.LU

Method: MA5

Sample Number	Parameter	Units	LOR	Result
LB044377.001	Benzene	µg/m³	-	<6.5
	Ethylbenzene	µg/m³	-	<3.5
	Naphthalene	µg/m³	-	<4.4
	Toluene	µg/m³	-	<4.4
	o-Xylene	µg/m³	-	<3.6
	m&p-Xylene	µg/m³	-	<3.6



DUPLICATES

ME322526 R0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: $RPD = | \text{OriginalResult} - \text{ReplicateResult} | \times 100 / \text{Mean}$

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: $MAD = 100 \times \text{SDL} / \text{Mean} + \text{LR}$

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifier when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

NOTE: The RPD reported is calculated from the unrounded data for the original and replicate result. Manual calculation of the RPD from the rounded data reported may

No duplicates were required for this job.



Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

VOC in Waterloo Samplers MA-5.WL.LU

Method: MA5

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB044377.002	Benzene	µg/m³	-	1.2	1	60 - 140	116
	Ethylbenzene	µg/m³	-	1.3	1	60 - 140	126
	Toluene	µg/m³	-	1.2	1	60 - 140	121
	o-Xylene	µg/m³	-	1.2	1	60 - 140	118
	m&p-Xylene	µg/m³	-	2.5	2	60 - 140	125



MATRIX SPIKES

ME322526 R0

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub-sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifier when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No matrix spikes were required for this job.



MATRIX SPIKE DUPLICATES

ME322526 R0

Matrix spike duplicates are calculated as Relative Percent Difference (RPD) using the formula: $RPD = | \text{OriginalResult} - \text{ReplicateResult} | \times 100 / \text{Mean}$

The original result is the analyte concentration of the matrix spike. The Duplicate result is the analyte concentration of the matrix spike duplicate.

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: $MAD = 100 \times \text{SDL} / \text{Mean} + \text{LR}$

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifier when outside suggested criteria. Refer to the footnotes section at the

No matrix spike duplicates were required for this job.

Samples analysed as received.

Solid samples expressed on a dry weight basis.

QC criteria are subject to internal review according to the SGS QA/QC plan and may be provided on request or alternatively can be found here : <https://www.sgs.com.au/~media/Local/Australia/Documents/Technical Documents/MP-AU-ENV-QU-022 QA QC Plan.pdf>

- * NATA accreditation does not cover the performance of this service .
- ** Indicative data, theoretical holding time exceeded.
- *** Indicates that both * and ** apply.
- Sample not analysed for this analyte.
- IS Insufficient sample for analysis.
- LNR Sample listed, but not received.
- LOR Limit of reporting.
- QFH QC result is above the upper tolerance.
- QFL QC result is below the lower tolerance.
- ① At least 2 of 3 surrogates are within acceptance criteria.
- ② RPD failed acceptance criteria due to sample heterogeneity.
- ③ Results less than 5 times LOR preclude acceptance criteria for RPD.
- ④ Recovery failed acceptance criteria due to matrix interference.
- ⑤ Recovery failed acceptance criteria due to the presence of significant concentration of analyte (i.e. the concentration of analyte exceeds the spike level).
- ⑥ LOR was raised due to sample matrix interference.
- ⑦ LOR was raised due to dilution of significantly high concentration of analyte in sample.
- ⑧ Reanalysis of sample in duplicate confirmed sample heterogeneity and inconsistency of results.
- ⑨ Recovery failed acceptance criteria due to sample heterogeneity.
- ⑩ LOR was raised due to high conductivity of the sample (required dilution).
- † Refer to relevant report comments for further information.

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SGS

Passive Sample Collection

Unit 10 /585 Blackburn Road,

Notting Hill VIC 3168

Ph: (03) 9574 3311

au.samplerreceipt.melbourne@sgs.com

Email address: kristen@lowecol.com.au

Project Manager: Bill Low

Sampled by: (Print and Sign) Kristen Grant

Company Low Ecological Service

Address 25 Isotoma Rd

City Alice Springs State NT Post Code 0870

Phone: (08) 8955 5222

ABN: 55 064 311 502

Page 1 of 1

Project Info		Turn Around Time									
Purchase Order Number: _____		Normal: ☒ X									
Suburb & State: NT		Rapid: _____									
Project Number: _____		(surcharges apply)									
Project Name: Glen Helen Fuel Systems		Specify: _____ (days)									
Lab ID	Field Sample I.D. (Location)	Sampler I.D. (WMS Code)	Date of Deployment	Time of Deployment	Date of Retrieval	Time of Retrieval	Analysis Required	Indoor Air	Outdoor Air	Workplace Monitoring	Other (Soil Vapour)
1	SV1	AN-LU-20-1518	26/08/2021	14:05	3/09/2021	12:38	NEPM Hydrocarbon				X
2	SV2	AN-LU-20-1516	26/08/2021	14:20	3/09/2021	12:51	NEPM Hydrocarbon				X
3	SV3	AN-LU-20-1520	26/08/2021	14:26	3/09/2021	12:45	NEPM Hydrocarbon				X
4	SV4	AN-LU-20-1514	26/08/2021	13:55	3/09/2021	12:34	NEPM Hydrocarbon				X
5	SV5	AN-LU-20-1519	26/08/2021	13:40	3/09/2021	12:27	NEPM Hydrocarbon				X
6	SV6	AN-LU-20-1517	26/08/2021	14:37	3/09/2021	12:55	NEPM Hydrocarbon				X
Relinquished By: Name, Signature, Date/Time Kristen Grant								Air Temp and Weather Description: Daily Temp max 19-29 degrees C. No rain. Very low humidity except last 2 days.			
Relinquished By: Name, Signature, Date/Time Celine Tamir											
Relinquished By: Name, Signature, Date/Time											

SGS Notting Hill Bottle Map for Air Samples

Temperature		N/A	Ice Brick	Ice	Esky	Bag	Box	Orange Case									
Name + Date		C-Tamin 9/9/24															
Sample ID		Tray #	Canister	Other	Gas Bag	Isocyanate Tube	1.4 Canister (TO15)	6L Canister (TO15)	Thermal Radiello Tube (TO17_RAD)	ATD Tube (TO17)	Radiello Tube (MA5_RAD)	Waterloo Sampler (MA5_WL_LU)	Carbon Tube (MA5_ST)	XAD Tube (MA5_ST)	Silica Gel Tube (MA5_ST)	Puffs (TO13)	Number of labels to be printed per sample ID
1	SVI	loc										/					/
2	2											/					
3	3											/					
4	4											/					
5	5											/					
6	6											/					
7																	
8																	
9																	
10																	

Comments:

6



SAMPLE RECEIPT ADVICE

ME322526

CLIENT DETAILS

Contact Kristen Grant
Client LOW ECOLOGICAL SERVICES PTY LTD
Address PO BOX 3130
ALICE SPRINGS NT 0870

Telephone 61 8 89555222
Facsimile (Not specified)
Email kristen@lowecol.com.au

Project Glen Helen Fuel Systems
Order Number TBA
Samples 6

LABORATORY DETAILS

Manager Adam Atkinson
Laboratory SGS Melbourne EH&S
Address 10/585 Blackburn Road
Notting Hill Victoria 3168

Telephone +61395743200
Facsimile +61395743399
Email Au.SampleReceipt.Melbourne@sgs.com

Samples Received Thu 9/9/2021
Report Due Thu 16/9/2021
SGS Reference ME322526

SUBMISSION DETAILS

This is to confirm that 6 samples were received on Thursday 9/9/2021. Results are expected to be ready by COB Thursday 16/9/2021. Please quote SGS reference ME322526 when making enquiries. Refer below for details relating to sample integrity upon receipt.

Samples clearly labelled	Yes	Complete documentation received	Yes
Sample container provider	SGS	Sample cooling method	N/A
Samples received in correct containers	Yes	Sample counts by matrix	6 WMS
Date documentation received	9/9/2021	Type of documentation received	COC
Number of eskies/boxes received	1	Samples received in good order	Yes
Samples received without headspace	Yes	Sample temperature upon receipt	N/A
Sufficient sample for analysis	Yes	Turnaround time requested	Standard

Unless otherwise instructed, water and bulk samples will be held for one month from date of report, and soil samples will be held for two months.

COMMENTS

Please send PO to au.samplereceipt.melbourne@sgs.com

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SAMPLE RECEIPT ADVICE

ME322526

CLIENT DETAILS

Client **LOW ECOLOGICAL SERVICES PTY LTD**

Project **Glen Helen Fuel Systems**

SUMMARY OF ANALYSIS

No.	Sample ID	TRH in air MA-30.AIR.01	VOC in Waterloo Samplers MA-5.WL.LU
001	SV1 AN-LU-20-1518	4	6
002	SV2 AN-LU-20-1516	4	6
003	SV3 AN-LU-20-1520	4	6
004	SV4 AN-LU-20-1514	4	6
005	SV5 AN-LU-20-1519	4	6
006	SV6 AN-LU-20-1517	4	6

The above table represents SGS' interpretation of the client-supplied Chain Of Custody document.

The numbers shown in the table indicate the number of results requested in each package.

Please indicate as soon as possible should your request differ from these details .

Testing as per this table shall commence immediately unless the client intervenes with a correction .

CLIENT DETAILS

Contact Kristen Grant
Client LOW ECOLOGICAL SERVICES PTY LTD
Address PO BOX 3130
ALICE SPRINGS NT 0870

Telephone 61 8 89555222
Facsimile (Not specified)
Email kristen@lowecol.com.au
Project Glen Helen Fuel Systems
Order Number COD - Paid EFT 14-9
Samples 6

LABORATORY DETAILS

Manager Adam Atkinson
Laboratory SGS Melbourne EH&S
Address 10/585 Blackburn Road
Notting Hill Victoria 3168
Telephone +61395743200
Facsimile +61395743399
Email Au.SampleReceipt.Melbourne@sgs.com
SGS Reference ME322526 R0
Date Received 09 Sep 2021
Date Reported 16 Sep 2021

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(14420).

SIGNATORIES



Susan WAN
Senior Chemist



ANALYTICAL REPORT

ME322526 R0

Parameter	Units	LOR	Sample Number	ME322526.001	ME322526.002	ME322526.003	ME322526.004
			Sample Matrix	WMS	WMS	WMS	WMS
			Sample Date	3/9/21 12:38	3/9/21 12:51	3/9/21 12:45	3/9/21 12:34
			Sample Name	SV1	SV2	SV3	SV4
				AN-LU-20-1518	AN-LU-20-1516	AN-LU-20-1520	AN-LU-20-1514

VOC in Waterloo Samplers MA-5.WL.LU Method: MA5 Tested: 13/9/2021

Benzene	µg/m³	-	<6.5	<6.5	<6.5	16
Ethylbenzene	µg/m³	-	51	<3.5	<3.5	<3.5
Naphthalene	µg/m³	-	<4.4	<4.4	<4.4	7.8
Toluene	µg/m³	-	67	5.5	6.4	8.3
o-Xylene	µg/m³	-	300	<3.6	<3.6	9.3
m&p-Xylene	µg/m³	-	220	<3.6	<3.6	<3.6

TRH in air MA-30.AIR.01 Method: MA30 Tested: 13/9/2021

C6-C10	mg/m³	-	46	4.7	<0.86	1800
C6-C10 less BTEX (F1)	mg/m³	-	46	4.7	<0.86	1800
>C10-C16	mg/m³	-	120	1.9	0.47	550
>C10-C16 less naphthalene (F2)	mg/m³	-	120	1.9	0.47	550



ANALYTICAL REPORT

ME322526 R0

		Sample Number	ME322526.005	ME322526.006
		Sample Matrix	WMS	WMS
		Sample Date	3/9/21 12:27	3/9/21 12:55
		Sample Name	SV5	SV6
			AN-LU-20-1519	AN-LU-20-1517
Parameter	Units	LOR		

VOC in Waterloo Samplers MA-5.WL.LU Method: MA5 Tested: 13/9/2021

Benzene	µg/m³	-	<6.5	<6.5
Ethylbenzene	µg/m³	-	<3.5	<3.5
Naphthalene	µg/m³	-	<4.4	<4.4
Toluene	µg/m³	-	6.6	4.9
o-Xylene	µg/m³	-	<3.6	<3.6
m&p-Xylene	µg/m³	-	<3.6	<3.6

TRH in air MA-30.AIR.01 Method: MA30 Tested: 13/9/2021

C6-C10	mg/m³	-	<0.86	<0.86
C6-C10 less BTEX (F1)	mg/m³	-	<0.86	<0.86
>C10-C16	mg/m³	-	0.47	0.74
>C10-C16 less naphthalene (F2)	mg/m³	-	0.47	0.74

MB blank results are compared to the Limit of Reporting

LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.

DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

TRH in air MA-30.AIR.01 Method: MA30

Parameter	QC Reference	Units	LOR	MB
C6-C10	LB044377	mg/m³	-	<0.86
C6-C10 less BTEX (F1)	LB044377	mg/m³	-	<0.86
>C10-C16	LB044377	mg/m³	-	<0.36
>C10-C16 less naphthalene (F2)	LB044377	mg/m³	-	<0.36

VOC in Waterloo Samplers MA-5.WL.LU Method: MA5

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Benzene	LB044377	µg/m³	-	<6.5	116%
Ethylbenzene	LB044377	µg/m³	-	<3.5	126%
Naphthalene	LB044377	µg/m³	-	<4.4	NA
Toluene	LB044377	µg/m³	-	<4.4	121%
o-Xylene	LB044377	µg/m³	-	<3.6	118%
m&p-Xylene	LB044377	µg/m³	-	<3.6	125%



METHOD

METHODOLOGY SUMMARY

MA30

This method is used for the analysis of Total Recoverable Hydrocarbons (TRH). TRH is a generic term for all extractable organic compounds and includes all hydrocarbons and hydrocarbon derivatives that have between six and forty carbons per molecule i.e. compounds in the range >C5 to C40.

The reporting of Total Recoverable Hydrocarbons is done by grouping compounds of similar nature and behaviour into "fractions".

Samples are extracted into a solvent appropriate to the matrix. The extract is then analysed using a gas chromatograph with either a flame ionisation detector (GC-FID) or a mass spectrometer (GC-MS).

MA5

This method is used for the analysis of volatile organics compounds which have been sampled from air by the use of Waterloo Samplers.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
**	Indicative data, theoretical holding time exceeded.	QFL	QC result is below the lower tolerance
***	Indicates that both * and ** apply.	-	The sample was not analysed for this analyte
		NVL	Not Validated

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.

Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the "Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.

Note that in terms of units of radioactivity:

- 1 Bq is equivalent to 27 pCi
- 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.

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**CERTIFICATE OF ANALYSIS****Work Order : ES2132828****Client : LOW ECOLOGICAL SERVICES****Contact : MR BILL LOW****Address : PO BOX 3130****ALICE SPRINGS NT, AUSTRALIA 0871****Telephone : +61 08 89 555 222****Project : Glen Helen - Soil Testing****Order number : ---****C-O-C number : ---****Sampler : ---****Site : ---****Quote number : EN/333****No. of samples received : 13****No. of samples analysed : 13****Page : 1 of 24****Laboratory : Environmental Division Sydney****Contact : Customer Services ES****Address : 277-289 Woodpark Road Smithfield NSW Australia 2164****Telephone : +61-2-8784 8555****Date Samples Received : 10-Sep-2021 07:00****Date Analysis Commenced : 15-Sep-2021****Issue Date : 21-Sep-2021 18:22**Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Jarwis Nheu	Non-Metals Team Leader	Melbourne Inorganics, Springvale, VIC
Sanjeshni Jyoti	Senior Chemist Volatiles	Sydney Organics, Smithfield, NSW
Xing Lin	Senior Organic Chemist	Melbourne Organics, Springvale, VIC



Page : 2 of 24
Work Order : ES2132828
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Soil Testing

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(k)fluoranthene (1.0), Benzo(a)pyrene (0.1), Indeno(1,2,3-cd)pyrene (0.1), Dibenz(a,h)anthracene (1.0), Benzo(g,h,i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP074-UT: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- EP074-WF: Where reported, Sum of trichlorobenzenes is the sum of the reported concentrations of 1,2,3-Trichlorobenzene and 1,2,4-Trichlorobenzene, and 1,3,5-Trichlorobenzene at or above the LOR.



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID			P5 (6+10)		P5 (2+7)		P5 (1+5)		P5(9+4)		P5(3+8)	
Compound	CAS Number	Sampling date / time		Unit	Result		Result		Result		Result		Result	
		LOR												
EA001: pH in soil using 0.01M CaCl extract														
pH (CaCl2)	-----	0.1	pH Unit	7.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
EA055: Moisture Content														
Moisture Content	-----	1.0	%	-----	3.4	3.2	3.0	-----	-----	-----	-----	-----	3.5	-----
EA055: Moisture Content (Dried @ 105-110°C)														
Moisture Content	-----	1.0	%	3.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
EG005(ED093)T: Total Metals by ICP-AES														
Molybdenum	7439-98-7	2	mg/kg	<2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Selenium	7782-49-2	5	mg/kg	<5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Silver	7440-22-4	2	mg/kg	<2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Tin	7440-31-5	5	mg/kg	<5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Arsenic	7440-38-2	5	mg/kg	<5	-----	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	-----	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	-----	-----	16	16	16	16	16	17	17	16	16
Copper	7440-50-8	5	mg/kg	11	-----	12	12	12	12	12	13	13	13	13
Lead	7439-92-1	5	mg/kg	12	-----	17	17	17	11	11	7	7	8	8
Nickel	7440-02-0	2	mg/kg	9	-----	9	9	9	9	9	10	10	11	11
Zinc	7440-66-6	5	mg/kg	30	-----	30	30	30	31	31	26	26	28	28
EG035T: Total Recoverable Mercury by FIMS														
Mercury	7439-97-6	0.1	mg/kg	<0.1	-----	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EG048: Hexavalent Chromium (Alkaline Digest)														
Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
EK026SF: Total CN by Segmented Flow Analyser														
Total Cyanide	57-12-5	1	mg/kg	<1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
EK040T: Fluoride Total														
Fluoride	16984-48-8	40	mg/kg	320	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
EP066: Polychlorinated Biphenyls (PCB)														
Total Polychlorinated biphenyls	-----	0.1	mg/kg	<0.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
EP074A: Monocyclic Aromatic Hydrocarbons														
Benzene	71-43-2	0.2	mg/kg	<0.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Toluene	108-88-3	0.5	mg/kg	<0.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Styrene	100-42-5	0.5	mg/kg	<0.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	Page 314 of 657



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		P5 (6+10)		P5 (2+7)		P5 (1+5)		P5 (9+4)		P5 (3+8)	
Compound	CAS Number	LOR	Unit	Sampling date / time	Result	Result	Result	Result	Result	Result	Result	Result	Result
EP074A: Monocyclic Aromatic Hydrocarbons - Continued													
^ Sum of monocyclic aromatic hydrocarbons		0.2	mg/kg		<0.2								
^ Total Xylenes		0.5	mg/kg		<0.5								
EP074H: Naphthalene													
Naphthalene	91-20-3	1	mg/kg		<1								
EP074I: Volatile Halogenated Compounds													
Vinyl chloride	75-01-4	0.02	mg/kg		<0.02								
1,1-Dichloroethene	75-35-4	0.01	mg/kg		<0.01								
Methylene chloride	75-09-2	0.4	mg/kg		<0.4								
trans-1,2-Dichloroethene	156-60-5	0.02	mg/kg		<0.02								
cis-1,2-Dichloroethene	156-59-2	0.01	mg/kg		<0.01								
Chloroform	67-66-3	0.02	mg/kg		<0.02								
1,1,1-Trichloroethane	71-55-6	0.01	mg/kg		<0.01								
Carbon Tetrachloride	56-23-5	0.01	mg/kg		<0.01								
1,2-Dichloroethane	107-06-2	0.02	mg/kg		<0.02								
Trichloroethene	79-01-6	0.02	mg/kg		<0.02								
1,1,2-Trichloroethane	79-00-5	0.04	mg/kg		<0.04								
Tetrachloroethene	127-18-4	0.02	mg/kg		<0.02								
1,1,1,2-Tetrachloroethane	630-20-6	0.01	mg/kg		<0.01								
1,1,1,2,2-Tetrachloroethane	79-34-5	0.02	mg/kg		<0.02								
Hexachlorobutadiene	87-68-3	0.02	mg/kg		<0.02								
Chlorobenzene	108-90-7	0.02	mg/kg		<0.02								
1,4-Dichlorobenzene	106-46-7	0.02	mg/kg		<0.02								
1,2-Dichlorobenzene	95-50-1	0.02	mg/kg		<0.02								
1,2,4-Trichlorobenzene	120-82-1	0.01	mg/kg		<0.01								
^ Sum of volatile chlorinated hydrocarbons		0.01	mg/kg		<0.01								
^ Sum of other chlorinated hydrocarbons		0.01	mg/kg		<0.01								
EP075A: Phenolic Compounds (Halogenated)													
2-Chlorophenol	95-57-8	0.03	mg/kg		<0.03								
2,4-Dichlorophenol	120-83-2	0.03	mg/kg		<0.03								
2,6-Dichlorophenol	87-65-0	0.03	mg/kg		<0.03								
4-Chloro-3-methylphenol	59-50-7	0.03	mg/kg		<0.03								
2,4,5-Trichlorophenol	95-95-4	0.05	mg/kg		<0.05								
2,4,6-Trichlorophenol	88-06-2	0.05	mg/kg		<0.05								



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		P5 (6+10)		P5 (2+7)		P5 (1+5)		P5 (9+4)		P5 (3+8)	
Compound	CAS Number	LOR	Sampling date / time	Unit	Result	Result	Result	Result	Result	Result	Result	Result	Result
EP075A: Phenolic Compounds (Halogenated) - Continued													
2,3,5,6-Tetrachlorophenol	935-95-5	0.03		mg/kg	<0.03								
2,3,4,5 & 2,3,4,6-Tetrachlorophenol	4901-51-3/58-90-2	0.05		mg/kg	<0.05								
Pentachlorophenol	87-86-5	0.2		mg/kg	<0.2								
^ Sum of Phenols (halogenated)	-----	0.03		mg/kg	<0.03								
EP075A: Phenolic Compounds (Non-halogenated)													
Phenol	108-95-2	1		mg/kg	<1								
2-Methylphenol	95-48-7	1		mg/kg	<1								
3- & 4-Methylphenol	1319-77-3	1		mg/kg	<1								
2-Nitrophenol	88-75-5	1		mg/kg	<1								
2,4-Dimethylphenol	105-67-9	1		mg/kg	<1								
2,4-Dinitrophenol	51-28-5	5		mg/kg	<5								
4-Nitrophenol	100-02-7	5		mg/kg	<5								
2-Methyl-4,6-dinitrophenol	8071-51-0	5		mg/kg	<5								
Dinoseb	88-85-7	5		mg/kg	<5								
2-Cyclohexyl-4,6-Dinitrophenol	131-89-5	5		mg/kg	<5								
^ Sum of Phenols (non-halogenated)	-----	1		mg/kg	<1								
EP075B: Polynuclear Aromatic Hydrocarbons													
Naphthalene	91-20-3	0.5		mg/kg	<0.5								
Acenaphthene	83-32-9	0.5		mg/kg	<0.5								
Acenaphthylene	208-96-8	0.5		mg/kg	<0.5								
Fluorene	86-73-7	0.5		mg/kg	<0.5								
Phenanthrene	85-01-8	0.5		mg/kg	<0.5								
Anthracene	120-12-7	0.5		mg/kg	<0.5								
Fluoranthene	206-44-0	0.5		mg/kg	<0.5								
Pyrene	129-00-0	0.5		mg/kg	<0.5								
Benz(a)anthracene	56-55-3	0.5		mg/kg	<0.5								
Chrysene	218-01-9	0.5		mg/kg	<0.5								
Benzo(b+) & Benzo(k)fluoranthene	205-99-2 207-08-9	1.0		mg/kg	<1.0								
Benzo(a)pyrene	50-32-8	0.5		mg/kg	<0.5								
Indeno(1,2,3-cd)pyrene	193-39-5	0.5		mg/kg	<0.5								
Dibenz(a,h)anthracene	53-70-3	0.5		mg/kg	<0.5								
Benzo(g,h,i)perylene	191-24-2	0.5		mg/kg	<0.5								
^ Sum of polycyclic aromatic hydrocarbons	-----	0.5		mg/kg	<0.5								

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID						
Compound	CAS Number	LOR	Sampling date / time	P5 (6+10)	P5 (2+7)	P5 (1+5)	P5(9+4)	P5(3+8)
				Result	Result	Result	Result	Result
EP075B: Polynuclear Aromatic Hydrocarbons - Continued								
^ Benzo(a)pyrene TEQ (zero)		0.5	mg/kg	<0.5				
^ Benzo(a)pyrene TEQ (half LOR)		0.5	mg/kg	0.6				
^ Benzo(a)pyrene TEQ (LOR)		0.5	mg/kg	1.2				
EP075I: Organochlorine Pesticides								
alpha-BHC	319-84-6	0.03	mg/kg	<0.03				
Hexachlorobenzene (HCB)	118-74-1	0.03	mg/kg	<0.03				
beta-BHC	319-85-7	0.03	mg/kg	<0.03				
gamma-BHC	58-89-9	0.03	mg/kg	<0.03				
delta-BHC	319-86-8	0.03	mg/kg	<0.03				
Heptachlor	76-44-8	0.03	mg/kg	<0.03				
Aldrin	309-00-2	0.03	mg/kg	<0.03				
Heptachlor epoxide	1024-57-3	0.03	mg/kg	<0.03				
cis-Chlordane	5103-71-9	0.03	mg/kg	<0.03				
trans-Chlordane	5103-74-2	0.03	mg/kg	<0.03				
Endosulfan 1	959-98-8	0.03	mg/kg	<0.03				
4,4'-DDE	72-55-9	0.05	mg/kg	<0.05				
Dieldrin	60-57-1	0.03	mg/kg	<0.03				
Endrin aldehyde	7421-93-4	0.03	mg/kg	<0.03				
Endrin	72-20-8	0.03	mg/kg	<0.03				
Endosulfan 2	33213-65-9	0.03	mg/kg	<0.03				
4,4'-DDD	72-54-8	0.05	mg/kg	<0.05				
Endosulfan sulfate	1031-07-8	0.03	mg/kg	<0.03				
4,4'-DDT	50-29-3	0.05	mg/kg	<0.05				
Methoxychlor	72-43-5	0.03	mg/kg	<0.03				
^ Sum of organochlorine pesticides		0.03	mg/kg	<0.03				
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.03	mg/kg	<0.03				
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg	<0.05				
^ Chlordane	57-74-9	0.03	mg/kg	<0.03				
^ Sum of other organochlorine pesticides		0.03	mg/kg	<0.03				
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction		10	mg/kg	----	<10	<10	<10	<10
C6 - C9 Fraction		10	mg/kg	<10				
C10 - C14 Fraction		50	mg/kg	----	<50	<50	<50	<50
C10 - C14 Fraction		50	mg/kg	<50				Page 317 of 657



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID			P5 (6+10)		P5 (2+7)		P5 (1+5)		P5 (9+4)		P5 (3+8)	
Compound	CAS Number	LOR	Unit	Sampling date / time		Result		Result		Result		Result		
EP080/071: Total Petroleum Hydrocarbons - Continued														
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	----	----	----	----	----	----	----	----	
C15 - C28 Fraction		100	mg/kg		----		<100	----	<100	----	<100	----	<100	
C15 - C28 Fraction		100	mg/kg		<100	----	----	----	----	----	----	----	----	
C29 - C36 Fraction		100	mg/kg		----		<100	----	<100	----	<100	----	<100	
C29 - C36 Fraction		100	mg/kg		<100	----	----	----	----	----	----	----	----	
^ C10 - C36 Fraction (sum)		50	mg/kg		----		<50	----	<50	----	<50	----	<50	
^ C10 - C36 Fraction (sum)		50	mg/kg		<50	----	----	----	----	----	----	----	----	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions														
C6 - C10 Fraction	C6_C10	10	mg/kg		----		<10	----	<10	----	<10	----	<10	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		----		<10	----	<10	----	<10	----	<10	
>C10 - C16 Fraction	----	50	mg/kg		----		<50	----	<50	----	<50	----	<50	
>C10 - C16 Fraction	----	50	mg/kg		<50	----	----	----	----	----	----	----	----	
>C16 - C34 Fraction	----	100	mg/kg		----		<100	----	<100	----	<100	----	<100	
>C16 - C34 Fraction	----	100	mg/kg		<100	----	----	----	----	----	----	----	----	
>C34 - C40 Fraction	----	100	mg/kg		----		<100	----	<100	----	<100	----	<100	
>C34 - C40 Fraction	----	100	mg/kg		<100	----	----	----	----	----	----	----	----	
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		----		<50	----	<50	----	<50	----	<50	
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	----	----	----	----	----	----	----	----	
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		----		<50	----	<50	----	<50	----	<50	
>C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	----	----	----	----	----	----	----	----	
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	----	----	----	----	----	----	----	----	
EP080: BTEXN														
Benzene	71-43-2	0.2	mg/kg		----		<0.2	----	<0.2	----	<0.2	----	<0.2	
Toluene	108-88-3	0.5	mg/kg		----		<0.5	----	<0.5	----	<0.5	----	<0.5	
Ethylbenzene	100-41-4	0.5	mg/kg		----		<0.5	----	<0.5	----	<0.5	----	<0.5	
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		----		<0.5	----	<0.5	----	<0.5	----	<0.5	
ortho-Xylene	95-47-6	0.5	mg/kg		----		<0.5	----	<0.5	----	<0.5	----	<0.5	
^ Sum of BTEX	----	0.2	mg/kg		----		<0.2	----	<0.2	----	<0.2	----	<0.2	
^ Total Xylenes	----	0.5	mg/kg		----		<0.5	----	<0.5	----	<0.5	----	<0.5	
Naphthalene	91-20-3	1	mg/kg		----		<1	----	<1	----	<1	----	<1	
EP066S: PCB Surrogate													Page 318 of 657	



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID				P5 (6+10)		P5 (2+7)		P5 (1+5)		P5 (9+4)		P5 (3+8)	
Compound	CAS Number	LOR	Sampling date / time		Result	06-Sep-2021 16:20	ES2132828-001	06-Sep-2021 16:05	ES2132828-002	06-Sep-2021 16:00	ES2132828-003	06-Sep-2021 16:15	ES2132828-004	06-Sep-2021 16:12	ES2132828-005
			Unit	Unit											
EP066S: PCB Surrogate - Continued															
Decachlorobiphenyl	2051-24-3	0.1	%		87.2										
EP074S: VOC Surrogates (Ultra-Trace)															
1,2-Dichloroethane-D4	17060-07-0	0.1	%		109										
Toluene-D8	2037-26-5	0.1	%		101										
4-Bromofluorobenzene	460-00-4	0.1	%		101										
EP075S: Acid Extractable Surrogates (Waste Classification)															
Phenol-d6	13127-88-3	0.025	%		86.5										
2-Chlorophenol-D4	93951-73-6	0.025	%		77.6										
2,4,6-Tribromophenol	118-79-6	0.025	%		82.7										
EP075T: Base/Neutral Extractable Surrogates (Waste Classification)															
Nitrobenzene-D5	4165-60-0	0.025	%		80.2										
1,2-Dichlorobenzene-D4	2199-69-1	0.025	%		77.2										
2-Fluorobiphenyl	321-60-8	0.025	%		84.6										
Anthracene-d10	1719-06-8	0.025	%		86.5										
4-Terphenyl-d14	1718-51-0	0.025	%		89.5										
EP080S: TPH(V)/BTX Surrogates															
1,2-Dichloroethane-D4	17060-07-0	0.2	%					110		115		115		124	
Toluene-D8	2037-26-5	0.2	%					89.6		96.2		97.4		103	
4-Bromofluorobenzene	460-00-4	0.2	%					104		101		102		106	



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID			B10+B3+B9		B11 + B8		B4+ B7		B1 +BS		B2 + B6	
Compound	CAS Number	Sampling date / time		Unit	06-Sep-2021 17:35		06-Sep-2021 17:35		06-Sep-2021 17:30		06-Sep-2021 17:30		06-Sep-2021 17:30	
		LOR			ES2132828-006		ES2132828-007		ES2132828-008		ES2132828-009		ES2132828-010	
EA001: pH in soil using 0.01M CaCl extract														
pH (CaCl2)		0.1	pH Unit		7.9									
EA055: Moisture Content														
Moisture Content		1.0	%					2.9		4.2			3.3	
EA055: Moisture Content (Dried @ 105-110°C)														
Moisture Content		1.0	%		4.8			4.9						
EG005(ED093)T: Total Metals by ICP-AES														
Molybdenum	7439-98-7	2	mg/kg		<2									
Selenium	7782-49-2	5	mg/kg		<5									
Silver	7440-22-4	2	mg/kg		<2									
Tin	7440-31-5	5	mg/kg		<5									
Arsenic	7440-38-2	5	mg/kg		<5			<5		<5			<5	
Cadmium	7440-43-9	1	mg/kg		<1			<1		<1			<1	
Chromium	7440-47-3	2	mg/kg			13		13		13		17	16	
Copper	7440-50-8	5	mg/kg		11			10		13		13	31	
Lead	7439-92-1	5	mg/kg		18			13		13		10	12	
Nickel	7440-02-0	2	mg/kg		9			8		10		10	10	
Zinc	7440-66-6	5	mg/kg		29			25		24		28	26	
EG035T: Total Recoverable Mercury by FIMS														
Mercury	7439-97-6	0.1	mg/kg		<0.1			<0.1		<0.1			<0.1	
EG048: Hexavalent Chromium (Alkaline Digest)														
Hexavalent Chromium	18540-29-9	0.5	mg/kg		<0.5									
EK026SF: Total CN by Segmented Flow Analyser														
Total Cyanide	57-12-5	1	mg/kg		<1									
EK040T: Fluoride Total														
Fluoride	16984-48-8	40	mg/kg		310									
EP066: Polychlorinated Biphenyls (PCB)														
Total Polychlorinated biphenyls		0.1	mg/kg		<0.1									
EP074A: Monocyclic Aromatic Hydrocarbons														
Benzene	71-43-2	0.2	mg/kg		<0.2									
Toluene	108-88-3	0.5	mg/kg		<0.5									
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5									
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5									
Styrene	100-42-5	0.5	mg/kg		<0.5									
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5									

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Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID			B10+B3+B9		B11 + B8		B4+ B7		B1 +BS		B2 + B6	
Compound	CAS Number	LOR	Sampling date / time		06-Sep-2021 17:35		06-Sep-2021 17:35		06-Sep-2021 17:30		06-Sep-2021 17:30		06-Sep-2021 17:30	
				Unit	ES2132828-006	Result	ES2132828-007	Result	ES2132828-008	Result	ES2132828-009	Result	ES2132828-010	Result
EP074A: Monocyclic Aromatic Hydrocarbons - Continued														
^ Sum of monocyclic aromatic hydrocarbons			0.2	mg/kg	<0.2									
^ Total Xylenes			0.5	mg/kg	<0.5									
EP074H: Naphthalene														
Naphthalene			91-20-3	1	mg/kg	<1								
EP074I: Volatile Halogenated Compounds														
Vinyl chloride			75-01-4	0.02	mg/kg	<0.02								
1,1-Dichloroethene			75-35-4	0.01	mg/kg	<0.01								
Methylene chloride			75-09-2	0.4	mg/kg	<0.4								
trans-1,2-Dichloroethene			156-60-5	0.02	mg/kg	<0.02								
cis-1,2-Dichloroethene			156-59-2	0.01	mg/kg	<0.01								
Chloroform			67-66-3	0.02	mg/kg	<0.02								
1,1,1-Trichloroethane			71-55-6	0.01	mg/kg	<0.01								
Carbon Tetrachloride			56-23-5	0.01	mg/kg	<0.01								
1,2-Dichloroethane			107-06-2	0.02	mg/kg	<0.02								
Trichloroethene			79-01-6	0.02	mg/kg	<0.02								
1,1,2-Trichloroethane			79-00-5	0.04	mg/kg	<0.04								
Tetrachloroethene			127-18-4	0.02	mg/kg	<0.02								
1,1,1,2-Tetrachloroethane			630-20-6	0.01	mg/kg	<0.01								
1,1,2,2-Tetrachloroethane			79-34-5	0.02	mg/kg	<0.02								
Hexachlorobutadiene			87-68-3	0.02	mg/kg	<0.02								
Chlorobenzene			108-90-7	0.02	mg/kg	<0.02								
1,4-Dichlorobenzene			106-46-7	0.02	mg/kg	<0.02								
1,2-Dichlorobenzene			95-50-1	0.02	mg/kg	<0.02								
1,2,4-Trichlorobenzene			120-82-1	0.01	mg/kg	<0.01								
^ Sum of volatile chlorinated hydrocarbons				0.01	mg/kg	<0.01								
^ Sum of other chlorinated hydrocarbons				0.01	mg/kg	<0.01								
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons														
Naphthalene			91-20-3	0.5	mg/kg	<0.5								
Acenaphthylene			208-96-8	0.5	mg/kg	<0.5								
Acenaphthene			83-32-9	0.5	mg/kg	<0.5								
Fluorene			86-73-7	0.5	mg/kg	<0.5								
Phenanthrene			85-01-8	0.5	mg/kg	<0.5								
Anthracene			120-12-7	0.5	mg/kg	<0.5								



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		Sampling date / time		B10+B3+B9		B11 + B8		B4+ B7		B1 +BS		B2 + B6	
Compound	CAS Number	LOR	Unit	B10+B3+B9		B11 + B8		B4+ B7		B1 +BS		B2 + B6			
				Result	ES2132828-006	Result	ES2132828-007	Result	ES2132828-008	Result	ES2132828-009	Result	ES2132828-010		
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued															
Fluoranthene	206-44-0	0.5	mg/kg	-----	-----	<0.5	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pyrene	129-00-0	0.5	mg/kg	-----	-----	<0.5	-----	-----	-----	-----	-----	-----	-----	-----	-----
Benz(a)anthracene	56-55-3	0.5	mg/kg	-----	-----	<0.5	-----	-----	-----	-----	-----	-----	-----	-----	-----
Chrysene	218-01-9	0.5	mg/kg	-----	-----	<0.5	-----	-----	-----	-----	-----	-----	-----	-----	-----
Benzo(b+j)fluoranthene	205-99-2	0.5	mg/kg	-----	-----	<0.5	-----	-----	-----	-----	-----	-----	-----	-----	-----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	-----	-----	<0.5	-----	-----	-----	-----	-----	-----	-----	-----	-----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	-----	-----	<0.5	-----	-----	-----	-----	-----	-----	-----	-----	-----
Indeno(1,2,3.cd)pyrene	193-39-5	0.5	mg/kg	-----	-----	<0.5	-----	-----	-----	-----	-----	-----	-----	-----	-----
Dibenz(a,h)anthracene	53-70-3	0.5	mg/kg	-----	-----	<0.5	-----	-----	-----	-----	-----	-----	-----	-----	-----
Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg	-----	-----	<0.5	-----	-----	-----	-----	-----	-----	-----	-----	-----
^ Sum of polycyclic aromatic hydrocarbons				-----	-----	<0.5	-----	-----	-----	-----	-----	-----	-----	-----	-----
^ Benzo(a)pyrene TEQ (zero)				-----	-----	<0.5	-----	-----	-----	-----	-----	-----	-----	-----	-----
^ Benzo(a)pyrene TEQ (half LOR)				-----	-----	0.6	-----	-----	-----	-----	-----	-----	-----	-----	-----
^ Benzo(a)pyrene TEQ (LOR)				-----	-----	1.2	-----	-----	-----	-----	-----	-----	-----	-----	-----
EP075A: Phenolic Compounds (Halogenated)															
2-Chlorophenol	95-57-8	0.03	mg/kg	-----	-----	<0.03	-----	-----	-----	-----	-----	-----	-----	-----	-----
2,4-Dichlorophenol	120-83-2	0.03	mg/kg	-----	-----	<0.03	-----	-----	-----	-----	-----	-----	-----	-----	-----
2,6-Dichlorophenol	87-65-0	0.03	mg/kg	-----	-----	<0.03	-----	-----	-----	-----	-----	-----	-----	-----	-----
4-Chloro-3-methylphenol	59-50-7	0.03	mg/kg	-----	-----	<0.03	-----	-----	-----	-----	-----	-----	-----	-----	-----
2,4,5-Trichlorophenol	95-95-4	0.05	mg/kg	-----	-----	<0.05	-----	-----	-----	-----	-----	-----	-----	-----	-----
2,4,6-Trichlorophenol	88-06-2	0.05	mg/kg	-----	-----	<0.05	-----	-----	-----	-----	-----	-----	-----	-----	-----
2,3,5,6-Tetrachlorophenol	935-95-5	0.03	mg/kg	-----	-----	<0.03	-----	-----	-----	-----	-----	-----	-----	-----	-----
2,3,4,5 & 2,3,4,6-Tetrachlorophenol	4901-51-3/58-90-2	0.05	mg/kg	-----	-----	<0.05	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pentachlorophenol	87-86-5	0.2	mg/kg	-----	-----	<0.2	-----	-----	-----	-----	-----	-----	-----	-----	-----
^ Sum of Phenols (halogenated)				-----	-----	<0.03	-----	-----	-----	-----	-----	-----	-----	-----	-----
EP075A: Phenolic Compounds (Non-halogenated)															
Phenol	108-95-2	1	mg/kg	-----	-----	<1	-----	-----	-----	-----	-----	-----	-----	-----	-----
2-Methylphenol	95-48-7	1	mg/kg	-----	-----	<1	-----	-----	-----	-----	-----	-----	-----	-----	-----
3- & 4-Methylphenol	1319-77-3	1	mg/kg	-----	-----	<1	-----	-----	-----	-----	-----	-----	-----	-----	-----
2-Nitrophenol	88-75-5	1	mg/kg	-----	-----	<1	-----	-----	-----	-----	-----	-----	-----	-----	-----
2,4-Dimethylphenol	105-67-9	1	mg/kg	-----	-----	<1	-----	-----	-----	-----	-----	-----	-----	-----	-----
2,4-Dinitrophenol	51-28-5	5	mg/kg	-----	-----	<5	-----	-----	-----	-----	-----	-----	-----	-----	-----
4-Nitrophenol	100-02-7	5	mg/kg	-----	-----	<5	-----	-----	-----	-----	-----	-----	-----	-----	-----
2-Methyl-4,6-dinitrophenol	8071-51-0	5	mg/kg	-----	-----	<5	-----	-----	-----	-----	-----	-----	-----	-----	-----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID			B10+B3+B9		B11 + B8		B4+ B7		B1 +BS		B2 + B6	
Compound	CAS Number	LOR	Unit	Sampling date / time	Result		Result		Result		Result		Result	
					ES2132828-006	06-Sep-2021 17:35	ES2132828-007	06-Sep-2021 17:35	ES2132828-008	06-Sep-2021 17:30	ES2132828-009	06-Sep-2021 17:30	ES2132828-010	06-Sep-2021 17:30
EP075A: Phenolic Compounds (Non-halogenated) - Continued														
Dinoseb	88-85-7	5	mg/kg		<5									
2-Cyclohexyl-4,6-Dinitrophenol	131-89-5	5	mg/kg		<5									
^ Sum of Phenols (non-halogenated)		1	mg/kg		<1									
EP075B: Polynuclear Aromatic Hydrocarbons														
Naphthalene	91-20-3	0.5	mg/kg		<0.5									
Acenaphthene	83-32-9	0.5	mg/kg		<0.5									
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5									
Fluorene	86-73-7	0.5	mg/kg		<0.5									
Phenanthrene	85-01-8	0.5	mg/kg		<0.5									
Anthracene	120-12-7	0.5	mg/kg		<0.5									
Fluoranthene	206-44-0	0.5	mg/kg		<0.5									
Pyrene	129-00-0	0.5	mg/kg		<0.5									
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5									
Chrysene	218-01-9	0.5	mg/kg		<0.5									
Benzo(b+) & Benzo(k)fluoranthene	205-99-2 207-08-9	1.0	mg/kg		<1.0									
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5									
Indeno(1,2,3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5									
Dibenz(a,h)anthracene	53-70-3	0.5	mg/kg		<0.5									
Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg		<0.5									
^ Sum of polycyclic aromatic hydrocarbons		0.5	mg/kg		<0.5									
^ Benzo(a)pyrene TEQ (zero)		0.5	mg/kg		<0.5									
^ Benzo(a)pyrene TEQ (half LOR)		0.5	mg/kg		0.6									
^ Benzo(a)pyrene TEQ (LOR)		0.5	mg/kg		1.2									
EP075I: Organochlorine Pesticides														
alpha-BHC	319-84-6	0.03	mg/kg		<0.03									
Hexachlorobenzene (HCB)	118-74-1	0.03	mg/kg		<0.03									
beta-BHC	319-85-7	0.03	mg/kg		<0.03									
gamma-BHC	58-89-9	0.03	mg/kg		<0.03									
delta-BHC	319-86-8	0.03	mg/kg		<0.03									
Heptachlor	76-44-8	0.03	mg/kg		<0.03									
Aldrin	309-00-2	0.03	mg/kg		<0.03									
Heptachlor epoxide	1024-57-3	0.03	mg/kg		<0.03									
cis-Chlordane	5103-71-9	0.03	mg/kg		<0.03									



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		B10+B3+B9		B11 + B8		B4+ B7		B1 +BS		B2 + B6	
Compound	CAS Number	LOR	Unit	Sampling date / time	Result	Result	Result	Result	Result	Result	Result	Result	Result
EP075: Organochlorine Pesticides - Continued													
trans-Chlordane	5103-74-2	0.03	mg/kg		<0.03								
Endosulfan 1	959-98-8	0.03	mg/kg		<0.03								
4,4'-DDE	72-55-9	0.05	mg/kg		<0.05								
Dieldrin	60-57-1	0.03	mg/kg		<0.03								
Endrin aldehyde	7421-93-4	0.03	mg/kg		<0.03								
Endrin	72-20-8	0.03	mg/kg		<0.03								
Endosulfan 2	33213-65-9	0.03	mg/kg		<0.03								
4,4'-DDD	72-54-8	0.05	mg/kg		<0.05								
Endosulfan sulfate	1031-07-8	0.03	mg/kg		<0.03								
4,4'-DDT	50-29-3	0.05	mg/kg		<0.05								
Methoxychlor	72-43-5	0.03	mg/kg		<0.03								
^ Sum of organochlorine pesticides		0.03	mg/kg		<0.03								
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.03	mg/kg		<0.03								
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/5	0.05	mg/kg		<0.05								
	0-2												
^ Chlordane	57-74-9	0.03	mg/kg		<0.03								
^ Sum of other organochlorine pesticides		0.03	mg/kg		<0.03								
EP080/071: Total Petroleum Hydrocarbons													
C6 - C9 Fraction		10	mg/kg		<10					<10			<10
C6 - C9 Fraction		10	mg/kg		<10								
C10 - C14 Fraction		50	mg/kg		<50					<50			<50
C10 - C14 Fraction		50	mg/kg		<50								
C6 - C10 Fraction	C6_C10	10	mg/kg		<10								
C15 - C28 Fraction		100	mg/kg			980				<100			740
C15 - C28 Fraction		100	mg/kg			720							
C29 - C36 Fraction		100	mg/kg		<100					<100			<100
C29 - C36 Fraction		100	mg/kg		<100								
^ C10 - C36 Fraction (sum)		50	mg/kg			980				<50			740
^ C10 - C36 Fraction (sum)		50	mg/kg			720							
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions													
C6 - C10 Fraction	C6_C10	10	mg/kg		<10					<10			<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10					<10			<10
>C10 - C16 Fraction		50	mg/kg			220				<50			150
>C10 - C16 Fraction		50	mg/kg			180							



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		B10+B3+B9		B11 + B8		B4+ B7		B1 +B5		B2 + B6	
Compound	CAS Number	LOR	Sampling date / time		06-Sep-2021 17:35		06-Sep-2021 17:35		06-Sep-2021 17:30		06-Sep-2021 17:30		
			Unit		ES2132828-006	Result	ES2132828-007	Result	ES2132828-008	Result	ES2132828-009	Result	ES2132828-010
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued													
>C16 - C34 Fraction		100	mg/kg				830		<100		480		640
>C16 - C34 Fraction		100	mg/kg			570							
>C34 - C40 Fraction		100	mg/kg				<100		<100		<100		<100
>C34 - C40 Fraction		100	mg/kg			<100							
^ >C10 - C40 Fraction (sum)		50	mg/kg				1050		<50		610		790
^ >C10 - C40 Fraction (sum)		50	mg/kg			750							
^ >C10 - C16 Fraction minus Naphthalene (F2)		50	mg/kg				220		<50		130		150
>C10 - C16 Fraction minus Naphthalene (F2)		50	mg/kg			180							
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg			<10							
EP080: BTEXN													
Benzene	71-43-2	0.2	mg/kg				<0.2		<0.2		<0.2		<0.2
Toluene	108-88-3	0.5	mg/kg				<0.5		<0.5		<0.5		<0.5
Ethylbenzene	100-41-4	0.5	mg/kg				<0.5		<0.5		<0.5		<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg				<0.5		<0.5		<0.5		<0.5
ortho-Xylene	95-47-6	0.5	mg/kg				<0.5		<0.5		<0.5		<0.5
^ Sum of BTEX		0.2	mg/kg				<0.2		<0.2		<0.2		<0.2
^ Total Xylenes		0.5	mg/kg				<0.5		<0.5		<0.5		<0.5
Naphthalene	91-20-3	1	mg/kg				<1		<1		<1		<1
EP066S: PCB Surrogate													
Decachlorobiphenyl	2051-24-3	0.1	%			94.7							
EP074S: VOC Surrogates (Ultra-Trace)													
1,2-Dichloroethane-D4	17060-07-0	0.1	%			96.3							
Toluene-D8	2037-26-5	0.1	%			93.9							
4-Bromofluorobenzene	460-00-4	0.1	%			91.6							
EP075(SIM)S: Phenolic Compound Surrogates													
Phenol-d6	13127-88-3	0.5	%				93.2						
2-Chlorophenol-D4	93951-73-6	0.5	%				92.1						
2,4,6-Tribromophenol	118-79-6	0.5	%				73.0						
EP075(SIM)T: PAH Surrogates													
2-Fluorobiphenyl	321-60-8	0.5	%				102						
Anthracene-d10	1719-06-8	0.5	%				98.2						



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		Sampling date / time		B10+B3+B9		B11 + B8		B4+ B7		B1 +BS		B2 + B6	
Compound	CAS Number	LOR	Unit	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
EP075(SIM)T: PAH Surrogates - Continued															
4-Terphenyl-d14	1718-51-0	0.5	%	81.7											
EP075S: Acid Extractable Surrogates (Waste Classification)															
Phenol-d6	13127-88-3	0.025	%	89.9											
2-Chlorophenol-D4	93951-73-6	0.025	%	81.1											
2,4,6-Tribromophenol	118-79-6	0.025	%	88.7											
EP075T: Base/Neutral Extractable Surrogates (Waste Classification)															
Nitrobenzene-D5	4165-60-0	0.025	%	82.7											
1,2-Dichlorobenzene-D4	2199-69-1	0.025	%	80.4											
2-Fluorobiphenyl	321-60-8	0.025	%	89.2											
Anthracene-d10	1719-06-8	0.025	%	93.6											
4-Terphenyl-d14	1718-51-0	0.025	%	95.0											
EP080S: TPH(V)/BTEX Surrogates															
1,2-Dichloroethane-D4	17060-07-0	0.2	%		106					115		123		112	
Toluene-D8	2037-26-5	0.2	%		94.4					102		107		98.8	
4-Bromofluorobenzene	460-00-4	0.2	%		94.7					104		107		100	



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID			D5 + D2		D7 + DB		INTRA DUPLICATE			
		Sampling date / time										
Compound	CAS Number	LOR	Unit			Result		Result		Result		
EA001: pH in soil using 0.01M CaCl extract												
pH (CaCl2)	-----	0.1	pH Unit			8.0						
EA055: Moisture Content												
Moisture Content	-----	1.0	%			3.5						
EA055: Moisture Content (Dried @ 105-110°C)												
Moisture Content	-----	1.0	%			4.5		3.9				
EG005(ED093)T: Total Metals by ICP-AES												
Molybdenum	7439-98-7	2	mg/kg					<2				
Selenium	7782-49-2	5	mg/kg					<5				
Silver	7440-22-4	2	mg/kg					<2				
Tin	7440-31-5	5	mg/kg					<5				
Arsenic	7440-38-2	5	mg/kg			<5		<5				
Cadmium	7440-43-9	1	mg/kg			<1		<1				
Chromium	7440-47-3	2	mg/kg			16		17				
Copper	7440-50-8	5	mg/kg			11		13				
Lead	7439-92-1	5	mg/kg			12		9		13		
Nickel	7440-02-0	2	mg/kg			9		10		10		
Zinc	7440-66-6	5	mg/kg			27		28		32		
EG035T: Total Recoverable Mercury by FIMS												
Mercury	7439-97-6	0.1	mg/kg			<0.1		<0.1				
EG048: Hexavalent Chromium (Alkaline Digest)												
Hexavalent Chromium	18540-29-9	0.5	mg/kg					<0.5				
EK026SF: Total CN by Segmented Flow Analyser												
Total Cyanide	57-12-5	1	mg/kg					<1				
EK040T: Fluoride Total												
Fluoride	16984-48-8	40	mg/kg					320				
EP066: Polychlorinated Biphenyls (PCB)												
Total Polychlorinated biphenyls	-----	0.1	mg/kg					<0.1				
EP074A: Monocyclic Aromatic Hydrocarbons												
Benzene	71-43-2	0.2	mg/kg					<0.2				
Toluene	108-88-3	0.5	mg/kg					<0.5				
Ethylbenzene	100-41-4	0.5	mg/kg					<0.5				
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg					<0.5				
Styrene	100-42-5	0.5	mg/kg					<0.5				
ortho-Xylene	95-47-6	0.5	mg/kg					<0.5				Page 327 of 657



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		D5 + D2		D7 + DB		INTRA DUPLICATE			
Compound	CAS Number	LOR	Unit	Sampling date / time		06-Sep-2021 17:40		06-Sep-2021 17:40		06-Sep-2021 00:00	
						ES2132828-011	ES2132828-012	ES2132828-013	Result	Result	Result
EP074A: Monocyclic Aromatic Hydrocarbons - Continued											
^ Sum of monocyclic aromatic hydrocarbons		0.2	mg/kg						<0.2		
^ Total Xylenes		0.5	mg/kg						<0.5		
EP074H: Naphthalene											
Naphthalene	91-20-3	1	mg/kg						<1		
EP074I: Volatile Halogenated Compounds											
Vinyl chloride	75-01-4	0.02	mg/kg						<0.02		
1,1-Dichloroethene	75-35-4	0.01	mg/kg						<0.01		
Methylene chloride	75-09-2	0.4	mg/kg						<0.4		
trans-1,2-Dichloroethene	156-60-5	0.02	mg/kg						<0.02		
cis-1,2-Dichloroethene	156-59-2	0.01	mg/kg						<0.01		
Chloroform	67-66-3	0.02	mg/kg						<0.02		
1,1,1-Trichloroethane	71-55-6	0.01	mg/kg						<0.01		
Carbon Tetrachloride	56-23-5	0.01	mg/kg						<0.01		
1,2-Dichloroethane	107-06-2	0.02	mg/kg						<0.02		
Trichloroethene	79-01-6	0.02	mg/kg						<0.02		
1,1,2-Trichloroethane	79-00-5	0.04	mg/kg						<0.04		
Tetrachloroethene	127-18-4	0.02	mg/kg						<0.02		
1,1,1,2-Tetrachloroethane	630-20-6	0.01	mg/kg						<0.01		
1,1,2,2-Tetrachloroethane	79-34-5	0.02	mg/kg						<0.02		
Hexachlorobutadiene	87-68-3	0.02	mg/kg						<0.02		
Chlorobenzene	108-90-7	0.02	mg/kg						<0.02		
1,4-Dichlorobenzene	106-46-7	0.02	mg/kg						<0.02		
1,2-Dichlorobenzene	95-50-1	0.02	mg/kg						<0.02		
1,2,4-Trichlorobenzene	120-82-1	0.01	mg/kg						<0.01		
^ Sum of volatile chlorinated hydrocarbons		0.01	mg/kg						<0.01		
^ Sum of other chlorinated hydrocarbons		0.01	mg/kg						<0.01		
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons											
Naphthalene	91-20-3	0.5	mg/kg						<0.5		
Acenaphthylene	208-96-8	0.5	mg/kg						<0.5		
Acenaphthene	83-32-9	0.5	mg/kg						<0.5		
Fluorene	86-73-7	0.5	mg/kg						<0.5		
Phenanthrene	85-01-8	0.5	mg/kg						<0.5		
Anthracene	120-12-7	0.5	mg/kg						<0.5		



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID			D5 + D2		D7 + DB		INTRA DUPLICATE			
		Sampling date / time			06-Sep-2021 17:40		06-Sep-2021 17:40		06-Sep-2021 00:00			
		LOR			ES2132828-011		ES2132828-012		ES2132828-013			
Compound	CAS Number	LOR	Unit	Result		Result		Result				
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued												
Fluoranthene	206-44-0	0.5	mg/kg	<0.5								
Pyrene	129-00-0	0.5	mg/kg	<0.5								
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5								
Chrysene	218-01-9	0.5	mg/kg	<0.5								
Benzo(b+j)fluoranthene	205-99-2	0.5	mg/kg	<0.5								
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5								
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5								
Indeno(1,2,3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5								
Dibenz(a,h)anthracene	53-70-3	0.5	mg/kg	<0.5								
Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg	<0.5								
^ Sum of polycyclic aromatic hydrocarbons				0.5								
^ Benzo(a)pyrene TEQ (zero)				0.5								
^ Benzo(a)pyrene TEQ (half LOR)				0.5								
^ Benzo(a)pyrene TEQ (LOR)				0.5								
EP075A: Phenolic Compounds (Halogenated)												
2-Chlorophenol	95-57-8	0.03	mg/kg							<0.03		
2,4-Dichlorophenol	120-83-2	0.03	mg/kg							<0.03		
2,6-Dichlorophenol	87-65-0	0.03	mg/kg							<0.03		
4-Chloro-3-methylphenol	59-50-7	0.03	mg/kg							<0.03		
2,4,5-Trichlorophenol	95-95-4	0.05	mg/kg							<0.05		
2,4,6-Trichlorophenol	88-06-2	0.05	mg/kg							<0.05		
2,3,5,6-Tetrachlorophenol	935-95-5	0.03	mg/kg							<0.03		
2,3,4,5 & 2,3,4,6-Tetrachlorophenol	4901-51-3/58-90-2	0.05	mg/kg							<0.05		
Pentachlorophenol	87-86-5	0.2	mg/kg							<0.2		
^ Sum of Phenols (halogenated)				0.03						<0.03		
EP075A: Phenolic Compounds (Non-halogenated)												
Phenol	108-95-2	1	mg/kg							<1		
2-Methylphenol	95-48-7	1	mg/kg							<1		
3- & 4-Methylphenol	1319-77-3	1	mg/kg							<1		
2-Nitrophenol	88-75-5	1	mg/kg							<1		
2,4-Dimethylphenol	105-67-9	1	mg/kg							<1		
2,4-Dinitrophenol	51-28-5	5	mg/kg							<5		
4-Nitrophenol	100-02-7	5	mg/kg							<5		
2-Methyl-4,6-dinitrophenol	8071-51-0	5	mg/kg							<5		

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Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		Sampling date / time		D5 + D2		D7 + DB		INTRA DUPLICATE			
Compound	CAS Number	LOR	Unit	06-Sep-2021 17:40		06-Sep-2021 17:40		06-Sep-2021 17:40		06-Sep-2021 00:00			
				ES2132828-011		ES2132828-012		ES2132828-013		Result		Result	
EP075A: Phenolic Compounds (Non-halogenated) - Continued													
Dinoseb	88-85-7	5	mg/kg							<5			
2-Cyclohexyl-4,6-Dinitrophenol	131-89-5	5	mg/kg							<5			
^ Sum of Phenols (non-halogenated)		1	mg/kg							<1			
EP075B: Polynuclear Aromatic Hydrocarbons													
Naphthalene	91-20-3	0.5	mg/kg							<0.5			
Acenaphthene	83-32-9	0.5	mg/kg							<0.5			
Acenaphthylene	208-96-8	0.5	mg/kg							<0.5			
Fluorene	86-73-7	0.5	mg/kg							<0.5			
Phenanthrene	85-01-8	0.5	mg/kg							<0.5			
Anthracene	120-12-7	0.5	mg/kg							<0.5			
Fluoranthene	206-44-0	0.5	mg/kg							<0.5			
Pyrene	129-00-0	0.5	mg/kg							<0.5			
Benz(a)anthracene	56-55-3	0.5	mg/kg							<0.5			
Chrysene	218-01-9	0.5	mg/kg							<0.5			
Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1.0	mg/kg							<1.0			
Benzo(a)pyrene	50-32-8	0.5	mg/kg							<0.5			
Indeno(1,2,3.cd)pyrene	193-39-5	0.5	mg/kg							<0.5			
Dibenz(a,h)anthracene	53-70-3	0.5	mg/kg							<0.5			
Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg							<0.5			
^ Sum of polycyclic aromatic hydrocarbons		0.5	mg/kg							<0.5			
^ Benzo(a)pyrene TEQ (zero)		0.5	mg/kg							<0.5			
^ Benzo(a)pyrene TEQ (half LOR)		0.5	mg/kg							0.6			
^ Benzo(a)pyrene TEQ (LOR)		0.5	mg/kg							1.2			
EP075i: Organochlorine Pesticides													
alpha-BHC	319-84-6	0.03	mg/kg							<0.03			
Hexachlorobenzene (HCB)	118-74-1	0.03	mg/kg							<0.03			
beta-BHC	319-85-7	0.03	mg/kg							<0.03			
gamma-BHC	58-89-9	0.03	mg/kg							<0.03			
delta-BHC	319-86-8	0.03	mg/kg							<0.03			
Heptachlor	76-44-8	0.03	mg/kg							<0.03			
Aldrin	309-00-2	0.03	mg/kg							<0.03			
Heptachlor epoxide	1024-57-3	0.03	mg/kg							<0.03			
cis-Chlordane	5103-71-9	0.03	mg/kg							<0.03			



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		Sampling date / time		D5 + D2		D7 + DB		INTRA DUPLICATE			
Compound	CAS Number	LOR	Unit	Result		Result		Result		Result			
EP075i: Organochlorine Pesticides - Continued													
trans-Chlordane	5103-74-2	0.03	mg/kg								<0.03		
Endosulfan 1	959-98-8	0.03	mg/kg								<0.03		
4,4'-DDE	72-55-9	0.05	mg/kg								<0.05		
Dieldrin	60-57-1	0.03	mg/kg								<0.03		
Endrin aldehyde	7421-93-4	0.03	mg/kg								<0.03		
Endrin	72-20-8	0.03	mg/kg								<0.03		
Endosulfan 2	33213-65-9	0.03	mg/kg								<0.03		
4,4'-DDD	72-54-8	0.05	mg/kg								<0.05		
Endosulfan sulfate	1031-07-8	0.03	mg/kg								<0.03		
4,4'-DDT	50-29-3	0.05	mg/kg								<0.05		
Methoxychlor	72-43-5	0.03	mg/kg								<0.03		
^ Sum of organochlorine pesticides		0.03	mg/kg								<0.03		
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.03	mg/kg								<0.03		
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg								<0.05		
^ Chlordane	57-74-9	0.03	mg/kg								<0.03		
^ Sum of other organochlorine pesticides		0.03	mg/kg								<0.03		
EP080/071: Total Petroleum Hydrocarbons													
C6 - C9 Fraction		10	mg/kg			<10					<10		
C6 - C9 Fraction		10	mg/kg								<10		
C10 - C14 Fraction		50	mg/kg			<50					<50		
C10 - C14 Fraction		50	mg/kg								<50		
C6 - C10 Fraction	C6_C10	10	mg/kg								<10		
C15 - C28 Fraction		100	mg/kg			600					260		
C15 - C28 Fraction		100	mg/kg								<100		
C29 - C36 Fraction		100	mg/kg			<100					<100		
C29 - C36 Fraction		100	mg/kg								<100		
^ C10 - C36 Fraction (sum)		50	mg/kg			600					260		
^ C10 - C36 Fraction (sum)		50	mg/kg								<50		
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions													
C6 - C10 Fraction	C6_C10	10	mg/kg			<10					<10		
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg			<10					<10		
>C10 - C16 Fraction		50	mg/kg								50		
>C10 - C16 Fraction		50	mg/kg								<50		

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Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID										
Compound	CAS Number	LOR	Sampling date / time		D5 + D2	D7 + DB	INTRA DUPLICATE					
			Unit									
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued												
>C16 - C34 Fraction		100	mg/kg		520	230						
>C16 - C34 Fraction		100	mg/kg				<100					
>C34 - C40 Fraction		100	mg/kg		<100							
>C34 - C40 Fraction		100	mg/kg				<100					
^ >C10 - C40 Fraction (sum)		50	mg/kg		630	280						
^ >C10 - C40 Fraction (sum)		50	mg/kg				<50					
^ >C10 - C16 Fraction minus Naphthalene (F2)		50	mg/kg		110	50						
>C10 - C16 Fraction minus Naphthalene (F2)		50	mg/kg				<50					
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg				<10					
EP080: BTEXN												
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2						
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5						
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5						
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5						
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5						
^ Sum of BTEX		0.2	mg/kg		<0.2	<0.2						
^ Total Xylenes		0.5	mg/kg		<0.5	<0.5						
Naphthalene	91-20-3	1	mg/kg		<1	<1						
EP066S: PCB Surrogate												
Decachlorobiphenyl	2051-24-3	0.1	%				88.4					
EP074S: VOC Surrogates (Ultra-Trace)												
1,2-Dichloroethane-D4	17060-07-0	0.1	%				96.8					
Toluene-D8	2037-26-5	0.1	%				90.3					
4-Bromofluorobenzene	460-00-4	0.1	%				96.6					
EP075(SIM)S: Phenolic Compound Surrogates												
Phenol-d6	13127-88-3	0.5	%		92.3							
2-Chlorophenol-D4	93951-73-6	0.5	%		92.2							
2,4,6-Tribromophenol	118-79-6	0.5	%		77.1							
EP075(SIM)T: PAH Surrogates												
2-Fluorobiphenyl	321-60-8	0.5	%		101							
Anthracene-d10	1719-06-8	0.5	%		97.2							



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		Sampling date / time		D5 + D2		D7 + DB		INTRA DUPLICATE			
Compound	CAS Number	LOR	Unit			Result		Result		Result			
EP075(SIM)T: PAH Surrogates - Continued													
4-Terphenyl-d14	1718-51-0	0.5	%			81.5							
EP075S: Acid Extractable Surrogates (Waste Classification)													
Phenol-d6	13127-88-3	0.025	%							87.1			
2-Chlorophenol-D4	93951-73-6	0.025	%							78.0			
2,4,6-Tribromophenol	118-79-6	0.025	%							84.2			
EP075T: Base/Neutral Extractable Surrogates (Waste Classification)													
Nitrobenzene-D5	4165-60-0	0.025	%							81.4			
1,2-Dichlorobenzene-D4	2199-69-1	0.025	%							77.0			
2-Fluorobiphenyl	321-60-8	0.025	%							84.3			
Anthracene-d10	1719-06-8	0.025	%							87.4			
4-Terphenyl-d14	1718-51-0	0.025	%							89.6			
EP080S: TPH(V)/BTEX Surrogates													
1,2-Dichloroethane-D4	17060-07-0	0.2	%			116		110					
Toluene-D8	2037-26-5	0.2	%			101		100					
4-Bromofluorobenzene	460-00-4	0.2	%			103		101					



Surrogate Control Limits

Sub-Matrix: SOIL			Recovery Limits (%)	
Compound	CAS Number	Low	High	
EP066S: PCB Surrogate				
Decachlorobiphenyl	2051-24-3	41	122	
EP074S: VOC Surrogates (Ultra-Trace)				
1,2-Dichloroethane-D4	17060-07-0	59	119	
Toluene-D8	2037-26-5	55	117	
4-Bromofluorobenzene	460-00-4	59	123	
EP075(SIM)S: Phenolic Compound Surrogates				
Phenol-d6	13127-88-3	63	123	
2-Chlorophenol-D4	93951-73-6	66	122	
2,4,6-Tribromophenol	118-79-6	40	138	
EP075(SIM)T: PAH Surrogates				
2-Fluorobiphenyl	321-60-8	70	122	
Anthracene-d10	1719-06-8	66	128	
4-Terphenyl-d14	1718-51-0	65	129	
EP075S: Acid Extractable Surrogates (Waste Classification)				
Phenol-d6	13127-88-3	63	134	
2-Chlorophenol-D4	93951-73-6	60	125	
2,4,6-Tribromophenol	118-79-6	54	129	
EP075T: Base/Neutral Extractable Surrogates (Waste Classification)				
Nitrobenzene-D5	4165-60-0	63	131	
1,2-Dichlorobenzene-D4	2199-69-1	61	124	
2-Fluorobiphenyl	321-60-8	69	131	
Anthracene-d10	1719-06-8	70	133	
4-Terphenyl-d14	1718-51-0	59	141	
EP080S: TPH(V)/BTEX Surrogates				
1,2-Dichloroethane-D4	17060-07-0	73	133	
Toluene-D8	2037-26-5	74	132	
4-Bromofluorobenzene	460-00-4	72	130	



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Work Order : ES2132828
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Soil Testing

Inter-Laboratory Testing

Analysis conducted by ALS Melbourne, NATA accreditation no. 825, site no. 13778 (Chemistry).

- (SOIL) EP074A: Monocyclic Aromatic Hydrocarbons
- (SOIL) EP074H: Naphthalene
- (SOIL) EP074S: VOC Surrogates (Ultra-Trace)
- (SOIL) EG048: Hexavalent Chromium (Alkaline Digest)
- (SOIL) EK026SF: Total CN by Segmented Flow Analyser
- (SOIL) EK040T: Fluoride Total
- (SOIL) EP066: Polychlorinated Biphenyls (PCB)
- (SOIL) EP066S: PCB Surrogate
- (SOIL) EP074I: Volatile Halogenated Compounds
- (SOIL) EP075B: Polynuclear Aromatic Hydrocarbons
- (SOIL) EP075I: Organochlorine Pesticides
- (SOIL) EP075A: Phenolic Compounds (Non-halogenated)
- (SOIL) EP075A: Phenolic Compounds (Halogenated)
- (SOIL) EP075T: Base/Neutral Extractable Surrogates (Waste Classification)
- (SOIL) EP075S: Acid Extractable Surrogates (Waste Classification)
- (SOIL) EA001: pH in soil using 0.01M CaCl extract

Analysis conducted by ALS Melbourne, NATA accreditation no. 825, site no. 13778 (Chemistry). Only applies to samples ES2132828 (001, 006, 013).

- (SOIL) EP080/071: Total Petroleum Hydrocarbons
- (SOIL) EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions
- (SOIL) EA055: Moisture Content (Dried @ 105-110°C)
- (SOIL) EG005(ED093)T: Total Metals by ICP-AES
- (SOIL) EG035T: Total Recoverable Mercury by FIMS



QUALITY CONTROL REPORT

Work Order : **ES2132828**

Page : 1 of 16

Client : **LOW ECOLOGICAL SERVICES**

Contact : **MR BILL LOW**

Address : **PO BOX 3130**

ALICE SPRINGS NT, AUSTRALIA 0871

Telephone : **+61 08 89 555 222**

Project : **Glen Helen - Soil Testing**

Order number : **----**

C-O-C number : **----**

Sampler : **----**

Site : **----**

Quote number : **EN/333**

No. of samples received : **13**

No. of samples analysed : **13**

Laboratory

Contact

Address

Telephone

Date Samples Received

Date Analysis Commenced

Issue Date

: Environmental Division Sydney

: Customer Services ES

: 277-289 Woodpark Road Smithfield NSW Australia 2164

: +61-2-8784 8555

: 10-Sep-2021

: 15-Sep-2021

: 21-Sep-2021



Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Jarvis Nheu	Non-Metals Team Leader	Melbourne Inorganics, Springvale, VIC
Sanjeshni Jyoti	Senior Chemist Volatiles	Sydney Inorganics, Smithfield, NSW
Xing Lin	Senior Organic Chemist	Melbourne Inorganics, Springvale, VIC



Page : 2 of 16
Work Order : ES2132828
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Soil Testing

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot

CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

RPD = Relative Percentage Difference

= Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: SOIL

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 3907153)									
EM2118447-012	Anonymous	EG005T: Chromium	7440-47-3	2	mg/kg	130	116	11.2	0% - 20%
		EG005T: Nickel	7440-02-0	2	mg/kg	40	45	13.1	0% - 20%
EM2118447-012	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	8	6	20.1	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	28	33	17.7	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	18	10	55.5	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Tin	7440-31-5	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	18	22	18.8	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
EM2118453-008	Anonymous	EG005T: Chromium	7440-47-3	2	mg/kg	37	38	0.0	0% - 50%
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	11	11	0.0	No Limit
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	6	5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	12	12	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	15	13	12.4	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Tin	7440-31-5	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	13	11	18.2	No Limit
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 3907176)									
ES2132249-001	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit



Sub-Matrix: SOIL									
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOI	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 3907476) - continued									
ES2132249-001	Anonymous	EG005T: Chromium	7440-47-3	2	mg/kg	36	34	5.5	0% - 50%
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	13	9	34.1	No Limit
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	17	16	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	111	127	13.5	0% - 20%
		EG005T: Lead	7439-92-1	5	mg/kg	199	172	14.4	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Tin	7440-31-5	5	mg/kg	10	13	26.9	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	399	346	14.4	0% - 20%
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	32	32	0.0	0% - 50%
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	2	<2	0.0	No Limit
ES2132573-007	Anonymous	EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	11	77.3	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	11	14	21.5	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	14	22	42.3	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Tin	7440-31-5	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	16	18	8.5	No Limit
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	10	10	0.0	No Limit
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	31	12	90.6	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	12	12	0.0	No Limit
ES2132828-010	B2 + B6	EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Tin	7440-31-5	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	26	29	10.9	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	34	25	31.4	0% - 50%
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	19	21	10.3	0% - 50%
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	9	8	11.9	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	23	24	4.7	Page 338 of 667Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	16	18	8.5	No Limit
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	10	10	0.0	No Limit
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 3907477)	B2 + B6	EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	31	12	90.6	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	12	12	0.0	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Tin	7440-31-5	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	26	29	10.9	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	34	25	31.4	0% - 50%
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	19	21	10.3	0% - 50%
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	9	8	11.9	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	23	24	4.7	Page 338 of 667Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	34	25	31.4	0% - 50%
ES2133127-005	Anonymous	EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	19	21	10.3	0% - 50%
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	9	8	11.9	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	23	24	4.7	Page 338 of 667Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	34	25	31.4	0% - 50%
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	19	21	10.3	0% - 50%
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	9	8	11.9	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	23	24	4.7	Page 338 of 667Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	34	25	31.4	0% - 50%
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.0	No Limit



Sub-Matrix: SOIL			Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 3907177) - continued									
ES2133127-005	Anonymous	EG005T: Lead	7439-92-1	5	mg/kg	15	13	10.0	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Tin	7440-31-5	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	50	52	3.4	0% - 50%
EA001: pH in soil using 0.01M CaCl extract (QC Lot: 3906671)									
ES2132828-001	P5 (6+10)	EA001: pH (CaCl2)	----	0.1	pH Unit	7.9	7.9	0.0	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3907180)									
ES2132573-006	Anonymous	EA055: Moisture Content	----	0.1	%	22.3	21.5	3.4	0% - 20%
ES2132828-011	D5 + D2	EA055: Moisture Content	----	0.1	%	4.5	4.6	0.0	No Limit
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3907602)									
EM2118532-019	Anonymous	EA055: Moisture Content	----	0.1	%	32.5	31.6	2.9	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3907154)									
EM2118447-012	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EM2118453-008	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3907175)									
ES2132249-001	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	1.8	2.1	18.0	0% - 20%
ES2132573-007	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3907178)									
ES2132828-010	B2 + B6	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
ES2133127-005	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EG048: Hexavalent Chromium (Alkaline Digest) (QC Lot: 3907555)									
EM2118432-012	Anonymous	EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EM2118444-024	Anonymous	EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 3908667)									
EM2118453-009	Anonymous	EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	<1	0.0	No Limit
EK040T: Fluoride Total (QC Lot: 3907107)									
EM2118432-004	Anonymous	EK040T: Fluoride	16984-48-8	40	mg/kg	420	410	0.0	0% - 50%
EM2118432-018	Anonymous	EK040T: Fluoride	16984-48-8	40	mg/kg	440	440	0.0	0% - 50%
EP066: Polychlorinated Biphenyls (PCB) (QC Lot: 3907092)									
EM2118397-005	Anonymous	EP066-EM: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP074A: Monocyclic Aromatic Hydrocarbons (QC Lot: 3906559)									
ES2132828-001	P5 (6+10)	EP074-UT: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP074-UT: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074-UT: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074-UT: meta- & para-Xylene	108-38-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
			106-42-3						
		EP074-UT: Styrene	100-42-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074-UT: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit



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Work Order : ES2132828
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Soil Testing

Sub-Matrix: SOIL		Laboratory Duplicate (DUP) Report									
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)		
EP074H: Naphthalene (QC Lot: 3906559)											
ES2132828-001	P5 (6+10)	EP074-UT: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit		
EP074I: Volatile Halogenated Compounds (QC Lot: 3906559)											
ES2132828-001	P5 (6+10)	EP074-UT: 1,1-Dichloroethene	75-35-4	0.01	mg/kg	<0.01	<0.01	0.0	No Limit		
		EP074-UT: cis-1,2-Dichloroethene	156-59-2	0.01	mg/kg	<0.01	<0.01	0.0	No Limit		
		EP074-UT: 1,1,1-Trichloroethane	71-55-6	0.01	mg/kg	<0.01	<0.01	0.0	No Limit		
		EP074-UT: Carbon Tetrachloride	56-23-5	0.01	mg/kg	<0.01	<0.01	0.0	No Limit		
		EP074-UT: 1,1,1,2-Tetrachloroethane	630-20-6	0.01	mg/kg	<0.01	<0.01	0.0	No Limit		
		EP074-UT: 1,2,4-Trichlorobenzene	120-82-1	0.01	mg/kg	<0.01	<0.01	0.0	No Limit		
		EP074-UT: Vinyl chloride	75-01-4	0.02	mg/kg	<0.02	<0.02	0.0	No Limit		
		EP074-UT: trans-1,2-Dichloroethene	156-60-5	0.02	mg/kg	<0.02	<0.02	0.0	No Limit		
		EP074-UT: Chloroform	67-66-3	0.02	mg/kg	<0.02	<0.02	0.0	No Limit		
		EP074-UT: 1,2-Dichloroethane	107-06-2	0.02	mg/kg	<0.02	<0.02	0.0	No Limit		
		EP074-UT: Trichloroethene	79-01-6	0.02	mg/kg	<0.02	<0.02	0.0	No Limit		
		EP074-UT: Tetrachloroethene	127-18-4	0.02	mg/kg	<0.02	<0.02	0.0	No Limit		
		EP074-UT: 1,1,2,2-Tetrachloroethane	79-34-5	0.02	mg/kg	<0.02	<0.02	0.0	No Limit		
		EP074-UT: Hexachlorobutadiene	87-68-3	0.02	mg/kg	<0.02	<0.02	0.0	No Limit		
		EP074-UT: Chlorobenzene	108-90-7	0.02	mg/kg	<0.02	<0.02	0.0	No Limit		
		EP074-UT: 1,4-Dichlorobenzene	106-46-7	0.02	mg/kg	<0.02	<0.02	0.0	No Limit		
		EP074-UT: 1,2-Dichlorobenzene	95-50-1	0.02	mg/kg	<0.02	<0.02	0.0	No Limit		
		EP074-UT: 1,1,2-Trichloroethane	79-00-5	0.04	mg/kg	<0.04	<0.04	0.0	No Limit		
		EP074-UT: Methylene chloride	75-09-2	0.4	mg/kg	<0.4	<0.4	0.0	No Limit		
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3902925)											
ES2132952-004	Anonymous	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit		
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit		
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit		
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit		
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit		
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit		
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit		
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit		
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit		
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit		
		EP075(SIM): Benzo(b+)fluoranthene	205-99-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit		
			205-82-3								
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit		
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit		
		EP075(SIM): Indeno(1,2,3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit		
		EP075(SIM): Dibenzo(a,h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit		
		EP075(SIM): Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit		



Sub-Matrix: SOIL		Laboratory Duplicate (DUP) Report							
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3902925) - continued									
ES2132952-004	Anonymous	EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075A: Phenolic Compounds (Halogenated) (QC Lot: 3907090)									
EM2118397-005	Anonymous	EP075-EM: 2-Chlorophenol	95-57-8	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: 2,4-Dichlorophenol	120-83-2	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: 2,6-Dichlorophenol	87-65-0	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: 4-Chloro-3-methylphenol	59-50-7	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: 2,3,5,6-Tetrachlorophenol	935-95-5	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: 2,4,5-Trichlorophenol	95-95-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP075-EM: 2,4,6-Trichlorophenol	88-06-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP075-EM: 2,3,4,5 & 2,3,4,6-Tetrachlorophenol	4901-51-3/58-9 0-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP075-EM: Pentachlorophenol	87-86-5	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP075A: Phenolic Compounds (Non-halogenated) (QC Lot: 3907090)							
EM2118397-005	Anonymous	EP075-EM: Phenol	108-95-2	1	mg/kg	<1	<1	0.0	No Limit
		EP075-EM: 2-Methylphenol	95-48-7	1	mg/kg	<1	<1	0.0	No Limit
		EP075-EM: 3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	<1	0.0	No Limit
		EP075-EM: 2-Nitrophenol	88-75-5	1	mg/kg	<1	<1	0.0	No Limit
		EP075-EM: 2,4-Dimethylphenol	105-67-9	1	mg/kg	<1	<1	0.0	No Limit
		EP075-EM: 2,4-Dinitrophenol	51-28-5	5	mg/kg	<5	<5	0.0	No Limit
		EP075-EM: 4-Nitrophenol	100-02-7	5	mg/kg	<5	<5	0.0	No Limit
		EP075-EM: 2-Methyl-4,6-dinitrophenol	8071-51-0	5	mg/kg	<5	<5	0.0	No Limit
		EP075-EM: Dinoseb	88-85-7	5	mg/kg	<5	<5	0.0	No Limit
		EP075-EM: 2-Cyclohexyl-4,6-Dinitrophenol	131-89-5	5	mg/kg	<5	<5	0.0	No Limit
EP075B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3907090)									
EM2118397-005	Anonymous	EP075-EM: Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075-EM: Benzo(a)pyrene									
EP075-EM: Indeno(1,2,3.cd)pyrene									
EP075-EM: Dibenzo(a,h)anthracene									
EP075-EM: Benzo(g,h,i)perylene									

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Sub-Matrix: SOIL			Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP075B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3907090) - continued									
EM2118397-005	Anonymous	EP075-EM: Benzo(b+i) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg	<1.0	<1.0	0.0	No Limit
EP075I: Organochlorine Pesticides (QC Lot: 3907090)									
EM2118397-005	Anonymous	EP075-EM: alpha-BHC	319-84-6	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Hexachlorobenzene (HCB)	118-74-1	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: beta-BHC	319-85-7	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: gamma-BHC	58-89-9	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: delta-BHC	319-86-8	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Heptachlor	76-44-8	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Aldrin	309-00-2	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Heptachlor epoxide	1024-57-3	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: cis-Chlordane	5103-71-9	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: trans-Chlordane	5103-74-2	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Endosulfan 1	959-98-8	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Dieldrin	60-57-1	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Endrin aldehyde	7421-93-4	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Endrin	72-20-8	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Endosulfan 2	33213-65-9	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Endosulfan sulfate	1031-07-8	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Methoxychlor	72-43-5	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: 4,4'-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
EP075-EM: 4,4'-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit		
EP075-EM: 4,4'-DDT	50-29-3	0.05	mg/kg	<0.05	<0.05	0.0	No Limit		
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3902293)									
ES2132828-002	P5 (2+7)	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
ES2133034-001	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3902924)									
ES2132828-002	P5 (2+7)	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
ES2132952-004	Anonymous	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3906559)									
ES2132828-001	P5 (6+10)	EP074-UT: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3907091)									
EM2118397-005	Anonymous	EP071-EM: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071-EM: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071-EM: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID		Sample ID	Method: Compound	CAS Number	LOR	Unit	Laboratory Duplicate (DUP) Report			
							Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP080/074: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3902293)										
ES2132828-002		P5 (2+7)	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
ES2133034-001		Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP080/074: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3902924)										
ES2132828-002		P5 (2+7)	EP071: >C16 - C34 Fraction	---	100	mg/kg	<100	<100	0.0	No Limit
			EP071: >C34 - C40 Fraction	---	100	mg/kg	<100	<100	0.0	No Limit
			EP071: >C10 - C16 Fraction	---	50	mg/kg	<50	<50	0.0	No Limit
ES2132952-004		Anonymous	EP071: >C16 - C34 Fraction	---	100	mg/kg	<100	<100	0.0	No Limit
			EP071: >C34 - C40 Fraction	---	100	mg/kg	<100	<100	0.0	No Limit
			EP071: >C10 - C16 Fraction	---	50	mg/kg	<50	<50	0.0	No Limit
EP080/074: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3906559)										
ES2132828-001		P5 (6+10)	EP074-UT: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
			EP074-UT: C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	<10	0.0	No Limit
EP080/074: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3907091)										
EM2118397-005		Anonymous	EP071-EM: >C16 - C34 Fraction	---	100	mg/kg	<100	<100	0.0	No Limit
			EP071-EM: >C34 - C40 Fraction	---	100	mg/kg	<100	<100	0.0	No Limit
			EP071-EM: >C10 - C16 Fraction	---	50	mg/kg	<50	<50	0.0	No Limit
EP080: BTEXN (QC Lot: 3902293)										
ES2132828-002		P5 (2+7)	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
			EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
			EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
			EP080: meta- & para-Xylene	108-38-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
				106-42-3						
			EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
			EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
			EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
			EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
			EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
			EP080: meta- & para-Xylene	108-38-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
				106-42-3						
ES2133034-001		Anonymous	EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
			EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit



Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: SOIL

Sub-Matrix: SOIL		Method: Compound				Laboratory Control Spike (LCS) Report				
						Method Blank (MB) Report		Spike Recovery (%)		Acceptable Limits (%)
Method: Compound		CAS Number	LOR	Unit	Result	Concentration	Spike	LCS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3907153)										
EG005T: Arsenic		7440-38-2	5	mg/kg	<5	123 mg/kg		102	70.0	130
EG005T: Cadmium		7440-43-9	1	mg/kg	<1	1.23 mg/kg		59.7	50.0	130
EG005T: Chromium		7440-47-3	2	mg/kg	<2	20.2 mg/kg		97.8	70.0	130
EG005T: Copper		7440-50-8	5	mg/kg	<5	55.9 mg/kg		92.6	70.0	130
EG005T: Lead		7439-92-1	5	mg/kg	<5	62.4 mg/kg		92.1	70.0	130
EG005T: Molybdenum		7439-98-7	2	mg/kg	<2	2.19 mg/kg		76.4	70.0	130
EG005T: Nickel		7440-02-0	2	mg/kg	<2	15.4 mg/kg		93.1	70.0	130
EG005T: Selenium		7782-49-2	5	mg/kg	<5	-----		-----	-----	-----
EG005T: Silver		7440-22-4	2	mg/kg	<2	2.9 mg/kg		89.3	70.0	130
EG005T: Tin		7440-31-5	5	mg/kg	<5	5.33 mg/kg		86.8	70.0	130
EG005T: Zinc		7440-66-6	5	mg/kg	<5	162 mg/kg		77.9	70.0	130
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3907176)										
EG005T: Arsenic		7440-38-2	5	mg/kg	<5	121.1 mg/kg		94.1	88.0	113
EG005T: Cadmium		7440-43-9	1	mg/kg	<1	0.74 mg/kg		83.5	70.0	130
EG005T: Chromium		7440-47-3	2	mg/kg	<2	19.6 mg/kg		111	68.0	132
EG005T: Copper		7440-50-8	5	mg/kg	<5	52.9 mg/kg		106	89.0	111
EG005T: Lead		7439-92-1	5	mg/kg	<5	60.8 mg/kg		84.0	82.0	119
EG005T: Molybdenum		7439-98-7	2	mg/kg	<2	2.3 mg/kg		87.6	77.0	119
EG005T: Nickel		7440-02-0	2	mg/kg	<2	15.3 mg/kg		98.7	80.0	120
EG005T: Selenium		7782-49-2	5	mg/kg	<5	-----		-----	-----	-----
EG005T: Silver		7440-22-4	2	mg/kg	<2	2.3 mg/kg		128	42.0	158
EG005T: Tin		7440-31-5	5	mg/kg	<5	-----		-----	-----	-----
EG005T: Zinc		7440-66-6	5	mg/kg	<5	139.3 mg/kg		89.5	66.0	133
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3907177)										
EG005T: Arsenic		7440-38-2	5	mg/kg	<5	121.1 mg/kg		94.7	88.0	113
EG005T: Cadmium		7440-43-9	1	mg/kg	<1	0.74 mg/kg		79.5	70.0	130
EG005T: Chromium		7440-47-3	2	mg/kg	<2	19.6 mg/kg		105	68.0	132
EG005T: Copper		7440-50-8	5	mg/kg	<5	52.9 mg/kg		104	89.0	111
EG005T: Lead		7439-92-1	5	mg/kg	<5	60.8 mg/kg		83.6	82.0	119
EG005T: Molybdenum		7439-98-7	2	mg/kg	<2	2.3 mg/kg		93.9	77.0	119
EG005T: Nickel		7440-02-0	2	mg/kg	<2	15.3 mg/kg		95.0	80.0	120
EG005T: Selenium		7782-49-2	5	mg/kg	<5	-----		-----	-----	-----
EG005T: Silver		7440-22-4	2	mg/kg	<2	2.3 mg/kg		120	42.0	158
EG005T: Tin		7440-31-5	5	mg/kg	<5	-----		-----	-----	-----

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Sub-Matrix: SOIL				Method Blank (MB) Report		Laboratory Control Spike (LCS) Report			
Method: Compound	CAS Number	LOR	Unit	Result	Spike Concentration	Spike Recovery (%)	Acceptable Limits (%)	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3907177) - continued									
EG005T: Zinc	7440-66-6	5	mg/kg	<5	139.3 mg/kg	86.4	66.0	133	
EA001: pH in soil using 0.01M CaCl ₂ extract (QCLot: 3906671)									
EA001: pH (CaCl ₂)	-----	-----	pH Unit	----	4 pH Unit	101	98.8	101	
				----	7 pH Unit	101	99.3	101	
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3907154)									
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	0.64 mg/kg	92.2	70.0	130	
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3907175)									
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	0.087 mg/kg	92.5	70.0	125	
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3907178)									
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	0.087 mg/kg	89.3	70.0	125	
EG048: Hexavalent Chromium (Alkaline Digest) (QCLot: 3907555)									
EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	20 mg/kg	79.4	70.0	130	
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 3908667)									
EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	20 mg/kg	111	70.0	130	
EK040T: Fluoride Total (QCLot: 3907107)									
EK040T: Fluoride	16984-48-8	40	mg/kg	<40	400 mg/kg	96.5	75.2	110	
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 3907092)									
EP066-EM: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	1 mg/kg	92.2	67.4	136	
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 3906559)									
EP074-UT: Benzene	71-43-2	0.2	mg/kg	<0.2	2.1 mg/kg	102	69.2	116	
EP074-UT: Toluene	108-88-3	0.5	mg/kg	<0.5	2.1 mg/kg	98.8	67.7	116	
EP074-UT: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	2.1 mg/kg	90.4	66.6	115	
EP074-UT: meta- & para-Xylene	108-38-3	0.5	mg/kg	<0.5	4.2 mg/kg	88.1	65.2	112	
	106-42-3								
EP074-UT: Styrene	100-42-5	0.5	mg/kg	<0.5	2.1 mg/kg	90.6	69.4	111	
EP074-UT: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	2.1 mg/kg	88.1	68.4	110	
EP074H: Naphthalene (QCLot: 3906559)									
EP074-UT: Naphthalene	91-20-3	1	mg/kg	<1	0.6 mg/kg	106	72.3	114	
EP074I: Volatile Halogenated Compounds (QCLot: 3906559)									
EP074-UT: Vinyl chloride	75-01-4	0.02	mg/kg	<0.02	0.1 mg/kg	81.4	47.0	138	
EP074-UT: 1,1-Dichloroethene	75-35-4	0.01	mg/kg	<0.01	0.1 mg/kg	93.0	57.6	125	
EP074-UT: Methylene chloride	75-09-2	0.4	mg/kg	<0.4	2.1 mg/kg	95.5	72.3	115	
EP074-UT: trans-1,2-Dichloroethene	156-60-5	0.02	mg/kg	<0.02	0.1 mg/kg	98.4	60.5	122	
EP074-UT: cis-1,2-Dichloroethene	156-59-2	0.01	mg/kg	<0.01	0.1 mg/kg	98.4	70.3	112	
EP074-UT: Chloroform	67-66-3	0.02	mg/kg	<0.02	0.1 mg/kg	94.8	66.6	115	
EP074-UT: 1,1,1-Trichloroethane	71-55-6	0.01	mg/kg	<0.01	0.1 mg/kg	93.6	64.4	122	
EP074-UT: Carbon Tetrachloride	56-23-5	0.01	mg/kg	<0.01	0.1 mg/kg	91.0	34.5 of 657	127	

Sub-Matrix: SOIL		Laboratory Control Spike (LCS) Report											
Method: Compound		CAS Number		LOR	Unit	Method Blank (MB) Report		Spike		Spike Recovery (%)		Acceptable Limits (%)	
						Result	Concentration	LCS	Low	High			
EP0741: Volatile Halogenated Compounds (QCLot: 3906559) - continued													
EP074-UT: 1,2-Dichloroethane		107-06-2		0.02	mg/kg	<0.02	0.1 mg/kg	99.8		72.9		114	
EP074-UT: Trichloroethene		79-01-6		0.02	mg/kg	<0.02	0.1 mg/kg	99.6		64.7		115	
EP074-UT: 1,1,2-Trichloroethane		79-00-5		0.04	mg/kg	<0.04	0.1 mg/kg	110		72.6		116	
EP074-UT: Tetrachloroethene		127-18-4		0.02	mg/kg	<0.02	0.1 mg/kg	96.1		60.0		119	
EP074-UT: 1,1,1,2-Tetrachloroethane		630-20-6		0.01	mg/kg	<0.01	0.1 mg/kg	99.2		71.8		116	
EP074-UT: 1,1,2,2-Tetrachloroethane		79-34-5		0.02	mg/kg	<0.02	0.1 mg/kg	96.6		66.1		116	
EP074-UT: Hexachlorobutadiene		87-68-3		0.02	mg/kg	<0.02	0.1 mg/kg	81.4		39.8		128	
EP074-UT: Chlorobenzene		108-90-7		0.02	mg/kg	<0.02	0.1 mg/kg	97.0		70.3		113	
EP074-UT: 1,4-Dichlorobenzene		106-46-7		0.02	mg/kg	<0.02	0.1 mg/kg	95.4		62.6		113	
EP074-UT: 1,2-Dichlorobenzene		95-50-1		0.02	mg/kg	<0.02	0.1 mg/kg	97.4		70.8		110	
EP074-UT: 1,2,4-Trichlorobenzene		120-82-1		0.01	mg/kg	<0.01	0.1 mg/kg	89.0		48.4		120	
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3902925)													
EP075(SIM): Naphthalene		91-20-3		0.5	mg/kg	<0.5	6 mg/kg	116		77.0		125	
EP075(SIM): Acenaphthylene		208-96-8		0.5	mg/kg	<0.5	6 mg/kg	108		72.0		124	
EP075(SIM): Acenaphthene		83-32-9		0.5	mg/kg	<0.5	6 mg/kg	119		73.0		127	
EP075(SIM): Fluorene		86-73-7		0.5	mg/kg	<0.5	6 mg/kg	116		72.0		126	
EP075(SIM): Phenanthrene		85-01-8		0.5	mg/kg	<0.5	6 mg/kg	105		75.0		127	
EP075(SIM): Anthracene		120-12-7		0.5	mg/kg	<0.5	6 mg/kg	109		77.0		127	
EP075(SIM): Fluoranthene		206-44-0		0.5	mg/kg	<0.5	6 mg/kg	106		73.0		127	
EP075(SIM): Pyrene		129-00-0		0.5	mg/kg	<0.5	6 mg/kg	108		74.0		128	
EP075(SIM): Benz(a)anthracene		56-55-3		0.5	mg/kg	<0.5	6 mg/kg	84.0		69.0		123	
EP075(SIM): Chrysene		218-01-9		0.5	mg/kg	<0.5	6 mg/kg	99.6		75.0		127	
EP075(SIM): Benzo(b+)fluoranthene		205-99-2		0.5	mg/kg	<0.5	6 mg/kg	87.9		68.0		116	
		205-82-3											
EP075(SIM): Benzo(k)fluoranthene		207-08-9		0.5	mg/kg	<0.5	6 mg/kg	95.6		74.0		126	
EP075(SIM): Benzo(a)pyrene		50-32-8		0.5	mg/kg	<0.5	6 mg/kg	103		70.0		126	
EP075(SIM): Indeno(1,2,3-cd)pyrene		193-39-5		0.5	mg/kg	<0.5	6 mg/kg	92.9		61.0		121	
EP075(SIM): Dibenzo(a,h)anthracene		53-70-3		0.5	mg/kg	<0.5	6 mg/kg	99.5		62.0		118	
EP075(SIM): Benzo(g,h,i)perylene		191-24-2		0.5	mg/kg	<0.5	6 mg/kg	84.9		63.0		121	
EP075A: Phenolic Compounds (Halogenated) (QCLot: 3907090)													
EP075-EM: 2-Chlorophenol		95-57-8		0.03	mg/kg	<0.03	2 mg/kg	94.7		74.5		126	
EP075-EM: 2,4-Dichlorophenol		120-83-2		0.03	mg/kg	<0.03	2 mg/kg	93.4		72.7		126	
EP075-EM: 2,6-Dichlorophenol		87-65-0		0.03	mg/kg	<0.03	2 mg/kg	93.8		73.5		132	
EP075-EM: 4-Chloro-3-methylphenol		59-50-7		0.03	mg/kg	<0.03	2 mg/kg	94.4		72.8		128	
EP075-EM: 2,4,5-Trichlorophenol		95-95-4		0.05	mg/kg	<0.05	2 mg/kg	96.5		73.3		134	
EP075-EM: 2,4,6-Trichlorophenol		88-06-2		0.05	mg/kg	<0.05	2 mg/kg	95.4		72.4		128	
EP075-EM: 2,3,5,6-Tetrachlorophenol		935-95-5		0.03	mg/kg	<0.03	2 mg/kg	89.4		69.4		126	
EP075-EM: 2,3,4,5 & 2,3,4,6-Tetrachlorophenol		4901-51-3/5		0.05	mg/kg	<0.05	4 mg/kg	95.0		71.9		128	
		8-90-2											Page 346 of 657



Sub-Matrix: SOIL				Method Blank (MB) Report		Laboratory Control Spike (LCS) Report			
Method: Compound	CAS Number	LOR	Unit	Result	Spike Concentration	Spike Recovery (%)	Acceptable Limits (%)	Low	High
EP075A: Phenolic Compounds (Halogenated) (QCLot: 3907090) - continued									
EP075-EM: Pentachlorophenol	87-86-5	0.2	mg/kg	<0.2	4 mg/kg	90.6	54.4	135	
EP075A: Phenolic Compounds (Non-halogenated) (QCLot: 3907090)									
EP075-EM: Phenol	108-95-2	1	mg/kg	<1	2 mg/kg	96.0	71.5	130	
EP075-EM: 2-Methylphenol	95-48-7	1	mg/kg	<1	2 mg/kg	92.9	73.4	129	
EP075-EM: 3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	4 mg/kg	92.9	74.3	129	
EP075-EM: 2-Nitrophenol	88-75-5	1	mg/kg	<1	2 mg/kg	92.5	70.9	133	
EP075-EM: 2,4-Dimethylphenol	105-67-9	1	mg/kg	<1	2 mg/kg	95.0	71.8	132	
EP075-EM: 2,4-Dinitrophenol	51-28-5	5	mg/kg	<5	10 mg/kg	107	41.0	156	
EP075-EM: 4-Nitrophenol	100-02-7	5	mg/kg	<5	10 mg/kg	97.2	65.3	134	
EP075-EM: 2-Methyl-4,6-dinitrophenol	8071-51-0	5	mg/kg	<5	10 mg/kg	98.0	43.6	128	
EP075-EM: Dinoseb	88-85-7	5	mg/kg	<5	10 mg/kg	93.7	62.0	128	
EP075-EM: 2-Cyclohexyl-4,6-Dinitrophenol	131-89-5	5	mg/kg	<5	10 mg/kg	87.1	34.5	137	
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 3907090)									
EP075-EM: Naphthalene	91-20-3	0.5	mg/kg	<0.5	2 mg/kg	94.2	73.0	131	
EP075-EM: Acenaphthene	83-32-9	0.5	mg/kg	<0.5	2 mg/kg	98.7	76.3	130	
EP075-EM: Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	2 mg/kg	99.4	72.0	135	
EP075-EM: Fluorene	86-73-7	0.5	mg/kg	<0.5	2 mg/kg	95.6	74.4	131	
EP075-EM: Phenanthrene	85-01-8	0.5	mg/kg	<0.5	2 mg/kg	96.9	73.3	130	
EP075-EM: Anthracene	120-12-7	0.5	mg/kg	<0.5	2 mg/kg	96.1	78.4	127	
EP075-EM: Fluoranthene	206-44-0	0.5	mg/kg	<0.5	2 mg/kg	97.2	75.3	132	
EP075-EM: Pyrene	129-00-0	0.5	mg/kg	<0.5	2 mg/kg	99.0	75.4	130	
EP075-EM: Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	2 mg/kg	95.4	69.6	133	
EP075-EM: Chrysene	218-01-9	0.5	mg/kg	<0.5	2 mg/kg	98.8	75.0	133	
EP075-EM: Benzo(b+) & Benzo(k)fluoranthene	205-99-2	1	mg/kg	<1.0	4 mg/kg	102	75.8	133	
EP075-EM: Benzo(a)pyrene	207-08-9								
EP075-EM: Indeno(1,2,3-cd)pyrene	50-32-8	0.5	mg/kg	<0.5	2 mg/kg	114	65.1	130	
EP075-EM: Dibenz(a,h)anthracene	193-39-5	0.5	mg/kg	<0.5	2 mg/kg	97.3	72.1	134	
EP075-EM: Benzo(g,h,i)perylene	53-70-3	0.5	mg/kg	<0.5	2 mg/kg	101	72.9	135	
EP075-EM: Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg	<0.5	2 mg/kg	101	71.3	134	
EP075I: Organochlorine Pesticides (QCLot: 3907090)									
EP075-EM: alpha-BHC	319-84-6	0.03	mg/kg	<0.03	2 mg/kg	96.6	71.0	129	
EP075-EM: Hexachlorobenzene (HCB)	118-74-1	0.03	mg/kg	<0.03	2 mg/kg	97.2	74.8	126	
EP075-EM: beta-BHC	319-85-7	0.03	mg/kg	<0.03	2 mg/kg	97.9	75.7	130	
EP075-EM: gamma-BHC	58-89-9	0.03	mg/kg	<0.03	2 mg/kg	100	70.8	130	
EP075-EM: delta-BHC	319-86-8	0.03	mg/kg	<0.03	2 mg/kg	100	76.5	134	
EP075-EM: Heptachlor	76-44-8	0.03	mg/kg	<0.03	2 mg/kg	95.8	75.5	131	
EP075-EM: Aldrin	309-00-2	0.03	mg/kg	<0.03	2 mg/kg	96.0	76.8	130	
EP075-EM: Heptachlor epoxide	1024-57-3	0.03	mg/kg	<0.03	2 mg/kg	98.2	73.6	130	



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Work Order : ES2132828
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Soil Testing

Sub-Matrix: SOIL				Method Blank (MB) Report		Laboratory Control Spike (LCS) Report			
Method: Compound	CAS Number	LOR	Unit	Result	Spike Concentration	Spike Recovery (%)	LCS	Low	High
EP075I: Organochlorine Pesticides (QCLot: 3907090) - continued									
EP075-EM: cis-Chlordane	5103-71-9	0.03	mg/kg	<0.03	2 mg/kg	98.3	75.0	133	
EP075-EM: trans-Chlordane	5103-74-2	0.03	mg/kg	<0.03	2 mg/kg	96.8	75.3	131	
EP075-EM: Endosulfan 1	959-98-8	0.03	mg/kg	<0.03	2 mg/kg	93.6	69.4	134	
EP075-EM: 4,4'-DDE	72-55-9	0.05	mg/kg	<0.05	2 mg/kg	100	71.0	132	
EP075-EM: Dieldrin	60-57-1	0.03	mg/kg	<0.03	2 mg/kg	98.7	78.0	133	
EP075-EM: Endrin aldehyde	7421-93-4	0.03	mg/kg	<0.03	2 mg/kg	106	69.0	143	
EP075-EM: Endrin	72-20-8	0.03	mg/kg	<0.03	2 mg/kg	95.6	55.7	145	
EP075-EM: Endosulfan 2	33213-65-9	0.03	mg/kg	<0.03	2 mg/kg	104	71.4	135	
EP075-EM: 4,4'-DDD	72-54-8	0.05	mg/kg	<0.05	2 mg/kg	98.6	74.8	134	
EP075-EM: Endosulfan sulfate	1031-07-8	0.03	mg/kg	<0.03	2 mg/kg	98.4	70.2	135	
EP075-EM: 4,4'-DDT	50-29-3	0.05	mg/kg	<0.05	2 mg/kg	98.3	77.7	133	
EP075-EM: Methoxychlor	72-43-5	0.03	mg/kg	<0.03	2 mg/kg	98.4	63.6	135	
EP080I/074: Total Petroleum Hydrocarbons (QCLot: 3902293)									
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	91.0	68.4	128	
EP080I/074: Total Petroleum Hydrocarbons (QCLot: 3902924)									
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	300 mg/kg	105	75.0	129	
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	450 mg/kg	106	77.0	131	
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	300 mg/kg	102	71.0	129	
EP080I/074: Total Petroleum Hydrocarbons (QCLot: 3906559)									
EP074-UT: C6 - C9 Fraction	----	10	mg/kg	<10	39.6 mg/kg	95.8	61.1	119	
EP080I/074: Total Petroleum Hydrocarbons (QCLot: 3907091)									
EP071-EM: C10 - C14 Fraction	----	50	mg/kg	<50	840 mg/kg	96.7	74.4	129	
EP071-EM: C15 - C28 Fraction	----	100	mg/kg	<100	2900 mg/kg	97.2	81.0	123	
EP071-EM: C29 - C36 Fraction	----	100	mg/kg	<100	1490 mg/kg	91.2	81.8	121	
EP080I/074: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3902293)									
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	91.7	68.4	128	
EP080I/074: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3902924)									
EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	375 mg/kg	108	77.0	125	
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	525 mg/kg	103	74.0	138	
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	225 mg/kg	101	63.0	131	
EP080I/074: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3906559)									
EP074-UT: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	48.9 mg/kg	95.3	59.9	119	
EP074-UT: C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	----	----	----	----	
EP080I/074: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3907091)									
EP071-EM: >C10 - C16 Fraction	----	50	mg/kg	<50	1110 mg/kg	99.0	75.4	132	
EP071-EM: >C16 - C34 Fraction	----	100	mg/kg	<100	3900 mg/kg	91.1	80.8	120	
EP071-EM: >C34 - C40 Fraction	----	100	mg/kg	<100	290 mg/kg	93.6	73.3	136	



Sub-Matrix: SOIL				Laboratory Control Spike (LCS) Report							
Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report		Spike Concentration	Spike Recovery (%)		Acceptable Limits (%)		
				Result			LCS	Low	High		
EP080: BTEXN (QCLot: 3902293)											
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2		1 mg/kg	110		62.0	116	
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5		1 mg/kg	93.1		67.0	121	
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5		1 mg/kg	93.2		65.0	117	
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5		2 mg/kg	93.0		66.0	118	
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5		1 mg/kg	91.1		68.0	120	
EP080: Naphthalene	91-20-3	1	mg/kg	<1		1 mg/kg	84.5		63.0	119	

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: SOIL

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike		SpikeRecovery(%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3907153)							
EM2118447-013	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	89.5	78.0	124
		EG005T: Cadmium	7440-43-9	50 mg/kg	95.2	79.7	116
		EG005T: Chromium	7440-47-3	50 mg/kg	91.9	79.0	121
		EG005T: Copper	7440-50-8	250 mg/kg	97.5	80.0	120
		EG005T: Lead	7439-92-1	250 mg/kg	95.8	80.0	120
		EG005T: Nickel	7440-02-0	50 mg/kg	93.7	78.0	120
EG005T: Zinc							
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3907176)							
ES2132249-001	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	88.8	70.0	130
		EG005T: Cadmium	7440-43-9	50 mg/kg	86.1	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	86.3	68.0	132
		EG005T: Copper	7440-50-8	250 mg/kg	95.1	70.0	130
		EG005T: Lead	7439-92-1	250 mg/kg	76.4	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	80.1	70.0	130
EG005T: Zinc							
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3907177)							
ES2132828-010	B2 + B6	EG005T: Arsenic	7440-38-2	50 mg/kg	86.5	70.0	130
		EG005T: Cadmium	7440-43-9	50 mg/kg	86.5	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	82.7	68.0	132
		EG005T: Copper	7440-50-8	250 mg/kg	81.7	70.0	130
		EG005T: Lead	7439-92-1	250 mg/kg	80.8	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	84.4	70.0	130



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Work Order : ES2132828
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Soil Testing

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number				
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3907177) - continued							
ES2132828-010	B2 + B6	EG005T: Zinc	7440-66-6	250 mg/kg	83.9	66.0	133
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3907154)							
EM2118447-013	Anonymous	EG035T: Mercury	7439-97-6	0.5 mg/kg	105	76.0	116
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3907175)							
ES2132249-001	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	91.6	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3907178)							
ES2132828-010	B2 + B6	EG035T: Mercury	7439-97-6	5 mg/kg	90.8	70.0	130
EG048: Hexavalent Chromium (Alkaline Digest) (QCLot: 3907555)							
EM2118432-013	Anonymous	EG048G: Hexavalent Chromium	18540-29-9	20 mg/kg	72.8	58.0	114
EM2118432-013	Anonymous	EG048G: Hexavalent Chromium	18540-29-9	20 mg/kg	70.0	58.0	114
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 3908667)							
EM2118602-006	Anonymous	EK026SF: Total Cyanide	57-12-5	20 mg/kg	98.5	70.0	130
EK040T: Fluoride Total (QCLot: 3907107)							
EM2118432-005	Anonymous	EK040T: Fluoride	16984-48-8	400 mg/kg	101	70.0	130
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 3907092)							
EM2118397-032	Anonymous	EP066-EM: Total Polychlorinated biphenyls	----	1 mg/kg	107	59.6	152
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 3906559)							
ES2132828-006	B10+B3+B9	EP074-UT: Benzene	71-43-2	2 mg/kg	82.3	53.7	130
		EP074-UT: Toluene	108-88-3	2 mg/kg	82.8	55.1	124
EP074I: Volatile Halogenated Compounds (QCLot: 3906559)							
ES2132828-006	B10+B3+B9	EP074-UT: 1,1-Dichloroethene	75-35-4	2 mg/kg	70.2	38.4	145
		EP074-UT: Trichloroethene	79-01-6	2 mg/kg	79.9	48.1	128
		EP074-UT: Chlorobenzene	108-90-7	2 mg/kg	77.2	55.5	122
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3902925)							
ES2132952-004	Anonymous	EP075(SIM): Acenaphthene	83-32-9	10 mg/kg	102	70.0	130
		EP075(SIM): Pyrene	129-00-0	10 mg/kg	102	70.0	130
EP075A: Phenolic Compounds (Halogenated) (QCLot: 3907090)							
EM2118397-016	Anonymous	EP075-EM: 2-Chlorophenol	95-57-8	3 mg/kg	86.8	44.0	143
		EP075-EM: 4-Chloro-3-methylphenol	59-50-7	3 mg/kg	85.4	41.5	139
		EP075-EM: Pentachlorophenol	87-86-5	3 mg/kg	74.3	10.0	144
EP075A: Phenolic Compounds (Non-halogenated) (QCLot: 3907090)							
EM2118397-016	Anonymous	EP075-EM: Phenol	108-95-2	3 mg/kg	86.4	44.2	134
		EP075-EM: 2-Nitrophenol	88-75-5	3 mg/kg	84.5	34.2	129
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 3907090)							



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Work Order : ES2132828
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Soil Testing

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 3907090) - continued							
EM2118397-016	Anonymous	EP075-EM: Acenaphthene	83-32-9	3 mg/kg	87.3	42.6	138
		EP075-EM: Pyrene	129-00-0	3 mg/kg	90.5	37.8	152
EP080/074: Total Petroleum Hydrocarbons (QCLot: 3902293)							
ES2132828-002	P5 (2+7)	EP080: C6 - C9 Fraction	----	32.5 mg/kg	97.5	70.0	130
EP080/074: Total Petroleum Hydrocarbons (QCLot: 3902924)							
ES2132952-004	Anonymous	EP071: C10 - C14 Fraction	----	480 mg/kg	113	73.0	137
		EP071: C15 - C28 Fraction	----	3100 mg/kg	120	53.0	131
		EP071: C29 - C36 Fraction	----	2060 mg/kg	123	52.0	132
EP080/074: Total Petroleum Hydrocarbons (QCLot: 3906559)							
ES2132828-006	B10+B3+B9	EP074-UT: C6 - C9 Fraction	----	28 mg/kg	73.0	42.3	111
EP080/074: Total Petroleum Hydrocarbons (QCLot: 3907091)							
EM2118397-022	Anonymous	EP071-EM: C10 - C14 Fraction	----	840 mg/kg	98.6	71.3	126
		EP071-EM: C15 - C28 Fraction	----	2900 mg/kg	97.8	75.1	123
		EP071-EM: C29 - C36 Fraction	----	1490 mg/kg	91.5	78.1	120
EP080/074: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3902293)							
ES2132828-002	P5 (2+7)	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	95.8	70.0	130
EP080/074: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3902924)							
ES2132952-004	Anonymous	EP071: >C10 - C16 Fraction	----	860 mg/kg	121	73.0	137
		EP071: >C16 - C34 Fraction	----	4320 mg/kg	124	53.0	131
		EP071: >C34 - C40 Fraction	----	890 mg/kg	101	52.0	132
EP080/074: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3906559)							
ES2132828-006	B10+B3+B9	EP074-UT: C6 - C10 Fraction	C6_C10	33 mg/kg	64.9	39.9	109
EP080/074: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3907091)							
EM2118397-022	Anonymous	EP071-EM: >C10 - C16 Fraction	----	1110 mg/kg	101	71.5	130
		EP071-EM: >C16 - C34 Fraction	----	3900 mg/kg	91.4	76.9	119
		EP071-EM: >C34 - C40 Fraction	----	290 mg/kg	97.1	65.3	139
EP080: BTEXN (QCLot: 3902293)							
ES2132828-002	P5 (2+7)	EP080: Benzene	71-43-2	2.5 mg/kg	106	70.0	130
		EP080: Toluene	108-88-3	2.5 mg/kg	89.5	70.0	130
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	90.6	70.0	130
		EP080: meta- & para-Xylene	108-38-3	2.5 mg/kg	89.3	70.0	130
			106-42-3				
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	90.8	70.0	130
		EP080: Naphthalene	91-20-3	2.5 mg/kg	78.8	70.0	130



QA/QC Compliance Assessment to assist with Quality Review

Work Order	: ES2132828	Page	: 1 of 10
Client	: LOW ECOLOGICAL SERVICES	Laboratory	: Environmental Division Sydney
Contact	: MR BILL LOW	Telephone	: +61-2-8784 8555
Project	: Glen Helen - Soil Testing	Date Samples Received	: 10-Sep-2021
Site	: ----	Issue Date	: 21-Sep-2021
Sampler	: ----	No. of samples received	: 13
Order number	: ----	No. of samples analysed	: 13

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- **NO** Matrix Spike outliers occur.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- **NO** Quality Control Sample Frequency Outliers exist.



Outliers : Analysis Holding Time Compliance

Matrix: SOIL

Method		Extraction / Preparation			Analysis	
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Days overdue
EA001: pH in soil using 0.01M CaCl extract						
Soil Glass Jar - Unpreserved P5 (6+10),	INTRA DUPLICATE	17-Sep-2021	13-Sep-2021	4		
Soil miscellaneous glass jar B10+B3+B9		17-Sep-2021	13-Sep-2021	4		
EP074A: Monocyclic Aromatic Hydrocarbons						
Soil Glass Jar - Unpreserved P5 (6+10),	INTRA DUPLICATE	16-Sep-2021	13-Sep-2021	3	17-Sep-2021	4
Soil miscellaneous glass jar B10+B3+B9		16-Sep-2021	13-Sep-2021	3	17-Sep-2021	4
EP074H: Naphthalene						
Soil Glass Jar - Unpreserved P5 (6+10),	INTRA DUPLICATE	16-Sep-2021	13-Sep-2021	3	17-Sep-2021	4
Soil miscellaneous glass jar B10+B3+B9		16-Sep-2021	13-Sep-2021	3	17-Sep-2021	4
EP074I: Volatile Halogenated Compounds						
Soil Glass Jar - Unpreserved P5 (6+10),	INTRA DUPLICATE	16-Sep-2021	13-Sep-2021	3	17-Sep-2021	4
Soil miscellaneous glass jar B10+B3+B9		16-Sep-2021	13-Sep-2021	3	17-Sep-2021	4
EP080/071: Total Petroleum Hydrocarbons						
Soil Glass Jar - Unpreserved P5 (6+10),	INTRA DUPLICATE	16-Sep-2021	13-Sep-2021	3	17-Sep-2021	4
Soil miscellaneous glass jar B10+B3+B9		16-Sep-2021	13-Sep-2021	3	17-Sep-2021	4
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions						
Soil Glass Jar - Unpreserved P5 (6+10),	INTRA DUPLICATE	16-Sep-2021	13-Sep-2021	3	17-Sep-2021	4
Soil miscellaneous glass jar B10+B3+B9		16-Sep-2021	13-Sep-2021	3	17-Sep-2021	4

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.



Matrix: **SOIL** Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method		Sample Date	Extraction / Preparation		Analysis	
Container / Client Sample ID(s)			Date extracted	Due for extraction	Date analysed	Due for analysis
EA001 : pH in soil using 0.01M CaCl extract						
Soil Glass Jar - Unpreserved (EA001) P5 (6+10);		06-Sep-2021	17-Sep-2021	13-Sep-2021	17-Sep-2021	17-Sep-2021
Soil miscellaneous glass jar (EA001) B10+B3+B9		06-Sep-2021	17-Sep-2021	13-Sep-2021	17-Sep-2021	17-Sep-2021
EA055: Moisture Content						
Soil Glass Jar - Unpreserved (EA055) P5 (2+7), P5(3+8), B1 +BS, B2 + B6,		06-Sep-2021	17-Sep-2021	13-Sep-2021	17-Sep-2021	17-Sep-2021
EA055: Moisture Content (Dried @ 105-110°C)						
Soil Glass Jar - Unpreserved (EA055) P5 (6+10); INTRA DUPLICATE		06-Sep-2021	17-Sep-2021	13-Sep-2021	17-Sep-2021	17-Sep-2021
Soil miscellaneous glass jar (EA055) B10+B3+B9,		06-Sep-2021	17-Sep-2021	13-Sep-2021	17-Sep-2021	17-Sep-2021
EG005(ED093)T: Total Metals by ICP-AES						
Soil Glass Jar - Unpreserved (EG005T) P5 (6+10), P5 (1+5), P5(3+8), B1 +BS, D5 + D2, INTRA DUPLICATE		06-Sep-2021	17-Sep-2021	05-Mar-2022	17-Sep-2021	05-Mar-2022
Soil miscellaneous glass jar (EG005T) B10+B3+B9,		06-Sep-2021	17-Sep-2021	05-Mar-2022	17-Sep-2021	05-Mar-2022
EG035T: Total Recoverable Mercury by FIMS						
Soil Glass Jar - Unpreserved (EG035T) P5 (6+10), P5 (1+5), P5(3+8), B1 +BS, D5 + D2, INTRA DUPLICATE		06-Sep-2021	17-Sep-2021	04-Oct-2021	17-Sep-2021	04-Oct-2021
Soil miscellaneous glass jar (EG035T) B10+B3+B9,		06-Sep-2021	17-Sep-2021	04-Oct-2021	17-Sep-2021	04-Oct-2021
EG048: Hexavalent Chromium (Alkaline Digest)						
Soil Glass Jar - Unpreserved (EG048G) P5 (6+10), INTRA DUPLICATE		06-Sep-2021	17-Sep-2021	04-Oct-2021	18-Sep-2021	24-Sep-2021
Soil miscellaneous glass jar (EG048G) B10+B3+B9		06-Sep-2021	17-Sep-2021	04-Oct-2021	18-Sep-2021	24-Sep-2021



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Matrix: **SOIL** Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method		Sample Date	Extraction / Preparation		Analysis	
Container / Client Sample ID(s)			Date extracted	Due for extraction	Date analysed	Due for analysis
EK026SF: Total CN by Segmented Flow Analyser						
Soil Glass Jar - Unpreserved (EK026SF) P5 (6+10),	INTRA DUPLICATE	06-Sep-2021	17-Sep-2021	20-Sep-2021	18-Sep-2021	01-Oct-2021
Soil miscellaneous glass jar (EK026SF) B10+B3+B9		06-Sep-2021	17-Sep-2021	20-Sep-2021	18-Sep-2021	01-Oct-2021
EK040T: Fluoride Total						
Soil Glass Jar - Unpreserved (EK040T) P5 (6+10),	INTRA DUPLICATE	06-Sep-2021	17-Sep-2021	04-Oct-2021	20-Sep-2021	04-Oct-2021
Soil miscellaneous glass jar (EK040T) B10+B3+B9		06-Sep-2021	17-Sep-2021	04-Oct-2021	20-Sep-2021	04-Oct-2021
EP066: Polychlorinated Biphenyls (PCB)						
Soil Glass Jar - Unpreserved (EP066-EM) P5 (6+10),	INTRA DUPLICATE	06-Sep-2021	17-Sep-2021	20-Sep-2021	17-Sep-2021	27-Oct-2021
Soil miscellaneous glass jar (EP066-EM) B10+B3+B9		06-Sep-2021	17-Sep-2021	20-Sep-2021	17-Sep-2021	27-Oct-2021
EP074A: Monocyclic Aromatic Hydrocarbons						
Soil Glass Jar - Unpreserved (EP074-UT) P5 (6+10),	INTRA DUPLICATE	06-Sep-2021	16-Sep-2021	13-Sep-2021	17-Sep-2021	13-Sep-2021
Soil miscellaneous glass jar (EP074-UT) B10+B3+B9		06-Sep-2021	16-Sep-2021	13-Sep-2021	17-Sep-2021	13-Sep-2021
EP074H: Naphthalene						
Soil Glass Jar - Unpreserved (EP074-UT) P5 (6+10),	INTRA DUPLICATE	06-Sep-2021	16-Sep-2021	13-Sep-2021	17-Sep-2021	13-Sep-2021
Soil miscellaneous glass jar (EP074-UT) B10+B3+B9		06-Sep-2021	16-Sep-2021	13-Sep-2021	17-Sep-2021	13-Sep-2021
EP074I: Volatile Halogenated Compounds						
Soil Glass Jar - Unpreserved (EP074-UT) P5 (6+10),	INTRA DUPLICATE	06-Sep-2021	16-Sep-2021	13-Sep-2021	17-Sep-2021	13-Sep-2021
Soil miscellaneous glass jar (EP074-UT) B10+B3+B9		06-Sep-2021	16-Sep-2021	13-Sep-2021	17-Sep-2021	13-Sep-2021
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons						
Soil Glass Jar - Unpreserved (EP075(SIM)) D5 + D2		06-Sep-2021	16-Sep-2021	20-Sep-2021	17-Sep-2021	26-Oct-2021
Soil miscellaneous glass jar (EP075(SIM)) B11 + B8		06-Sep-2021	16-Sep-2021	20-Sep-2021	17-Sep-2021	26-Oct-2021
EP075A: Phenolic Compounds (Halogenated)						
Soil Glass Jar - Unpreserved (EP075-EM) P5 (6+10),	INTRA DUPLICATE	06-Sep-2021	17-Sep-2021	20-Sep-2021	17-Sep-2021	27-Oct-2021
Soil miscellaneous glass jar (EP075-EM) B10+B3+B9		06-Sep-2021	17-Sep-2021	20-Sep-2021	17-Sep-2021	27-Oct-2021



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Matrix: **SOIL** Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method		Sample Date	Extraction / Preparation		Evaluation	Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction		Date analysed	Due for analysis	Evaluation
EP075A: Phenolic Compounds (Non-halogenated)								
Soil Glass Jar - Unpreserved (EP075-EM)	INTRA DUPLICATE	06-Sep-2021	17-Sep-2021	20-Sep-2021	✓	17-Sep-2021	27-Oct-2021	✓
Soil miscellaneous glass jar (EP075-EM)		06-Sep-2021	17-Sep-2021	20-Sep-2021	✓	17-Sep-2021	27-Oct-2021	✓
EP075B: Polynuclear Aromatic Hydrocarbons								
Soil Glass Jar - Unpreserved (EP075-EM)	INTRA DUPLICATE	06-Sep-2021	17-Sep-2021	20-Sep-2021	✓	17-Sep-2021	27-Oct-2021	✓
Soil miscellaneous glass jar (EP075-EM)		06-Sep-2021	17-Sep-2021	20-Sep-2021	✓	17-Sep-2021	27-Oct-2021	✓
EP075I: Organochlorine Pesticides								
Soil Glass Jar - Unpreserved (EP075-EM)	INTRA DUPLICATE	06-Sep-2021	17-Sep-2021	20-Sep-2021	✓	17-Sep-2021	27-Oct-2021	✓
Soil miscellaneous glass jar (EP075-EM)		06-Sep-2021	17-Sep-2021	20-Sep-2021	✓	17-Sep-2021	27-Oct-2021	✓
EP080/071: Total Petroleum Hydrocarbons								
Soil Glass Jar - Unpreserved (EP080)	P5 (1+5), P5(3+8), B1 +BS, D5 + D2,	06-Sep-2021	15-Sep-2021	20-Sep-2021	✓	17-Sep-2021	20-Sep-2021	✓
Soil Glass Jar - Unpreserved (EP074-UT)		06-Sep-2021	16-Sep-2021	13-Sep-2021	✗	17-Sep-2021	13-Sep-2021	✗
Soil Glass Jar - Unpreserved (EP071)		06-Sep-2021	16-Sep-2021	20-Sep-2021	✓	16-Sep-2021	26-Oct-2021	✓
Soil Glass Jar - Unpreserved (EP071-EM)		06-Sep-2021	16-Sep-2021	13-Sep-2021	✗	17-Sep-2021	13-Sep-2021	✗
Soil Glass Jar - Unpreserved (EP074-UT)	INTRA DUPLICATE	06-Sep-2021	17-Sep-2021	20-Sep-2021	✓	17-Sep-2021	27-Oct-2021	✓
Soil Glass Jar - Unpreserved (EP071-EM)		06-Sep-2021	15-Sep-2021	20-Sep-2021	✓	17-Sep-2021	20-Sep-2021	✓
Soil miscellaneous glass jar (EP074-UT)		06-Sep-2021	16-Sep-2021	13-Sep-2021	✗	17-Sep-2021	13-Sep-2021	✗
Soil miscellaneous glass jar (EP071)		06-Sep-2021	16-Sep-2021	20-Sep-2021	✓	16-Sep-2021	26-Oct-2021	✓
Soil miscellaneous glass jar (EP071-EM)	B10+B3+B9	06-Sep-2021	17-Sep-2021	20-Sep-2021	✓	17-Sep-2021	27-Oct-2021	✓



Matrix: **SOIL** Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation		Evaluation	Analysis	
Container / Client Sample ID(s)	Date extracted		Due for extraction	Date analysed		Due for analysis	Evaluation
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP080) P5 (2+7), P5(9+4), B4+ B7, B2 + B6, D7 + DB	P5 (1+5), P5(3+8), B1 +BS, D5 + D2,	06-Sep-2021	15-Sep-2021	20-Sep-2021	17-Sep-2021	20-Sep-2021	✓
		06-Sep-2021	16-Sep-2021	13-Sep-2021	17-Sep-2021	13-Sep-2021	✗
		06-Sep-2021	16-Sep-2021	20-Sep-2021	16-Sep-2021	26-Oct-2021	✓
		06-Sep-2021	16-Sep-2021	13-Sep-2021	17-Sep-2021	13-Sep-2021	✗
Soil Glass Jar - Unpreserved (EP074-UT) P5 (6+10)		06-Sep-2021	16-Sep-2021	13-Sep-2021	17-Sep-2021	13-Sep-2021	✗
Soil Glass Jar - Unpreserved (EP071) P5 (2+7), P5(9+4), B4+ B7, B2 + B6, D7 + DB	P5 (1+5), P5(3+8), B1 +BS, D5 + D2,	06-Sep-2021	16-Sep-2021	20-Sep-2021	16-Sep-2021	26-Oct-2021	✓
Soil Glass Jar - Unpreserved (EP074-UT) INTRA DUPLICATE		06-Sep-2021	16-Sep-2021	13-Sep-2021	17-Sep-2021	13-Sep-2021	✗
Soil Glass Jar - Unpreserved (EP071-EM) P5 (6+10), B11 + B8	INTRA DUPLICATE	06-Sep-2021	17-Sep-2021	20-Sep-2021	17-Sep-2021	27-Oct-2021	✓
Soil miscellaneous glass jar (EP080) B10+B3+B9		06-Sep-2021	15-Sep-2021	20-Sep-2021	17-Sep-2021	20-Sep-2021	✓
Soil miscellaneous glass jar (EP074-UT) B10+B3+B9		06-Sep-2021	16-Sep-2021	13-Sep-2021	17-Sep-2021	13-Sep-2021	✗
Soil miscellaneous glass jar (EP071) B11 + B8		06-Sep-2021	16-Sep-2021	20-Sep-2021	16-Sep-2021	26-Oct-2021	✓
Soil miscellaneous glass jar (EP071-EM) B10+B3+B9		06-Sep-2021	17-Sep-2021	20-Sep-2021	17-Sep-2021	27-Oct-2021	✓
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080) P5 (2+7), P5(9+4), B4+ B7, B2 + B6, D7 + DB	P5 (1+5), P5(3+8), B1 +BS, D5 + D2,	06-Sep-2021	15-Sep-2021	20-Sep-2021	17-Sep-2021	20-Sep-2021	✓
Soil miscellaneous glass jar (EP080) B11 + B8		06-Sep-2021	15-Sep-2021	20-Sep-2021	17-Sep-2021	20-Sep-2021	✓



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: * = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)		Quality Control Specification	
Analytical Methods		QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	10	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PCB - VIC EPA 448.3 Screen	EP066-EM	1	10	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
pH in soil using a 0.01M CaCl2 extract	EA001	1	3	33.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds - Waste Classification	EP075-EM	1	10	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	6	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Fluoride	EK040T	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	3	20	15.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071-EM	1	10	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds - Ultra-trace	EP074-UT	1	3	33.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PCB - VIC EPA 448.3 Screen	EP066-EM	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
pH in soil using a 0.01M CaCl2 extract	EA001	2	3	66.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds - Waste Classification	EP075-EM	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	6	16.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Fluoride	EK040T	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071-EM	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds - Ultra-trace	EP074-UT	1	3	33.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PCB - VIC EPA 448.3 Screen	EP066-EM	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds - Waste Classification	EP075-EM	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	6	16.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Fluoride	EK040T	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Matrix: **SOIL** Evaluation: * = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count			Rate (%)		Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Method Blanks (MB) - Continued							
Total Metals by ICP-AES	EG005T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071-EM	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds - Ultra-trace	EP074-UT	1	3	33.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PCB - VIC EPA 448.3 Screen	EP066-EM	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds - Waste Classification	EP075-EM	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	6	16.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Fluoride	EK040T	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071-EM	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds - Ultra-trace	EP074-UT	1	3	33.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH in soil using a 0.01M CaCl ₂ extract	EA001	SOIL	In house: Referenced to Rayment and Lyons 4B3 (mod.) or 4B4 (mod.) 10 g of soil is mixed with 50 mL of 0.01M CaCl ₂ and tumbled end over end for 1 hour. pH is measured from the continuous suspension. This method is compliant with NEPM Schedule B(3).
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	SOIL	In house: Referenced to USEPA SW846, Method 3060. Hexavalent chromium is extracted by alkaline digestion. The digest is determined by photometrically by automatic discrete analyser, following pH adjustment. The instrument uses colour development using dephenylcarbrazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	SOIL	In house: Referenced to APHA 4500-CN C / ASTM D7511 / ISO 14403. Caustic leachates of soil samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM Schedule B(3).
Total Fluoride	EK040T	SOIL	(In-house) Total fluoride is determined by ion specific electrode (ISE) in a solution obtained after a Sodium Carbonate / Potassium Carbonate fusion dissolution.
PCB - VIC EPA 448.3 Screen	EP066-EM	SOIL	In house: Referenced to USEPA SW 846 - 8270 Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3).
TRH - Semivolatle Fraction	EP071	SOIL	In house: Referenced to USEPA SW 846 - 8015 Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM Schedule B(3).
TRH - Semivolatle Fraction	EP071-EM	SOIL	In house: Referenced to USEPA SW 846 - 8015A Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40.



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Analytical Methods		Method	Matrix	Method Descriptions
Volatile Organic Compounds - Ultra-trace		EP074-UT	SOIL	In house: Referenced to USEPA SW 846 - 8260. Extracts are analysed by Purge and Trap, Capillary GC/MS in partial SIM/Scan mode. Quantification is by comparison against an established multi-point calibration curves. This method is compliant with NEPM Schedule B(3).
	Volatiles Organic Compounds - Ultra-trace - Summations	EP074-UT-SUM	SOIL	Summation of MAHs and VHCs
	PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270. Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
	Semivolatiles Organic Compounds - Waste Classification	EP075-EM	SOIL	In house: Referenced to USEPA SW 846 - 8270. Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM Schedule B(3).
SVOC - Waste Classification (Sums)		EP075-EM-SUM	SOIL	Summations for EP075 (EM variation)
	TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM Schedule B(3) amended.
Preparation Methods		Method	Matrix	Method Descriptions
NaOH leach for CN in Soils		CN-PR	SOIL	In house: APHA 4500 CN. Samples are extracted by end-over-end tumbling with NaOH.
	pH in soil using a 0.01M CaCl2 extract	EA001-PR	SOIL	In house: Referenced to Rayment and Lyons 4B1, 10 g of soil is mixed with 50 mL of 0.01M CaCl2 and tumbled end over end for 1 hour. pH is measured from the continuous suspension. This method is compliant with NEPM Schedule B(3).
Alkaline digestion for Hexavalent Chromium		EG048PR	SOIL	In house: Referenced to USEPA SW846, Method 3060A.
	Total Fluoride	EK040T-PR	SOIL	In house: Samples are fused with Sodium Carbonate / Potassium Carbonate flux.
	Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).
Methanolic Extraction of Soils for Purge and Trap		ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
	Methanolic Extraction of Soils - Ultra-trace.	ORG16-UT	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids		ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
	Tumbler Extraction of Solids - VIC EPA Screen	ORG17-EM	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.

UPDATED COC

COMMENTS (SUPPLY CHAIN, FINANCIALS, LOGISTICS, ONE STOP/3PL, ETC.)	SAMPLE DETAILS MATRIX, INVENTORY, PAPERWORK	CONTAINER INFORMATION	ANALYSIS REQUIRED (including samples and their names and the name of analyst (last name))	ANALYST AND LABORATORY

LAS ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (enter all codes & vol)	TOTAL SCOTS (g)	10-15% SOLIDS SCOTS (g)	20-40% SOLIDS SCOTS (g)	40-60% SOLIDS SCOTS (g)	60-80% SOLIDS SCOTS (g)	80-100% SOLIDS SCOTS (g)	Environmental Division

[illegible]

4	P-2 (P-4)	8/00/2/021	1-2-13	3	1	1 (100) per wt with below listed vol. wt. (34) for composite 2
5	P-5 (P-6)	6/00/2/021	1-2-13	3	1	100 wt with below listed vol. wt. (34) for composite 2

β	$m_1 + m_2$	signature	σ	signature	λ
0	04 + 07	6092621	S	(0, 0) or with other fields, see of Project C.	X

Sl.	Dts + D2	VT+0	S	Remarks	Lab./Analysis	Remarks
11	D18 + D2	VT+0	S	Slime jar with latex found 99.9% - Colours up to 99.9%	X	
12	D18 + D2	VT+0	S	Slime jar with latex found 99.9% - Colours up to 99.9%	X	

INTRA DUPLICATE	20	1	X	Continued on Card No. 1
				WON

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

[illegible]

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Environmental Division
Sydney
Work Order Reference
ES2132828



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Subcon / Consultant / Subcontractor / Supplier / Vendor

Lab / Analyst: E.A.
Organised By / Date:

Requisitioned By / Date

Conductivity

2000

Issued by MO / Internal Sheet



Australian Laboratory Services Pty Ltd ABN 84 009 936 029. An ALS Limited Company

TAX INVOICE: 1151360919

LOW ECOLOGICAL SERVICES

MR BILL LOW

PO BOX 3130

ALICE SPRINGS

NT, AUSTRALIA 0871

Work Order	Project / Overall Description	Site	Order number	C-O-C number	Contact
ES2132828	Glen 5 elen - Soil TestinH / ----	----	----	----	MR BILL LOW

Issue Date	: 21-Sep-2021	Taxable value	: AUD\$	1,587.00
		Tax Incurred (GST)	: AUD\$	158.70
Due Date	: 22-Oct-2021	Amount Payable	: AUD\$	1,745.70

Work Order BreakdoFn

MetVod	Sale Item Descriptions	\$ uantit)	Unit (alue yAUD: v	(alue yAUD: v	GST yAUD: v	Line Total yAUD: w
Work Order ES2132828						
		\$ uote number EN/333		SubmatriQsummar)g 13 SOILS		
hMisc	Workorder Admin 4ee	1*00	x0*00	x0*00	x*00	xx*00
hMisc	Euro.ins Courier .ee	1*00	x0*00	x0*00	x*00	xx*00
P-19	IWRG 921	3*00	2f 3*00	7f 6*00	7f *60	83x*60
S-0f	TR5 /BTEXN/8 Metals	8*00	98*20	f xf *90	f x*f 9	900*19
S-29	8 metals/TR5 /BTEXN/PA5	2*00	101*20	202*x0	20*2x	222*9x

Workorder Additional Volume Based Discount

0.00 (net)

* denotes non-discountable item

- Please direct all queries to Environmental Division Sydney on +61-2-8784 8555.

REMITTANCE ADVICE

POST TO: Australian Laboratory Services Pty Ltd
PO BOX 99 Everton Park
QLD 4053 Australia

EMAIL TO: remittances@alsHobal.com

Vendor bank details

Bank: Commonwealth Bank
BSBg: 064 000
Accountg: 12672843
SFi.t Codeg: CTBAAU2S

or C/veque

Pa)able to Australian Laboratory Services Pty Ltd

or Credit Card

(isa

Mastercard

American EQpress

Amount Payable

AUD\$ 1,745.70

ALS Client Reference

LOWECO

TAX INVOICE

1151360919

Eurofins Environment Testing Australia Pty Ltd

ABN: 50 005 085 521

Melbourne
6 Monterey Road
Dandenong South VIC 3175
Phone : +61 3 8564 5000
NATA # 1261 Site # 1254

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Newcastle
4/52 Industrial Drive
Mayfield East NSW 2304
PO Box 60 Wickham 2293
Phone : +61 2 4968 8448
NATA # 1261 Site # 25079

Eurofins ARL Pty Ltd

ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool WA 6106
Phone : +61 8 6253 4444
NATA # 2377 Site # 2370

Eurofins Environment Testing NZ Limited

NZBN: 9429046024954

Auckland
35 O'Rorke Road
Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Sample Receipt Advice

Company name: Low Ecological Services
Contact name: Bill Low
Project name: GLEN HELEN - SOIL TESTING
Project ID: Not provided
Turnaround time: 5 Day
Date/Time received: Sep 14, 2021 5:36 PM
Eurofins reference: 825639

Sample Information

- ✓ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ✓ All samples have been received as described on the above COC.
- ✓ COC has been completed correctly.
- ✓ Attempt to chill was evident.
- ✓ Appropriately preserved sample containers have been used.
- ✓ All samples were received in good condition.
- ✗ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ✓ Appropriate sample containers have been used.
- ✓ Sample containers for volatile analysis received with zero headspace.
- ✗ Split sample sent to requested external lab.
- ✗ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Notes

Samples received by the laboratory after 5.30pm are deemed to have been received the following working day.

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Michael Morrison on phone : 03 8564 5933 or by email: MichaelMorrison@eurofins.com

Results will be delivered electronically via email to Bill Low - lowecol@lowecol.com.au.



Environment Testing

web: www.eurofins.com.au

email: EnviroSales@eurofins.com

ABN: 50 005 085 521

Melbourne6 Monterey Road
Dandenong South VIC 3175
Phone : +61 3 8564 5000
NATA # 1261 Site # 1254**Sydney**Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217**Brisbane**1/21 Smallwood Place
Murarie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794**Newcastle**4/52 Industrial Drive
Mayfield East NSW 2304
PO Box 60 Wickham 2293
Phone : +61 2 4968 8448
NATA # 1261 Site # 25079**Perth**46-48 Banksia Road
Weshpool WA 6106
Phone : +61 8 6253 4444
NATA # 2377 Site # 2370**Auckland**35 O'Rourke Road
Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327**Christchurch**43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290**Company Name:** Low Ecological Services
Address: Lot 1858 Isotoma Road
Alice Springs
NT 0870**Project Name:** GLEN HELEN - SOIL TESTING**Order No.:**
Report #:
Phone:
Fax:825639
08 89555222**Received:** Sep 14, 2021 5:36 PM
Due: Sep 22, 2021
Priority: 5 Day
Contact Name: Bill Low**Eurofins Analytical Services Manager : Michael Morrison**

Sample Detail					Moisture Set	Vic EPA 1828.2 Table 3 (Solids)
Melbourne Laboratory - NATA # 1261 Site # 1254						X
Sydney Laboratory - NATA # 1261 Site # 18217					X	X
Brisbane Laboratory - NATA # 1261 Site # 20794						
Mayfield Laboratory - NATA # 1261 Site # 25079						
Perth Laboratory - NATA # 2377 Site # 2370						
External Laboratory						
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID	
1	INTER DUPLICATE	Not Provided		Soil	S21-Se37977	X X
Test Counts					1	1

IOW Low Ecological Services
Lot 1858 Isotoma Road
Alice Springs
NT 0870



NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
 NATA is a signatory to the ILAC Mutual Recognition
 Arrangement for the mutual recognition of the
 equivalence of testing, medical testing, calibration,
 inspection, proficiency testing scheme providers and
 reference materials producers reports and certificates.

Attention: **Bill Low**

Report **825639-S**

Project name **GLEN HELEN - SOIL TESTING**

Received Date **Sep 14, 2021**

Client Sample ID			INTER DUPLICATE
Sample Matrix			Soil
Eurofins Sample No.			S21-Se37977
Date Sampled			Not Provided¹²
Test/Reference	LOR	Unit	
Total Recoverable Hydrocarbons			
TRH C6-C9	20	mg/kg	< 20
TRH C10-C14	20	mg/kg	< 20
TRH C15-C28	50	mg/kg	< 50
TRH C29-C36	50	mg/kg	< 50
TRH C10-C36 (Total)	50	mg/kg	< 50
Naphthalene ^{N02}	0.5	mg/kg	< 0.5
TRH C6-C10	20	mg/kg	< 20
TRH C6-C10 less BTEX (F1) ^{N04}	20	mg/kg	< 20
TRH >C10-C16	50	mg/kg	< 50
TRH >C10-C16 less Naphthalene (F2) ^{N01}	50	mg/kg	< 50
TRH >C16-C34	100	mg/kg	< 100
TRH >C34-C40	100	mg/kg	< 100
TRH >C10-C40 (total)*	100	mg/kg	< 100
Volatile Halogenated Compounds (VHC)			
Hexachlorobutadiene	0.5	mg/kg	< 0.5
Volatile Organics			
1.1-Dichloroethane	0.5	mg/kg	< 0.5
1.2.4-Trichlorobenzene	0.5	mg/kg	< 0.5
1.1-Dichloroethene	0.5	mg/kg	< 0.5
1.1.1-Trichloroethane	0.5	mg/kg	< 0.5
1.1.1.2-Tetrachloroethane	0.5	mg/kg	< 0.5
1.1.2-Trichloroethane	0.5	mg/kg	< 0.5
1.1.2.2-Tetrachloroethane	0.5	mg/kg	< 0.5
1.2-Dibromoethane	0.5	mg/kg	< 0.5
1.2-Dichlorobenzene	0.5	mg/kg	< 0.5
1.2-Dichloroethane	0.5	mg/kg	< 0.5
1.2-Dichloropropane	0.5	mg/kg	< 0.5
1.2.3-Trichloropropane	0.5	mg/kg	< 0.5
1.2.4-Trimethylbenzene	0.5	mg/kg	< 0.5
1.3-Dichlorobenzene	0.5	mg/kg	< 0.5
1.3-Dichloropropane	0.5	mg/kg	< 0.5
1.3.5-Trimethylbenzene	0.5	mg/kg	< 0.5
1.4-Dichlorobenzene	0.5	mg/kg	< 0.5
2-Butanone (MEK)	0.5	mg/kg	< 0.5
2-Propanone (Acetone)	0.5	mg/kg	< 0.5
4-Chlorotoluene	0.5	mg/kg	< 0.5

Client Sample ID			INTER DUPLICATE
Sample Matrix			Soil
Eurofins Sample No.			S21-Se37977
Date Sampled			Not Provided¹²
Test/Reference	LOR	Unit	
Volatile Organics			
4-Methyl-2-pentanone (MIBK)	0.5	mg/kg	< 0.5
Allyl chloride	0.5	mg/kg	< 0.5
Benzene	0.1	mg/kg	< 0.1
Bromobenzene	0.5	mg/kg	< 0.5
Bromochloromethane	0.5	mg/kg	< 0.5
Bromodichloromethane	0.5	mg/kg	< 0.5
Bromoform	0.5	mg/kg	< 0.5
Bromomethane	0.5	mg/kg	< 0.5
Carbon disulfide	0.5	mg/kg	< 0.5
Carbon Tetrachloride	0.5	mg/kg	< 0.5
Chlorobenzene	0.5	mg/kg	< 0.5
Chloroethane	0.5	mg/kg	< 0.5
Chloroform	0.5	mg/kg	< 0.5
Chloromethane	0.5	mg/kg	< 0.5
cis-1.2-Dichloroethene	0.5	mg/kg	< 0.5
cis-1.3-Dichloropropene	0.5	mg/kg	< 0.5
Dibromochloromethane	0.5	mg/kg	< 0.5
Dibromomethane	0.5	mg/kg	< 0.5
Dichlorodifluoromethane	0.5	mg/kg	< 0.5
Ethylbenzene	0.1	mg/kg	< 0.1
Iodomethane	0.5	mg/kg	< 0.5
Isopropyl benzene (Cumene)	0.5	mg/kg	< 0.5
m&p-Xylenes	0.2	mg/kg	< 0.2
Methylene Chloride	0.5	mg/kg	< 0.5
o-Xylene	0.1	mg/kg	< 0.1
Styrene	0.5	mg/kg	< 0.5
Tetrachloroethene	0.5	mg/kg	< 0.5
Toluene	0.1	mg/kg	< 0.1
trans-1.2-Dichloroethene	0.5	mg/kg	< 0.5
trans-1.3-Dichloropropene	0.5	mg/kg	< 0.5
Trichloroethene	0.5	mg/kg	< 0.5
Trichlorofluoromethane	0.5	mg/kg	< 0.5
Vinyl chloride	0.5	mg/kg	< 0.5
Xylenes - Total*	0.3	mg/kg	< 0.3
Total MAH*	0.5	mg/kg	< 0.5
Vic EPA IWRG 621 CHC (Total)*	0.5	mg/kg	< 0.5
Vic EPA IWRG 621 Other CHC (Total)*	0.5	mg/kg	< 0.5
4-Bromofluorobenzene (surr.)	1	%	117
Toluene-d8 (surr.)	1	%	111
Polycyclic Aromatic Hydrocarbons			
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2
Acenaphthene	0.5	mg/kg	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5
Anthracene	0.5	mg/kg	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5
Benzo(b&j)fluoranthene ^{N07}	0.5	mg/kg	< 0.5

Client Sample ID			INTER DUPLICATE
Sample Matrix			Soil
Eurofins Sample No.			S21-Se37977
Date Sampled			Not Provided¹²
Test/Reference	LOR	Unit	
Polycyclic Aromatic Hydrocarbons			
Benzo(g,h,i)perylene	0.5	mg/kg	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5
Chrysene	0.5	mg/kg	< 0.5
Dibenz(a,h)anthracene	0.5	mg/kg	< 0.5
Fluoranthene	0.5	mg/kg	< 0.5
Fluorene	0.5	mg/kg	< 0.5
Indeno(1,2,3-cd)pyrene	0.5	mg/kg	< 0.5
Naphthalene	0.5	mg/kg	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5
Pyrene	0.5	mg/kg	< 0.5
Total PAH*	0.5	mg/kg	< 0.5
2-Fluorobiphenyl (surr.)	1	%	110
p-Terphenyl-d14 (surr.)	1	%	87
Organochlorine Pesticides			
Chlordanes - Total	0.1	mg/kg	< 0.1
4,4'-DDD	0.05	mg/kg	< 0.05
4,4'-DDE	0.05	mg/kg	< 0.05
4,4'-DDT	0.05	mg/kg	< 0.05
α-HCH	0.05	mg/kg	< 0.05
Aldrin	0.05	mg/kg	< 0.05
β-HCH	0.05	mg/kg	< 0.05
δ-HCH	0.05	mg/kg	< 0.05
Dieldrin	0.05	mg/kg	< 0.05
Endosulfan I	0.05	mg/kg	< 0.05
Endosulfan II	0.05	mg/kg	< 0.05
Endosulfan sulphate	0.05	mg/kg	< 0.05
Endrin	0.05	mg/kg	< 0.05
Endrin aldehyde	0.05	mg/kg	< 0.05
Endrin ketone	0.05	mg/kg	< 0.05
γ-HCH (Lindane)	0.05	mg/kg	< 0.05
Heptachlor	0.05	mg/kg	< 0.05
Heptachlor epoxide	0.05	mg/kg	< 0.05
Hexachlorobenzene	0.05	mg/kg	< 0.05
Methoxychlor	0.05	mg/kg	< 0.05
Toxaphene	0.5	mg/kg	< 0.5
Aldrin and Dieldrin (Total)*	0.05	mg/kg	< 0.05
DDT + DDE + DDD (Total)*	0.05	mg/kg	< 0.05
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	< 0.1
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	< 0.1
Dibutylchloroendate (surr.)	1	%	95
Tetrachloro-m-xylene (surr.)	1	%	101
Polychlorinated Biphenyls			
Aroclor-1016	0.1	mg/kg	< 0.1
Aroclor-1221	0.1	mg/kg	< 0.1
Aroclor-1232	0.1	mg/kg	< 0.1
Aroclor-1242	0.1	mg/kg	< 0.1
Aroclor-1248	0.1	mg/kg	< 0.1
Aroclor-1254	0.1	mg/kg	< 0.1
Aroclor-1260	0.1	mg/kg	< 0.1

Client Sample ID			INTER DUPLICATE
Sample Matrix			Soil
Eurofins Sample No.			S21-Se37977
Date Sampled			Not Provided¹²
Test/Reference	LOR	Unit	
Polychlorinated Biphenyls			
Total PCB*	0.1	mg/kg	< 0.1
Dibutylchloroendate (surr.)	1	%	95
Tetrachloro-m-xylene (surr.)	1	%	101
Phenols (Halogenated)			
2-Chlorophenol	0.5	mg/kg	< 0.5
2,4-Dichlorophenol	0.5	mg/kg	< 0.5
2,4,5-Trichlorophenol	1	mg/kg	< 1
2,4,6-Trichlorophenol	1	mg/kg	< 1
2,6-Dichlorophenol	0.5	mg/kg	< 0.5
4-Chloro-3-methylphenol	1	mg/kg	< 1
Pentachlorophenol	1	mg/kg	< 1
Tetrachlorophenols - Total	10	mg/kg	< 10
Total Halogenated Phenol*	1	mg/kg	< 1
Phenols (non-Halogenated)			
2-Cyclohexyl-4,6-dinitrophenol	20	mg/kg	< 20
2-Methyl-4,6-dinitrophenol	5	mg/kg	< 5
2-Nitrophenol	1	mg/kg	< 1
2,4-Dimethylphenol	0.5	mg/kg	< 0.5
2,4-Dinitrophenol	5	mg/kg	< 5
2-Methylphenol (o-Cresol)	0.2	mg/kg	< 0.2
3&4-Methylphenol (m&p-Cresol)	0.4	mg/kg	< 0.4
Total cresols*	0.5	mg/kg	< 0.5
4-Nitrophenol	5	mg/kg	< 5
Dinoseb	20	mg/kg	< 20
Phenol	0.5	mg/kg	< 0.5
Phenol-d6 (surr.)	1	%	94
Total Non-Halogenated Phenol*	20	mg/kg	< 20
Chromium (hexavalent)	1	mg/kg	< 1
Cyanide (total)	1	mg/kg	< 1
Fluoride (Total)	100	mg/kg	120
pH (1:5 Aqueous extract at 25°C as rec.)	0.1	pH Units	7.7
% Moisture	1	%	2.7
Heavy Metals			
Arsenic	2	mg/kg	2.1
Cadmium	0.4	mg/kg	< 0.4
Chromium	5	mg/kg	18
Copper	5	mg/kg	12
Lead	5	mg/kg	14
Mercury	0.1	mg/kg	< 0.1
Molybdenum	5	mg/kg	< 5
Nickel	5	mg/kg	10
Selenium	2	mg/kg	< 2
Silver	2	mg/kg	< 2
Tin	10	mg/kg	< 10
Zinc	5	mg/kg	34

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 1999 NEPM Fractions - Method: LTM-ORG-2010 TRH C6-C40	Sydney	Sep 21, 2021	14 Days
Total Recoverable Hydrocarbons - 2013 NEPM Fractions - Method: LTM-ORG-2010 TRH C6-C40	Sydney	Sep 21, 2021	14 Days
Total Recoverable Hydrocarbons - 2013 NEPM Fractions - Method: LTM-ORG-2010 TRH C6-C40	Sydney	Sep 21, 2021	14 Days
Volatile Halogenated Compounds (VHC) - Method: E016 Volatile Halogenated Compounds (VHC)	Sydney	Sep 21, 2021	7 Days
Volatile Organics - Method: LTM-ORG-2150 VOCs in Soils Liquid and other Aqueous Matrices	Sydney	Sep 21, 2021	7 Days
Polycyclic Aromatic Hydrocarbons - Method: LTM-ORG-2130 PAH and Phenols in Soil and Water	Sydney	Sep 21, 2021	14 Days
Organochlorine Pesticides - Method: LTM-ORG-2220 OCP & PCB in Soil and Water	Sydney	Sep 21, 2021	14 Days
Polychlorinated Biphenyls - Method: LTM-ORG-2220 OCP & PCB in Soil and Water	Sydney	Sep 21, 2021	28 Days
Phenols (Halogenated) - Method: LTM-ORG-2130 PAH and Phenols in Soil and Water	Sydney	Sep 21, 2021	14 Days
Phenols (non-Halogenated) - Method: LTM-ORG-2130 PAH and Phenols in Soil and Water	Sydney	Sep 21, 2021	14 Days
Chromium (hexavalent) - Method: In-house method E057.2	Sydney	Sep 21, 2021	28 Days
Cyanide (total) - Method: E054 Total Cyanide	Sydney	Sep 21, 2021	14 Days
Fluoride (Total) - Method: LTM-INO-4150 Determination of Total Fluoride PART B – ISE	Melbourne	Sep 22, 2021	28 Days
pH (1:5 Aqueous extract at 25°C as rec.) - Method: LTM-GEN-7090 pH by ISE	Sydney	Sep 21, 2021	7 Days
Metals IWRG 621 : Metals M12 - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Sydney	Sep 21, 2021	28 Days
% Moisture - Method: LTM-GEN-7080 Moisture	Sydney	Sep 18, 2021	14 Days



Environment Testing

web: www.eurofins.com.au

email: EnviroSales@eurofins.com

ABN: 50 005 085 521

Melbourne

6 Monterey Road
Dandenong South VIC 3175
Phone : +61 3 8564 5000
NATA # 1261 Site # 1254

Sydney

Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane

1/21 Smallwood Place
Murarie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Newcastle

4/52 Industrial Drive
Mayfield East NSW 2304
PO Box 60 Wickham 2293
Phone : +61 2 4968 8448
NATA # 1261 Site # 25079

Perth

46-48 Banksia Road
Welshpool WA 6106
Phone : +61 8 6253 4444
NATA # 2377 Site # 2370

Auckland

35 O'Rourke Road
Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch

43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290**Company Name:** Low Ecological Services
Address: Lot 1858 Isotoma Road
Alice Springs
NT 0870**Project Name:** GLEN HELEN - SOIL TESTING**Order No.:**
Report #:
Phone:
Fax:825639
08 89555222**Received:** Sep 14, 2021 5:36 PM
Due: Sep 22, 2021
Priority: 5 Day
Contact Name: Bill Low**Eurofins Analytical Services Manager : Michael Morrison**

Sample Detail					Moisture Set	Vic EPA 1828.2 Table 3 (Solids)
Melbourne Laboratory - NATA # 1261 Site # 1254						X
Sydney Laboratory - NATA # 1261 Site # 18217					X	X
Brisbane Laboratory - NATA # 1261 Site # 20794						
Mayfield Laboratory - NATA # 1261 Site # 25079						
Perth Laboratory - NATA # 2377 Site # 2370						
External Laboratory						
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID	
1	INTER DUPLICATE	Not Provided		Soil	S21-Se37977	X
Test Counts					1	1

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NC	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " - " in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons							
TRH C6-C9	mg/kg	< 20			20	Pass	
TRH C10-C14	mg/kg	< 20			20	Pass	
TRH C15-C28	mg/kg	< 50			50	Pass	
TRH C29-C36	mg/kg	< 50			50	Pass	
Naphthalene	mg/kg	< 0.5			0.5	Pass	
TRH C6-C10	mg/kg	< 20			20	Pass	
TRH >C10-C16	mg/kg	< 50			50	Pass	
TRH >C16-C34	mg/kg	< 100			100	Pass	
TRH >C34-C40	mg/kg	< 100			100	Pass	
Method Blank							
Volatile Halogenated Compounds (VHC)							
Hexachlorobutadiene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Volatile Organics							
1.1-Dichloroethane	mg/kg	< 0.5			0.5	Pass	
1.2.4-Trichlorobenzene	mg/kg	< 0.5			0.5	Pass	
1.1-Dichloroethene	mg/kg	< 0.5			0.5	Pass	
1.1.1-Trichloroethane	mg/kg	< 0.5			0.5	Pass	
1.1.1.2-Tetrachloroethane	mg/kg	< 0.5			0.5	Pass	
1.1.2-Trichloroethane	mg/kg	< 0.5			0.5	Pass	
1.1.2.2-Tetrachloroethane	mg/kg	< 0.5			0.5	Pass	
1.2-Dibromoethane	mg/kg	< 0.5			0.5	Pass	
1.2-Dichlorobenzene	mg/kg	< 0.5			0.5	Pass	
1.2-Dichloroethane	mg/kg	< 0.5			0.5	Pass	
1.2-Dichloropropane	mg/kg	< 0.5			0.5	Pass	
1.2.3-Trichloropropane	mg/kg	< 0.5			0.5	Pass	
1.2.4-Trimethylbenzene	mg/kg	< 0.5			0.5	Pass	
1.3-Dichlorobenzene	mg/kg	< 0.5			0.5	Pass	
1.3-Dichloropropane	mg/kg	< 0.5			0.5	Pass	
1.3.5-Trimethylbenzene	mg/kg	< 0.5			0.5	Pass	
1.4-Dichlorobenzene	mg/kg	< 0.5			0.5	Pass	
2-Butanone (MEK)	mg/kg	< 0.5			0.5	Pass	
2-Propanone (Acetone)	mg/kg	< 0.5			0.5	Pass	
4-Chlorotoluene	mg/kg	< 0.5			0.5	Pass	
4-Methyl-2-pentanone (MIBK)	mg/kg	< 0.5			0.5	Pass	
Allyl chloride	mg/kg	< 0.5			0.5	Pass	
Benzene	mg/kg	< 0.1			0.1	Pass	
Bromobenzene	mg/kg	< 0.5			0.5	Pass	
Bromochloromethane	mg/kg	< 0.5			0.5	Pass	
Bromodichloromethane	mg/kg	< 0.5			0.5	Pass	
Bromoform	mg/kg	< 0.5			0.5	Pass	
Bromomethane	mg/kg	< 0.5			0.5	Pass	
Carbon disulfide	mg/kg	< 0.5			0.5	Pass	
Carbon Tetrachloride	mg/kg	< 0.5			0.5	Pass	
Chlorobenzene	mg/kg	< 0.5			0.5	Pass	
Chloroethane	mg/kg	< 0.5			0.5	Pass	
Chloroform	mg/kg	< 0.5			0.5	Pass	
Chloromethane	mg/kg	< 0.5			0.5	Pass	
cis-1.2-Dichloroethene	mg/kg	< 0.5			0.5	Pass	
cis-1.3-Dichloropropene	mg/kg	< 0.5			0.5	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Dibromochloromethane	mg/kg	< 0.5			0.5	Pass	
Dibromomethane	mg/kg	< 0.5			0.5	Pass	
Dichlorodifluoromethane	mg/kg	< 0.5			0.5	Pass	
Ethylbenzene	mg/kg	< 0.1			0.1	Pass	
Iodomethane	mg/kg	< 0.5			0.5	Pass	
Isopropyl benzene (Cumene)	mg/kg	< 0.5			0.5	Pass	
m&p-Xylenes	mg/kg	< 0.2			0.2	Pass	
Methylene Chloride	mg/kg	< 0.5			0.5	Pass	
o-Xylene	mg/kg	< 0.1			0.1	Pass	
Styrene	mg/kg	< 0.5			0.5	Pass	
Tetrachloroethene	mg/kg	< 0.5			0.5	Pass	
Toluene	mg/kg	< 0.1			0.1	Pass	
trans-1,2-Dichloroethene	mg/kg	< 0.5			0.5	Pass	
trans-1,3-Dichloropropene	mg/kg	< 0.5			0.5	Pass	
Trichloroethene	mg/kg	< 0.5			0.5	Pass	
Trichlorofluoromethane	mg/kg	< 0.5			0.5	Pass	
Vinyl chloride	mg/kg	< 0.5			0.5	Pass	
Xylenes - Total*	mg/kg	< 0.3			0.3	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/kg	< 0.5			0.5	Pass	
Acenaphthylene	mg/kg	< 0.5			0.5	Pass	
Anthracene	mg/kg	< 0.5			0.5	Pass	
Benz(a)anthracene	mg/kg	< 0.5			0.5	Pass	
Benzo(a)pyrene	mg/kg	< 0.5			0.5	Pass	
Benzo(b&j)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Benzo(g,h,i)perylene	mg/kg	< 0.5			0.5	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Chrysene	mg/kg	< 0.5			0.5	Pass	
Dibenz(a,h)anthracene	mg/kg	< 0.5			0.5	Pass	
Fluoranthene	mg/kg	< 0.5			0.5	Pass	
Fluorene	mg/kg	< 0.5			0.5	Pass	
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.5			0.5	Pass	
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Phenanthrene	mg/kg	< 0.5			0.5	Pass	
Pyrene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Organochlorine Pesticides							
Chlordanes - Total	mg/kg	< 0.1			0.1	Pass	
4,4'-DDD	mg/kg	< 0.05			0.05	Pass	
4,4'-DDE	mg/kg	< 0.05			0.05	Pass	
4,4'-DDT	mg/kg	< 0.05			0.05	Pass	
a-HCH	mg/kg	< 0.05			0.05	Pass	
Aldrin	mg/kg	< 0.05			0.05	Pass	
b-HCH	mg/kg	< 0.05			0.05	Pass	
d-HCH	mg/kg	< 0.05			0.05	Pass	
Dieldrin	mg/kg	< 0.05			0.05	Pass	
Endosulfan I	mg/kg	< 0.05			0.05	Pass	
Endosulfan II	mg/kg	< 0.05			0.05	Pass	
Endosulfan sulphate	mg/kg	< 0.05			0.05	Pass	
Endrin	mg/kg	< 0.05			0.05	Pass	
Endrin aldehyde	mg/kg	< 0.05			0.05	Pass	
Endrin ketone	mg/kg	< 0.05			0.05	Pass	
g-HCH (Lindane)	mg/kg	< 0.05			0.05	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Heptachlor	mg/kg	< 0.05			0.05	Pass	
Heptachlor epoxide	mg/kg	< 0.05			0.05	Pass	
Hexachlorobenzene	mg/kg	< 0.05			0.05	Pass	
Methoxychlor	mg/kg	< 0.05			0.05	Pass	
Toxaphene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Polychlorinated Biphenyls							
Aroclor-1016	mg/kg	< 0.1			0.1	Pass	
Aroclor-1221	mg/kg	< 0.1			0.1	Pass	
Aroclor-1232	mg/kg	< 0.1			0.1	Pass	
Aroclor-1242	mg/kg	< 0.1			0.1	Pass	
Aroclor-1248	mg/kg	< 0.1			0.1	Pass	
Aroclor-1254	mg/kg	< 0.1			0.1	Pass	
Aroclor-1260	mg/kg	< 0.1			0.1	Pass	
Total PCB*	mg/kg	< 0.1			0.1	Pass	
Method Blank							
Phenols (Halogenated)							
2-Chlorophenol	mg/kg	< 0.5			0.5	Pass	
2,4-Dichlorophenol	mg/kg	< 0.5			0.5	Pass	
2,4,5-Trichlorophenol	mg/kg	< 1			1	Pass	
2,4,6-Trichlorophenol	mg/kg	< 1			1	Pass	
2,6-Dichlorophenol	mg/kg	< 0.5			0.5	Pass	
4-Chloro-3-methylphenol	mg/kg	< 1			1	Pass	
Pentachlorophenol	mg/kg	< 1			1	Pass	
Tetrachlorophenols - Total	mg/kg	< 10			10	Pass	
Method Blank							
Phenols (non-Halogenated)							
2-Cyclohexyl-4,6-dinitrophenol	mg/kg	< 20			20	Pass	
2-Methyl-4,6-dinitrophenol	mg/kg	< 5			5	Pass	
2-Nitrophenol	mg/kg	< 1			1	Pass	
2,4-Dimethylphenol	mg/kg	< 0.5			0.5	Pass	
2,4-Dinitrophenol	mg/kg	< 5			5	Pass	
2-Methylphenol (o-Cresol)	mg/kg	< 0.2			0.2	Pass	
3&4-Methylphenol (m&p-Cresol)	mg/kg	< 0.4			0.4	Pass	
4-Nitrophenol	mg/kg	< 5			5	Pass	
Dinoseb	mg/kg	< 20			20	Pass	
Phenol	mg/kg	< 0.5			0.5	Pass	
Total Non-Halogenated Phenol*	mg/kg	< 0			20	Pass	
Method Blank							
Chromium (hexavalent)	mg/kg	< 1			1	Pass	
Cyanide (total)	mg/kg	< 1			1	Pass	
Fluoride (Total)	mg/kg	< 100			100	Pass	
Method Blank							
Heavy Metals							
Arsenic	mg/kg	< 2			2	Pass	
Cadmium	mg/kg	< 0.4			0.4	Pass	
Chromium	mg/kg	< 5			5	Pass	
Copper	mg/kg	< 5			5	Pass	
Lead	mg/kg	< 5			5	Pass	
Mercury	mg/kg	< 0.1			0.1	Pass	
Molybdenum	mg/kg	< 5			5	Pass	
Nickel	mg/kg	< 5			5	Pass	
Selenium	mg/kg	< 2			2	Pass	
Silver	mg/kg	< 2			2	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Tin	mg/kg	< 10			10	Pass	
Zinc	mg/kg	< 5			5	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons							
TRH C6-C9	%	110			70-130	Pass	
TRH C10-C14	%	76			70-130	Pass	
Naphthalene	%	90			70-130	Pass	
TRH C6-C10	%	106			70-130	Pass	
TRH >C10-C16	%	73			70-130	Pass	
LCS - % Recovery							
Volatile Organics							
1.1-Dichloroethene	%	104			70-130	Pass	
1.1.1-Trichloroethane	%	87			70-130	Pass	
1.2-Dichlorobenzene	%	113			70-130	Pass	
1.2-Dichloroethane	%	129			70-130	Pass	
Benzene	%	126			70-130	Pass	
Ethylbenzene	%	115			70-130	Pass	
m&p-Xylenes	%	117			70-130	Pass	
o-Xylene	%	117			70-130	Pass	
Toluene	%	120			70-130	Pass	
Trichloroethene	%	109			70-130	Pass	
Xylenes - Total*	%	117			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	119			70-130	Pass	
Acenaphthylene	%	120			70-130	Pass	
Anthracene	%	111			70-130	Pass	
Benz(a)anthracene	%	126			70-130	Pass	
Benzo(a)pyrene	%	121			70-130	Pass	
Benzo(b&j)fluoranthene	%	116			70-130	Pass	
Benzo(g,h,i)perylene	%	120			70-130	Pass	
Benzo(k)fluoranthene	%	128			70-130	Pass	
Chrysene	%	122			70-130	Pass	
Dibenz(a,h)anthracene	%	112			70-130	Pass	
Fluoranthene	%	109			70-130	Pass	
Fluorene	%	126			70-130	Pass	
Indeno(1,2,3-cd)pyrene	%	117			70-130	Pass	
Naphthalene	%	124			70-130	Pass	
Phenanthrene	%	115			70-130	Pass	
Pyrene	%	108			70-130	Pass	
LCS - % Recovery							
Organochlorine Pesticides							
Chlordanes - Total	%	84			70-130	Pass	
4,4'-DDD	%	72			70-130	Pass	
4,4'-DDE	%	90			70-130	Pass	
4,4'-DDT	%	94			70-130	Pass	
a-HCH	%	90			70-130	Pass	
Aldrin	%	100			70-130	Pass	
b-HCH	%	93			70-130	Pass	
d-HCH	%	79			70-130	Pass	
Dieldrin	%	85			70-130	Pass	
Endosulfan I	%	92			70-130	Pass	
Endosulfan II	%	78			70-130	Pass	
Endosulfan sulphate	%	93			70-130	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Endrin			%	101			70-130	Pass	
Endrin aldehyde			%	84			70-130	Pass	
Endrin ketone			%	89			70-130	Pass	
g-HCH (Lindane)			%	91			70-130	Pass	
Heptachlor			%	86			70-130	Pass	
Heptachlor epoxide			%	80			70-130	Pass	
Hexachlorobenzene			%	93			70-130	Pass	
Methoxychlor			%	74			70-130	Pass	
LCS - % Recovery									
Polychlorinated Biphenyls									
Aroclor-1016			%	76			70-130	Pass	
Aroclor-1260			%	80			70-130	Pass	
LCS - % Recovery									
Phenols (Halogenated)									
2-Chlorophenol			%	117			25-140	Pass	
2,4-Dichlorophenol			%	114			25-140	Pass	
2,4,5-Trichlorophenol			%	113			25-140	Pass	
2,4,6-Trichlorophenol			%	122			25-140	Pass	
2,6-Dichlorophenol			%	115			25-140	Pass	
4-Chloro-3-methylphenol			%	120			25-140	Pass	
Tetrachlorophenols - Total			%	73			25-140	Pass	
LCS - % Recovery									
Phenols (non-Halogenated)									
2-Nitrophenol			%	118			25-140	Pass	
2,4-Dimethylphenol			%	113			25-140	Pass	
2-Methylphenol (o-Cresol)			%	129			25-140	Pass	
4-Nitrophenol			%	98			25-140	Pass	
Phenol			%	116			25-140	Pass	
LCS - % Recovery									
Chromium (hexavalent)			%	100			70-130	Pass	
Cyanide (total)			%	98			70-130	Pass	
Fluoride (Total)			%	125			70-130	Pass	
LCS - % Recovery									
Heavy Metals									
Arsenic			%	101			80-120	Pass	
Cadmium			%	103			80-120	Pass	
Chromium			%	101			80-120	Pass	
Copper			%	100			80-120	Pass	
Lead			%	102			80-120	Pass	
Mercury			%	102			80-120	Pass	
Molybdenum			%	103			80-120	Pass	
Nickel			%	102			80-120	Pass	
Selenium			%	99			80-120	Pass	
Silver			%	102			80-120	Pass	
Tin			%	101			80-120	Pass	
Zinc			%	100			80-120	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Total Recoverable Hydrocarbons				Result 1					
TRH C6-C9	S21-Se28818	NCP	%	89			70-130	Pass	
TRH C10-C14	S21-Se40005	NCP	%	74			70-130	Pass	
Naphthalene	S21-Se39572	NCP	%	102			70-130	Pass	
TRH C6-C10	S21-Se28818	NCP	%	91			70-130	Pass	
TRH >C10-C16	S21-Se40005	NCP	%	71			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Volatile Organics				Result 1					
1.1-Dichloroethene	S21-Se39572	NCP	%	89			70-130	Pass	
1.1.1-Trichloroethane	S21-Se39572	NCP	%	84			70-130	Pass	
1.2-Dichlorobenzene	S21-Se39572	NCP	%	108			70-130	Pass	
1.2-Dichloroethane	S21-Se39572	NCP	%	111			70-130	Pass	
Benzene	S21-Se39572	NCP	%	116			70-130	Pass	
Ethylbenzene	S21-Se39572	NCP	%	112			70-130	Pass	
m&p-Xylenes	S21-Se39572	NCP	%	114			70-130	Pass	
o-Xylene	S21-Se39572	NCP	%	115			70-130	Pass	
Toluene	S21-Se39572	NCP	%	115			70-130	Pass	
Trichloroethene	S21-Se39572	NCP	%	100			70-130	Pass	
Xylenes - Total*	S21-Se39572	NCP	%	115			70-130	Pass	
Spike - % Recovery									
				Result 1					
Cyanide (total)	S21-Se37977	CP	%	113			70-130	Pass	
Fluoride (Total)	M21-Se35715	NCP	%	91			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	S21-Se40005	NCP	%	106			75-125	Pass	
Cadmium	S21-Se40005	NCP	%	109			75-125	Pass	
Chromium	S21-Se40005	NCP	%	106			75-125	Pass	
Copper	S21-Se40005	NCP	%	107			75-125	Pass	
Lead	S21-Se40005	NCP	%	108			75-125	Pass	
Mercury	S21-Se40005	NCP	%	104			75-125	Pass	
Molybdenum	S21-Se40005	NCP	%	107			75-125	Pass	
Nickel	S21-Se40005	NCP	%	107			75-125	Pass	
Selenium	S21-Se40005	NCP	%	104			75-125	Pass	
Silver	S21-Se40005	NCP	%	108			75-125	Pass	
Zinc	S21-Se40005	NCP	%	107			75-125	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Total Recoverable Hydrocarbons				Result 1	Result 2	RPD			
TRH C6-C9	S21-Se37977	CP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C10-C14	S21-Se40568	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C15-C28	S21-Se40568	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH C29-C36	S21-Se40568	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
Naphthalene	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
TRH C6-C10	S21-Se37977	CP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH >C10-C16	S21-Se40568	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH >C16-C34	S21-Se40568	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
TRH >C34-C40	S21-Se40568	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
Duplicate									
Volatile Halogenated Compounds (VHC)				Result 1	Result 2	RPD			
Hexachlorobutadiene	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
Volatile Organics				Result 1	Result 2	RPD			
1.1-Dichloroethane	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
1.2.4-Trichlorobenzene	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
1.1-Dichloroethene	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
1.1.1-Trichloroethane	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
1.1.1.2-Tetrachloroethane	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
1.1.2-Trichloroethane	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
1.1.2.2-Tetrachloroethane	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	

Duplicate								
Volatile Organics				Result 1	Result 2	RPD		
1.2-Dibromoethane	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
1.2-Dichlorobenzene	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
1.2-Dichloroethane	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
1.2-Dichloropropane	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
1.2.3-Trichloropropane	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
1.2.4-Trimethylbenzene	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
1.3-Dichlorobenzene	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
1.3-Dichloropropane	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
1.3.5-Trimethylbenzene	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
1.4-Dichlorobenzene	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
2-Butanone (MEK)	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
2-Propanone (Acetone)	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
4-Chlorotoluene	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
4-Methyl-2-pentanone (MIBK)	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Allyl chloride	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Benzene	S21-Se37977	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass
Bromobenzene	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Bromochloromethane	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Bromodichloromethane	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Bromoform	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Bromomethane	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Carbon disulfide	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Carbon Tetrachloride	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Chlorobenzene	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Chloroethane	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Chloroform	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Chloromethane	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
cis-1.2-Dichloroethene	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
cis-1.3-Dichloropropene	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Dibromochloromethane	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Dibromomethane	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Dichlorodifluoromethane	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Ethylbenzene	S21-Se37977	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass
Iodomethane	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Isopropyl benzene (Cumene)	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
m&p-Xylenes	S21-Se37977	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass
Methylene Chloride	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
o-Xylene	S21-Se37977	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass
Styrene	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Tetrachloroethene	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Toluene	S21-Se37977	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass
trans-1.2-Dichloroethene	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
trans-1.3-Dichloropropene	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Trichloroethene	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Trichlorofluoromethane	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Vinyl chloride	S21-Se37977	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Xylenes - Total*	S21-Se37977	CP	mg/kg	< 0.3	< 0.3	<1	30%	Pass
Duplicate								
				Result 1	Result 2	RPD		
Cyanide (total)	S21-Se32068	NCP	mg/kg	< 1	< 1	<1	30%	Pass
Fluoride (Total)	M21-Se36486	NCP	mg/kg	< 100	< 100	<1	30%	Pass
pH (1:5 Aqueous extract at 25°C as rec.)	W21-Se32633	NCP	pH Units	5.6	5.6	<1	30%	Pass
% Moisture	S21-Se37679	NCP	%	17	17	3.0	30%	Pass

Duplicate								
Heavy Metals				Result 1	Result 2	RPD		
Arsenic	S21-Se37679	NCP	mg/kg	2.6	3.0	13	30%	Pass
Cadmium	S21-Se37679	NCP	mg/kg	< 0.4	< 0.4	<1	30%	Pass
Chromium	S21-Se37679	NCP	mg/kg	15	14	2.0	30%	Pass
Copper	S21-Se37679	NCP	mg/kg	< 5	< 5	<1	30%	Pass
Lead	S21-Se37679	NCP	mg/kg	6.1	6.3	2.0	30%	Pass
Mercury	S21-Se37679	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass
Molybdenum	S21-Se37679	NCP	mg/kg	< 5	< 5	<1	30%	Pass
Nickel	S21-Se37679	NCP	mg/kg	< 5	< 5	<1	30%	Pass
Selenium	S21-Se37679	NCP	mg/kg	< 2	< 2	<1	30%	Pass
Silver	S21-Se37679	NCP	mg/kg	< 2	< 2	<1	30%	Pass
Tin	S21-Se37679	NCP	mg/kg	< 10	< 10	<1	30%	Pass
Zinc	S21-Se37679	NCP	mg/kg	12	11	13	30%	Pass

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	N/A
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
I12	Where sampling date has not been provided, Eurofins Environment Testing is not able to determine whether analysis has been performed within recommended holding times.
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs

Authorised by:

Michael Morrison	Analytical Services Manager
Andrew Sullivan	Senior Analyst-Organic (NSW)
Charl Du Preez	Senior Analyst-Inorganic (NSW)
John Nguyen	Senior Analyst-Metal (NSW)
Roopesh Rangarajan	Senior Analyst-Volatile (NSW)
Scott Beddoes	Senior Analyst-Inorganic (VIC)



Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

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APPENDIX K – CRC CARE TECHNICAL REPORT #10 2011. SOIL VAPOUR HEALTH SCREENING LEVELS



CRC CARE Technical Report no. 10
Health screening levels for petroleum hydrocarbons in soil and groundwater. Part 1: Technical development document
Appendix A - HSL tables

TABLE A1 (cont)

SOIL VAPOUR HEALTH SCREENING LEVELS (mg/m³) * (a,b,f,g,h,i,j,o)

CHEMICAL ^(e)	HSL-C (Recreational / Open Space)					HSL-D (Commercial / Industrial)				
	0 to <1m	1m to <2m	2m to <4m	4m to <8m	8m+	0 to <1m	1m to <2m	2m to <4m	4m to <8m	8m+
SAND ⁽ⁱ⁾										
Toluene	NL	NL	NL	NL	NL	4,800.	16,000.	39,000.	84,000.	NL
Ethylbenzene ^(c)	NL	NL	NL	NL	NL	1,300.	4,600.	11,000.	25,000.	53,000.
Xylenes	NL	NL	NL	NL	NL	840.	3,200.	8,000.	18,000.	37,000.
Naphthalene ^(c)	410.	NL	NL	NL	NL	2.9	13.	33.	73.	150.
Benzene	360.	2,400.	4,700.	9,500.	19,000.	3.7	12.	30.	65.	130.
C6-C10	86,000.	NL	NL	NL	NL	680.	2,800.	7,000.	15,000.	32,000.
>C10-C16	NL	NL	NL	NL	NL	500.	2,400.	NL	NL	NL
SILT ⁽ⁱ⁾										
Toluene	NL	NL	NL	NL	NL	5,700.	63,000.	NL	NL	NL
Ethylbenzene ^(c)	NL	NL	NL	NL	NL	1,500.	19,000.	54,000.	NL	NL
Xylenes	NL	NL	NL	NL	NL	1,000.	13,000.	38,000.	NL	NL
Naphthalene ^(c)	NL	NL	NL	NL	NL	3.7	52.	150.	350.	750.
Benzene	1,800.	12,000.	24,000.	48,000.	97,000.	4.4	48.	140.	320.	670.
C6-C10	NL	NL	NL	NL	NL	850.	11,000.	33,000.	77,000.	160,000.
>C10-C16	NL	NL	NL	NL	NL	670.	NL	NL	NL	NL
CLAY ⁽ⁱ⁾										
Toluene	NL	NL	NL	NL	NL	6,500.	100,000.	NL	NL	NL
Ethylbenzene ^(c)	NL	NL	NL	NL	NL	1,800.	31,000.	NL	NL	NL
Xylenes	NL	NL	NL	NL	NL	1,200.	21,000.	NL	NL	NL
Naphthalene ^(c)	NL	NL	NL	NL	NL	4.3	83.	240.	560.	1,200.
Benzene	3,000.	20,000.	40,000.	81,000.	160,000.	5.0	78.	230.	530.	1,100.
C6-C10	NL	NL	NL	NL	NL	1,000.	19,000.	55,000.	130,000.	270,000.
>C10-C16	NL	NL	NL	NL	NL	800.	NL	NL	NL	NL

The figures in the above table may be multiplied by a factor to account for biodegradation of vapour. A factor of 10 may apply for source depths from 2 m to <4 m or a factor of 100 for source depths of 4 m and deeper.

To apply the attenuation factor for vapour degradation a number of conditions must be satisfied. Firstly, the maximum length of the shorter side of the concrete slab and surrounding pavement cannot exceed 15 m, as this would prevent oxygen penetrating to the centre of the slab. Secondly, measurement of oxygen in the subsurface is required to determine the potential for biodegradation to occur.

Refer to Section 7.4 of Friebe & Nadebaum 2011 (Part 1) or Davis, Patterson & Treffy 2009 (CRC CARE Technical Report no. 12) for further information.

* Refer to Table Notes

TABLE B3 (cont)
SOIL HEALTH SCREENING LEVELS FOR VAPOUR INTRUSION (mg/kg) * (a,b,d,f,h,i,k,l,m)

CHEMICAL ^(e)	Intrusive Maintenance Worker (Shallow Trench)			Saturation Conc. (C _{sat}) ⁽ⁱ⁾
	0m to <2m	2m to <4m	4m+	
SAND ⁽ⁿ⁾				
Toluene	NL	NL	NL	560.
Ethylbenzene ^(c)	NL	NL	NL	64.
Xylenes	NL	NL	NL	300.
Naphthalene ^(c)	NL	NL	NL	9.
Benzene	77.	160.	NL	360.
C6-C10	NL	NL	NL	950.
>C10-C16	NL	NL	NL	560.
SILT ⁽ⁿ⁾				
Toluene	NL	NL	NL	640.
Ethylbenzene ^(c)	NL	NL	NL	69.
Xylenes	NL	NL	NL	330.
Naphthalene ^(c)	NL	NL	NL	10.
Benzene	250.	NL	NL	440.
C6-C10	NL	NL	NL	910.
>C10-C16	NL	NL	NL	570.
CLAY ⁽ⁿ⁾				
Toluene	NL	NL	NL	630.
Ethylbenzene ^(c)	NL	NL	NL	68.
Xylenes	NL	NL	NL	330.
Naphthalene ^(c)	NL	NL	NL	10.
Benzene	350.	NL	NL	430.
C6-C10	NL	NL	NL	850.
>C10-C16	NL	NL	NL	560.

The figures in the above table may be multiplied by a factor to account for biodegradation of vapour. A factor of 10 may apply for source depths from 2 m to <4 m or a factor of 100 for source depths of 4 m and deeper. To apply the attenuation factor for vapour degradation a number of conditions must be satisfied. Firstly, the maximum length of the concrete slab and surrounding pavement cannot exceed 15 m, as this would prevent oxygen penetrating to the centre of the slab. Secondly, measurement of oxygen in the subsurface is required to determine the potential for biodegradation to occur. Refer to Section 7.4 of Friebe & Nadebaum 2011 (Part 1) or Davis, Patterson & Trefry 2009 (CRC CARE Technical Report no. 12) for further information.

* Refer to Table Notes

TABLE B4

SOIL HEALTH SCREENING LEVELS FOR DIRECT CONTACT (mg/kg) ^{*(a,b,i,j)}

Chemical	HSL-A Residential (Low-Density)	HSL-B Residential (High-Density)	HSL-C Recreational / Open Space	HSL-D Commercial / Industrial	Intrusive Maintenance Worker
Toluene	14,000.	21,000.	18,000.	99,000.	120,000.
Ethylbenzene ^(c)	4,500.	5,900.	5,300.	27,000.	85,000.
Xylenes	12,000.	17,000.	15,000.	81,000.	130,000.
Naphthalene ^(c)	1,400.	2,200.	1,900.	11,000.	29,000.
Benzene	100.	140.	120.	430.	1,100.
C6-C10	4,400.	5,600.	5,100.	26,000.	82,000.
>C10-C16	3,300.	4,200.	3,800.	20,000.	62,000.
>C16-C34	4,500.	5,800.	5,300.	27,000.	85,000.
>C34-C40	6,300.	8,100.	7,400.	38,000.	120,000.

* Refer to Table Notes

APPENDIX L - NEPM 2013 CONTAMINATION SCREENING LEVELS AND LIMITS

Assessing Petroleum Hydrocarbon Contamination

To demonstrate the investigation and screening levels for petroleum hydrocarbons, the HSLs, ESL and Management Limits for coarse soil applicable to a low density residential setting are summarised below.

HSLs Soil (mg/kg)

Chemical/ TPH fraction	HSL-A (low density residential)			
	0m to <1m	1m to <2m	2m to <4m	4m+
Toluene	100	260	370	NL
Ethylbenzene	NL	NL	NL	NL
Xylenes	45	70	110	200
Naphthalene	3	NL	NL	NL
Benzene	0.6	0.6	0.6	0.6
C6-C10	50	85	130	230
>C10-C16	130	280	520	NL

HSLs Groundwater (mg/L)

Chemical/ TPH fraction	HSL A (low density residential)		
	2 to <4m	4m to <8m	8m+
Toluene	NL	NL	NL
Ethylbenzene	NL	NL	NL
Xylenes	NL	NL	NL
Naphthalene	NL	NL	NL
Benzene	0.9	1	1
C6-C10	1	1	1
>C10-C16	1	1	1

HSLs Soil gas (mg/m³)

Chemical/ TPH fraction	HSL A (low density residential)			
	0 to <1m	1m to <2m	2m to <4m	4m to <8m
Toluene	1,500	4,400	8,600	17,000
Ethylbenzene	390	1,300	2,500	5,100
Xylenes	260	880	1,800	3,600
Naphthalene	0.9	4	7	15
Benzene	1	3	7	15
C6-C10	210	750	1,500	3,100
>C10-C16	160	650	1,400	2,800

NL indicates that the screening level is not limiting for the assessment as the derived number is greater than is physically possible for that substance. A multiplication factor of 10 or 100 may be applied to account for biodegradation depending on depth to vapour source and confirmation of the presence of oxygen.

ESLs

Chemical/ TPH fraction	ESLs (mg/kg) Coarse Soil	
	Urban residential and public open space	
Toluene	85	
Ethylbenzene	70	
Xylenes	105	
Benzene	50	
F1 C ₉ -C ₁₀	180	
F2 >C ₁₀ -C ₁₆	120	
F3 >C ₁₀ -C ₁₆	300	
F4 >C ₁₆	2800	

Management limits

TPH fraction	Management Limits (mg/kg) Coarse Soil	
	Residential, parkland and public open space	
F1 C ₉ -C ₁₀	700	
F2 >C ₁₀ -C ₁₆	1,000	
F3 >C ₁₀ -C ₁₆	2,500	
F4 >C ₁₆	10,000	

Refer to Schedule B1 for the full tables and guidance on the correct application of these numbers.

Table 1B(6) ESLs for TPH fractions F1 – F4, BTEX and benzo(a)pyrene in soil

CHEMICAL	Soil texture	ESLs (mg/kg dry soil)		
		Areas of ecological significance	Urban residential and public open space	Commercial and industrial
F1 C ₆ -C ₁₀		125*	180*	215*
F2 >C ₁₀ -C ₁₆	Coarse/ Fine	25*	120*	170*
F3 >C ₁₆ -C ₃₄	Coarse	-	300	1700
	Fine	-	1300	2500
F4 >C ₃₄ -C ₄₀	Coarse	-	2800	3300
	Fine	-	5600	6600
Benzene	Coarse	10	50	75
	Fine	10	65	95
Toluene	Coarse	10	85	135
	Fine	65	105	135
Ethylbenzene	Coarse	1.5	70	165
	Fine	40	125	185
Xylenes	Coarse	10	105	180
	Fine	1.6	45	95
Benzo(a)pyrene	Coarse	0.7	0.7	0.7
	Fine	0.7	0.7	0.7

Notes:

- (1) ESLs are of low reliability except where indicated by * which indicates that the ESL is of moderate reliability.
- (2) '-' indicates that insufficient data was available to derive a value.
- (3) To obtain F1, subtract the sum of BTEX concentrations from C₆-C₁₀ fraction and subtract naphthalene from >C₁₀-C₁₆ to obtain F2.

Table 1 B(7) Management Limits for TPH fractions F1–F4 in soil

TPH fraction	Soil texture	Management Limits ¹ (mg/kg dry soil)	
		Residential, parkland and public open space	Commercial and industrial
F1² C ₆ –C ₁₀	<i>Coarse</i>	700	700
	<i>Fine</i>	800	800
F2² >C ₁₀ –C ₁₆	<i>Coarse</i>	1000	1000
	<i>Fine</i>	1000	1000
F3 >C ₁₆ –C ₃₄	<i>Coarse</i>	2500	3500
	<i>Fine</i>	3500	5000
F4 >C ₃₄ –C ₄₀	<i>Coarse</i>	10 000	10 000
	<i>Fine</i>	10 000	10 000

¹ Management limits are applied after consideration of relevant ESLs and HSLs

² Separate management limits for BTEX and naphthalene are not available hence these should not be subtracted from the relevant fractions to obtain F1 and F2.

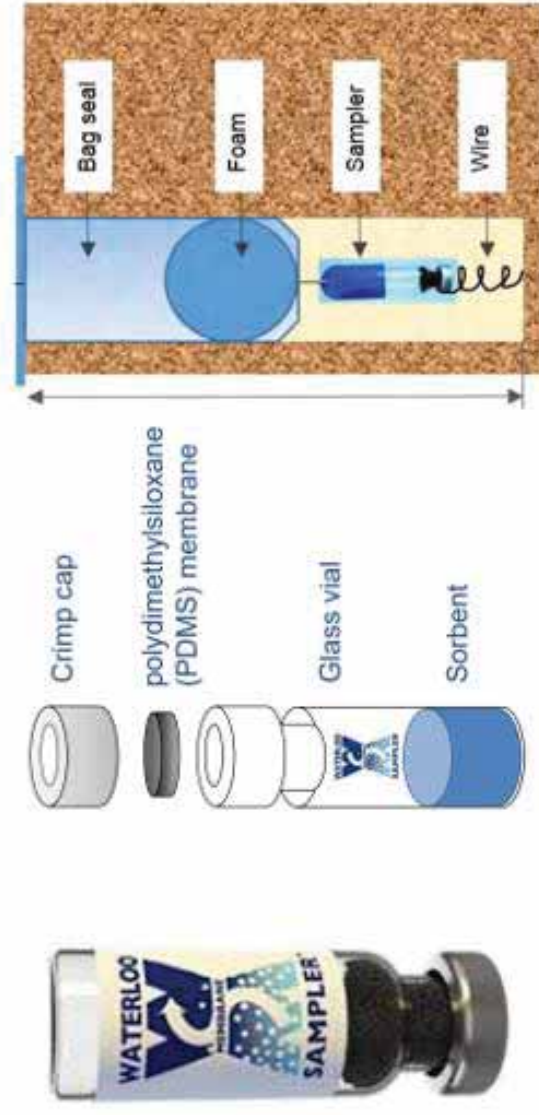
Table 1A(1) Health investigation levels for soil contaminants

Chemical	Health-based investigation levels (mg/kg)			
	Residential ¹ A	Residential ¹ B	Recreational ¹ C	Commercial/ industrial ¹ D
Metals and Inorganics				
Arsenic ²	100	500	300	3 000
Beryllium	60	90	90	500
Boron	4500	40 000	20 000	300 000
Cadmium	20	150	90	900
Chromium (VI)	100	500	300	3600
Cobalt	100	600	300	4000
Copper	6000	30 000	17 000	240 000
Lead ³	300	1200	600	1 500
Manganese	3800	14 000	19 000	60 000
Mercury (inorganic) ⁵	40	120	80	730
Methyl mercury ⁴	10	30	13	180
Nickel	400	1200	1200	6 000
Selenium	200	1400	700	10 000
Zinc	7400	60 000	30 000	400 000
Cyanide (free)	250	300	240	1 500

NR MAPS
Glen Helen Lodge - Aquifers



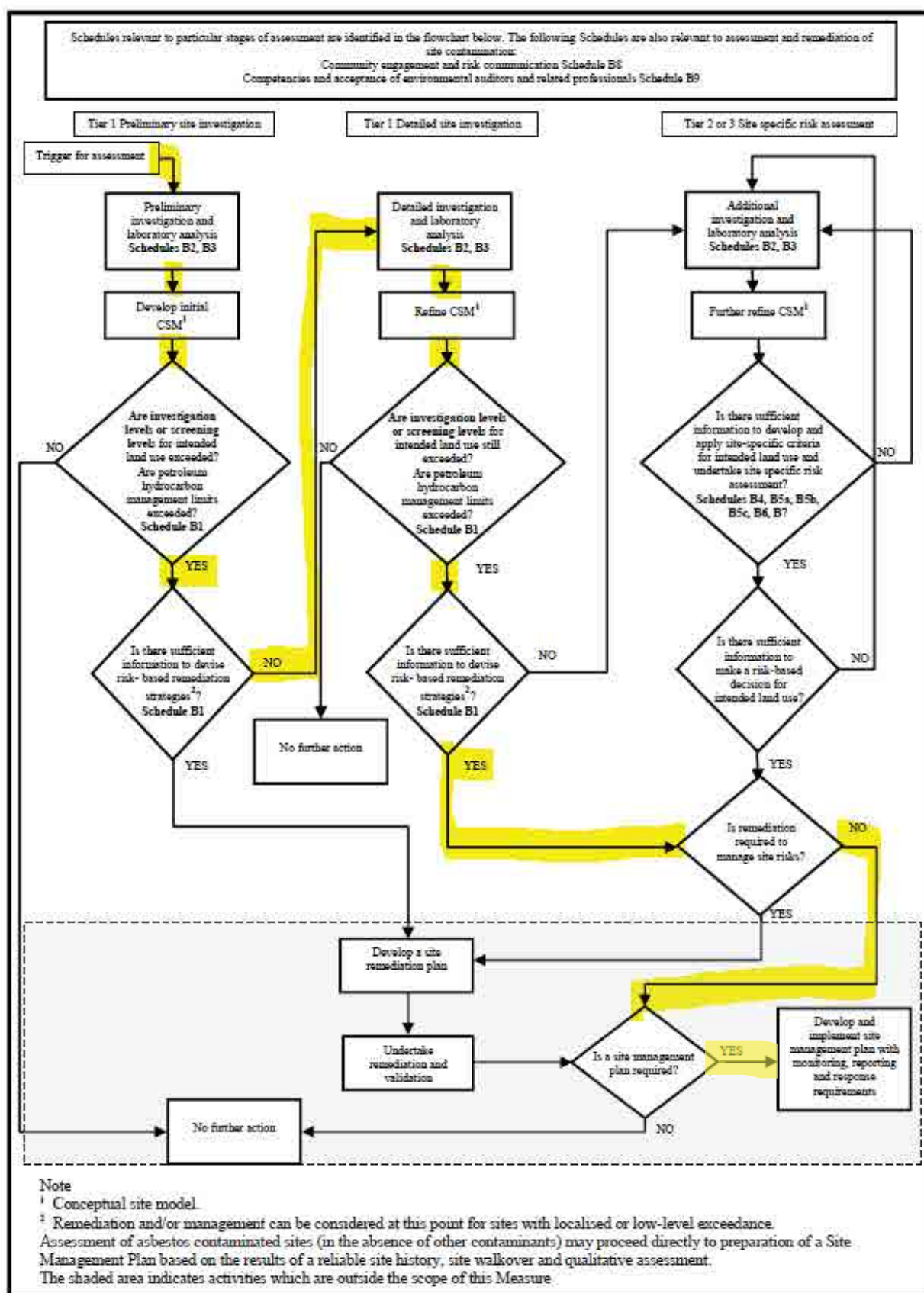
APPENDIX N – WATERLOO MEMBRANE SAMPLERS (WMS) FOR SOIL VAPOUR CONTAMINATION ANALYSIS



The Waterloo Membrane Sampler™ (WMS™) contains a sorbent in an inert container with an opening of known dimensions covered with a membrane. VOC vapours pass through the membrane at a constant rate, called the uptake rate, over time.

The Waterloo Membrane Sampler™ is a permeation-type passive sampler. When it is exposed to air (e.g., indoor, or outdoor air, soil gas, vent pipes), VOCs in the air permeate through the membrane covering the top of the sampler vial, driven by a concentration gradient. The sorbent inside the sampler then traps the vapours, and the mass of each compound on the sorbent is determined in an analytical laboratory by GC-MS. (SIREM, 2021)

APPENDIX O– STAGES OF ASSESSMENT AND REMEDIATION FLOWCHART



A flow chart adapted from NEPM 2013 showing the decision process for the assessment and proposed remediation

APPENDIX P – ALICE SPRINGS TOWN COUNCIL REGIONAL WASTE MANAGEMENT FACILITY
GENERAL FILL DISPOSAL ACCEPTANCE RECEIPTS.

Landfill

Commonage Road
Alice Springs NT 0871
Alice Springs Town Council
ABN 45 863 481 471

Docket : L230808\1

REPRINT

Date Started	Wed, 6 Oct 2021 12:45 PM
Date Completed	Wed, 6 Oct 2021 1:02 PM
Operator	Brucec
Customer	Cash Customers
Vehicle	977722
Vehicle Type	
Transporter	Self
Order No	

Clean Fill	\$0.00
9.10 t @ \$0.00/t	
Total Charge including GST	\$0.00

Gross	21.78 t
Tare	12.68 t
Net	9.10 t



L230808\1

Printed Mon, 11 Oct 2021 12:14 PM

**APPENDIX Q - LEGAL IDENTIFICATION OF SITE (CURRENT LAND TITLE
OWNERSHIP)**

Date Registered: 18/06/2021

Volume 849 Folio 156

Duplicate Certificate as to Title issued? No

SEARCH CERTIFICATE

N.T. Portion 830 from plan(s) A 000315

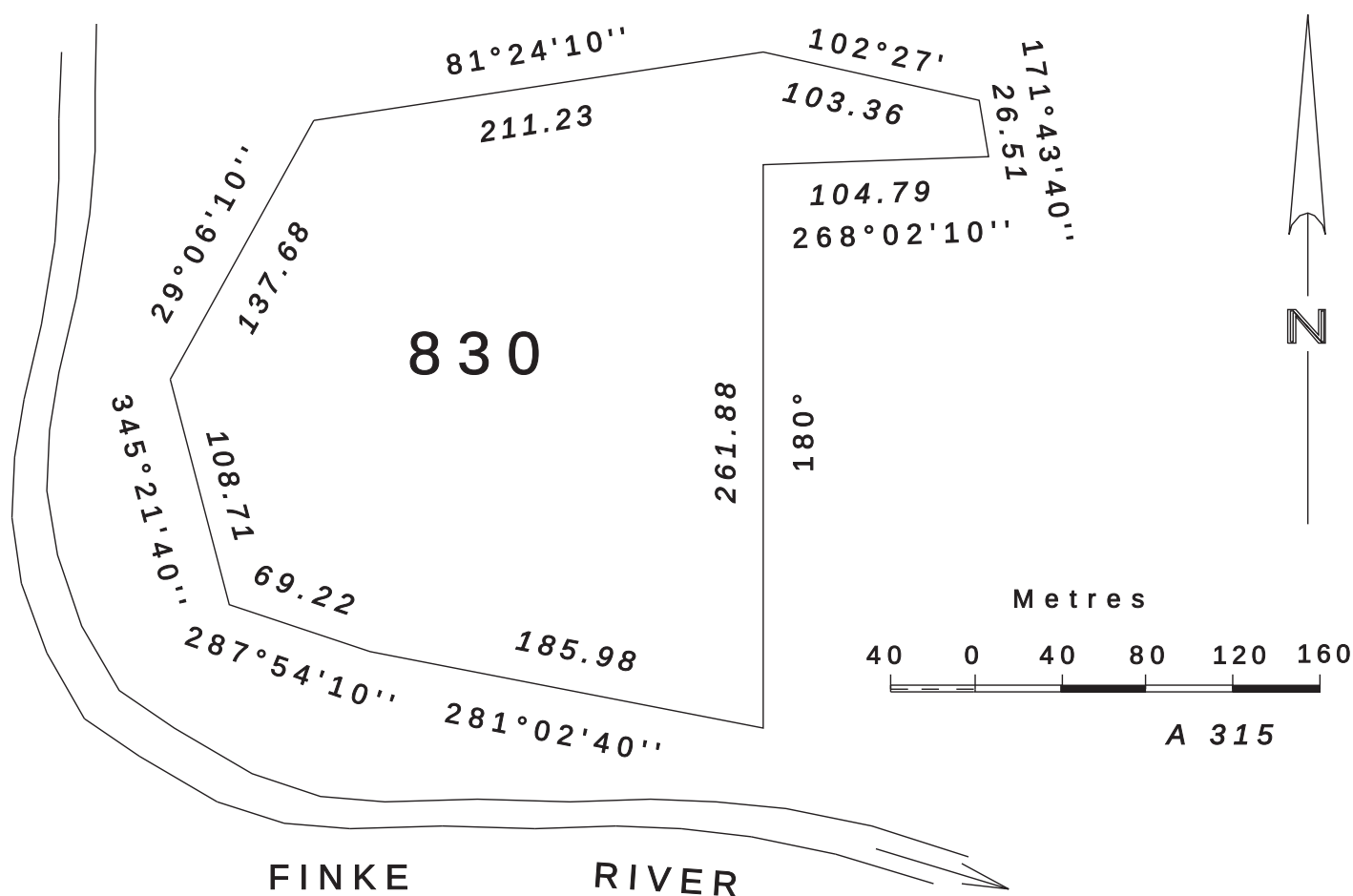
Area under title is 7 hectares 1800 square metres

Owner:

Beston Parks Land Co Pty Ltd (ACN 111 783 423) as trustee for Beston Accommodation Parks Trust (ABN 86 203 376 744)

of Level 7, 60 Light Square Adelaide SA 5000

Registered Date	Dealing Number	Description
		Previous title is Volume 848 Folio 674
15/12/2021	962792	Mortgage Westpac Administration Pty Limited
17/12/1992	277321	Lease to Discovery Holiday Parks Pty Ltd - expiring 14/12/2091
End of Dealings		





NORTHERN TERRITORY OF AUSTRALIA

Record of Administrative Interests and Information

Record of Administrative Interests and Information

The information contained in this record of Administrative Interests only relates to the below parcel reference.

Parcel Reference: N.T. Portion 00830 plan(s) A 000315

(See section 38 of the Land Title Act)

Note: The Record of Administrative Interests and Information is not part of the Land Register and is not guaranteed by the Northern Territory of Australia, and the NT Government accepts no Liability for any omission, misstatement or inaccuracy contained in this statement.

Registrar General

Government Land Register

(none found)

Custodian - Registrar General (+61 8 8999 6252)

Current Title

CUFT 849 156 (order 1)

Tenure Type

ESTATE IN FEE SIMPLE

Tenure Status

Current

Area Under Title

7 hectares 1800 square metres

Owners

Beston Parks Land Co Pty Ltd (ACN 111 783 423) as trustee for Beston Accommodation Parks Trust (ABN 86 203 376 744)
Level 7, 60 Light Square Adelaide SA 5000

Easements

(none found)

Scheme Name

(none found)

Scheme Body Corporate Name

(none found)

Reserved Name(s)

(none found)

Unit Entitlements

(none found)

Transfers

01/06/2021 for \$2,300,000 (nil GST)
17/12/1992 for \$1,750,000
17/12/1992 for \$1,750,000
15/12/1992 for \$1,750,000
13/05/1985 for \$350,000
27/02/1980 for \$144,000
03/10/1973 for n/a
02/08/1969 for n/a
10/06/1964 for n/a

Tenure Comments

(none found)

Historic Titles

CUFT 848 674 (order 1)
CUFT 804 302 (order 1)
CUFT 764 472 (order 1)
CUFT 747 376 (order 1)
CUFT 747 374 (order 1)
CUFT 747 114 (order 1)
CUFT 660 968 (order 1)
CUFT 629 801 (order 1)
CUFT 615 123 (order 1)
CUFT 288 150 (order 1)
CUFT 288 148 (order 1)
CUFT 288 147 (order 1)
CUFT 121 148 (order 2)
CUFT 121 148 (order 1)
CUCL 053 076 (order 5)
CUCL 053 076 (order 4)
CUCL 053 076 (order 3)
CUCL 053 076 (order 2)
CUCL 053 076 (order 1)

Visit the website http://www.nt.gov.au/justice/bdm/land_title_office/

Custodian - Surveyor General (+61 8 8995 5354)**Address**

8495 NAMATJIRA DR, MOUNT ZEIL

Survey Plan

A 000315

Survey Status

Approved

Parcel Status

CURRENT

Parcel Area

7 hectares, 1800 square metres

Map Reference

Code 010 Scale 500000 Sheet 00.20

Parent Parcels

(none found)

Parcel Comments

PROP CHALET. CONVERSION OF SPL 136 TO FREEHOLD, NTG G26 1/7/1983. PROPOSED HERITAGE DECLARATION OF "GLEN HELEN MEAT HOUSE" - NTG S105, 03/11/2015 - LI2015/0007~0063. REVOCATION OF PROVISIONAL DECLARATION OF HERITAGE PLACE NTG G16 20/4/2016 LI2016/0021~0014. PROVISIONAL DECLARATION OF HERITAGE PLACE - NTG G46, 16/11/2016 - LI2016/0021~0034. "GLEN HELEN MEAT HOUSE" DECLARED A HERITAGE PLACE - NTG G25 - 24/06/2020.

Survey Comments

(none found)

Proposed Easements

(none found)

Local Government Area

MACDONNELL SHIRE

Region

ALICE SPRINGS

Custodian - Valuer General (+61 8 8995 5375)**Owner's Last Known Address**

Beston Parks Land Co Pty Ltd (ACN 111 783 423) as trustee for Beston Accommodation Parks Trust (ABN 86 203 376 744), LEVEL 7, 60 LIGHT SQUARE ADELAIDE SA 5000

Parcels in Valuation

N.T. Portion 00830

Unimproved Capital Value

\$250,000 on 01/07/2021

\$38,000 on 01/07/2018

\$38,000 on 01/07/2015

\$38,000 on 01/07/2012

\$38,000 on 01/07/2010

\$50,000 on 01/07/1991

Custodian - Property Purchasing (+61 8 8999 6886)**Acquisitions**

(none found)

Custodian - Building Advisory Service (+61 8 8999 8965)**Building Control Areas**

(none found)

Building Permits

(none found)

Visit the website <http://www.nt.gov.au/building/>

Custodian - Town Planning and Development Assessment Services (+61 8 8999 6046)

Planning Scheme Zone

NOZONE (No NT Planning Scheme zone applies)

Overlays: The following overlays may apply to your land

- CNV - Clearing of Native Vegetation

Refer to the NT Planning Scheme 2020 for more information.

Strategic Frameworks:

(none found)

Interim Development Control Orders

(none found)

Planning Notes

The NT Planning Scheme may apply to development on this land.

Planning Applications

(none found)

Custodian - Pastoral Estate - Vegetation Assessment Unit (+61 8 8999 4454)

(none found)

Visit the website for information on Pastoral land permits.

Custodian - Power and Water Corporation (1800 245 092)

Meters on Parcel

Power Water - Electricity (none found)

Power Water - Water (none found)

For Account balances, contact the Power and Water Corporation.

Custodian - Pool Fencing Unit (+61 8 8924 3641)

Swimming Pool/Spa Status

(none found)

For more information, contact the Pool Fencing Unit (+61 8 8924 3641).

Custodian - Mines and Energy (+61 8 8999 5322)

For information on possible Mineral Titles or Petroleum Titles, contact Mines and Energy or visit the website <http://strike.nt.gov.au>

Custodian - NT Environment Protection Authority (+61 8 8924 4218)

Results of site contamination assessment

(none found)

For further information contact Environment Protection Authority or visit the website <https://ntepa.nt.gov.au/your-business/public-registers/contaminated-land-audits>

Custodian - Heritage Branch (+61 8 8999 5039)

Heritage Listing:
(none found)

For further information on heritage places contact Heritage Branch or visit the website
<https://nt.gov.au/property/land/heritage-register-search-for-places-or-objects>

Other Interests

For Account balances, contact MacDonnell Shire Council

Locality Diagram





HSL APPLICATION CHECKLIST

INTRODUCTION

This checklist is designed to allow assessors to conceptualise potential issues with contaminated land, and how to apply the HSLs. The checklist is designed to trigger responses from the assessor in determining whether the HSLs are applicable or whether consideration should be given to a more site-specific determination of risk. It highlights the key limitations and considerations that are common to contamination assessments and risk assessment.

The checklist summarises the key items from this Application Document.
It is recommended that the Application Document be read in conjunction with the use of this Checklist.

Summary of Steps	
Step 1	Identification of key limitations to the application of health screening levels
Step 2	Identification of key receptors and scenarios
Step 3	Identification of relevant soil type
Step 4	Identification of impacted media and depths
Step 5	Identification of source concentrations to be compared with health screening levels
Step 6	Selecting appropriate HSL and consideration of combining vapour intrusion and direct contact exposure
Step 7	Applying adjustments to the HSLs based on vapour biodegradation, soil organic carbon content, air exchange rate, and soil moisture content Consideration given to soil saturation and water solubility limits
Step 8	Adjustments for cancer risk assessment - modification of acceptable cancer risk level, assessment of cumulative cancer risk

Step 1 – Limitations to HSLs

Assessing contamination in soil and groundwater should only be carried out by a qualified professional.

Are guidelines relevant for site? Check the following limitations:

Have chemicals other than petroleum hydrocarbons been identified at the site?	Y	May consider site-specific risk assessment (refer to Section 5.2 of the Application Document)
Is the groundwater to be used for irrigation purposes?	NA	May consider site-specific risk assessment (refer to Section 2.4.5 of the Application Document)
Is the site conservation land?	N	May be required to also assess ecological values (refer to Section 2.4.6 of the Application Document)
Is the depth to groundwater impact less than 2m bgs ?	NA	May consider site-specific risk assessment for direct contact May consider soil vapour sampling for vapour intrusion (refer to Section 2.4.2 of the Application Document)
Has significant odour been observed at the site?	N	May be required to also assess odour for sensitive land uses (refer to Section 5.4 of the Application Document)
Is the identified chemical a result of a solvent spill rather than petroleum spill/leak?	N	HSLs may be used where saturation point is not considered (refer to Section 5.3 of the Application Document)
Is the identified contamination an atypical petroleum mixture?	N	May consider site-specific risk assessment to consider cumulative effects between chemicals (refer to Section 3.6 of the Application Document)
Is the soil source thickness significantly different than 2 m?	N	For small source thicknesses, HSLs may be overly conservative if source fully depletes. For larger thicknesses HSLs may not adequately characterise risk, however lateral extent of contamination should also be considered. A site-specific HRA may be considered. (refer to Section 2.4.7 of the Application Document)
Does the building have a crawl space rather than slab-on-ground construction?	NA	HSLs may be used as likely to be conservative. However, for situations where inhabitants may be exposed in crawl space area such as spaces under dwellings which incorporate garages/workshop then consideration may be given to ambient air sampling. (refer to Section 2.3.4 of the Application Document)
Does the building have or is likely to have a habitable basement?	NA	May consider site-specific risk assessment (refer to Section 2.3.3 of the Application Document)

Note that the HSLs may be used for assessing health risk. In addition to this assessment, legislation requirements still need to be fulfilled which may include other considerations and assessments. Such considerations may include:

- Assessment of environmental values and ecological impacts
- Consideration of sustainability issues
- Risks for extraction and use of groundwater
- Soil source ongoing source to groundwater contamination
- Local planning requirements, such as sensitive uses under commercial zones, or future land use zones
- Social impacts and consultation with stakeholders

Step 2 – Identify receptors and scenarios to be considered

Check the receptors and scenarios to be assessed. Note that receptors and scenarios may require consideration of future land use planning and local regulations pertaining to site redevelopment.

HSL-A	☐ N	Residential use (refer to Sections 2.1.1 and 2.3.1 of the Application Document)
	☐ N	Low-Density Residential – assumes access to soils with no management controls on site. Assessment may consider surface soils with direct contact, intrusive maintenance worker protection, and consider using surface soil HSL for all soils down to 3 m depth to protect uncontrolled excavation of contamination.
HSL-B	☐ N	High-Density Residential – assumes limited access to surface soils with management controls on site. Assessment may consider surface soils/dust with limited direct contact. Intrusive maintenance workers may be protected under suitable site management plan.
HSL-A	☐ N	Medium-Density Residential with grassed open space – assumes access to soils with management controls on site. Assessment may consider surface soils with direct contact and subsurface soils through vapour intrusion. Intrusive maintenance workers may be protected under suitable site management plan.
HSL-B	☐ N	Medium-Density Residential with permanent paving open space – assumes limited access to soils with management controls on site. Assessment may consider surface soils/dust with limited direct contact. Intrusive maintenance workers may be protected under suitable site management plan.
HSL-A (for VI)	☐ N	Low- or Medium-Density Residential with single basement garage – for vapour intrusion, low-density residential (HSL-A) may apply due to low air exchange rate for basement garage. HSL depth is displaced by depth of basement. For soil direct contact HSLs, select from above medium density scenarios based on access to soils. Intrusive maintenance workers may be protected under suitable site management plan (refer to Section 2.3.3 of the Application Document).
HSL-B (for VI)	☐ N	Medium- or High-Density Residential with communal basement car park – assumes no access to soils with management controls on site. HSL depth is displaced by depth of basement. Intrusive maintenance workers may be protected under suitable site management plan. Note that areas outside of the basement footprint may be required to be assessed as a building without basement and with limited direct contact with soil. Also, limited exposure time for basement users and therefore HSL for Commercial Worker may be used for vapour intrusion (refer to Section 2.3.3 of the Application Document).
HSL-B (for DC outside footprint)	☐ N	
HSL-C	☐ Y	Recreational / Public Open Space (refer to Section 2.1.2 of the Application Document)
	☐ N	Parks, ovals, pedestrian areas
	☐ N	National parks, conservation areas – may be required to also assess ecological values (refer to Section 2.4.6 of the Application Document)
HSL-D	☐ N	Commercial / Industrial Workers (refer to Section 2.1.3 of the Application Document) – considers only healthy adults under normal working conditions. Does not consider sensitive commercial uses such as schools, day care centres and medical practices.
	☐ N	Commercial sensitive users – may consider using residential HSLs or a site-specific HRA (refer to Section 2.4.1 of the Application Document)
	☐ N	Agricultural land – may consider a site specific HRA (refer to Section 2.4.5 of the Application Document)
	☐ N	Shallow intrusive workers down to 1 m deep. May require assessment of direct contact for soils surface to <2 m (refer to Sections 2.1.4 and 2.4.3 of the Application document)
	☐ N	Deep intrusive workers down to >1 m deep, such as sewer. Should be managed with appropriate procedures and work practices for confined spaces (refer to Section 2.4.4 of the Application Document)

Is a site management plan (that includes specific occupational hazard management for works on the site) to be implemented on the site (controlled site)? ☐ N May not need to consider health risks to intrusive workers



Step 3 – Identify soil type relevant to site (soils above impacts in soil and/or groundwater)

Note the following before selecting soil type for use in assessment:

1. The prime parameter that influences the value of the HSL is the air filled porosity and volatility of the specific chemical. The higher the air filled porosity the greater the potential for volatile chemicals to migrate vertically through the soil profile.
2. The selection of a generic soil type requires knowledge of the soil profile across the site.
3. The selection of generic soil types should take into account the predominant characteristics of the soil profile and depth of contamination. The generic soil types assume a uniform profile, which at many, if not all, sites will not be the case. Where the overlying profile is predominantly fine materials (clays) (i.e. > 50% for soil column), these may be considered as the generic soil type. If the profile has a significant proportion of loose/coarse materials (including backfill) (i.e. > 50%), these materials may be considered as the generic soil type.
4. Air filled porosity is affected by moisture content. The wetter the soil, the lower the air filled porosity. Generic soil types have assumed a typical moisture content for the profile typical of average soil conditions occurring at depth. Moisture content will vary greatly by location and season. Moisture content will also vary between sub-categories of soil, e.g. between sand and clayey sand. HSLs may be adjusted based on moisture content. This is done in Step 7.
5. The selection of appropriate soil type is discussed in Section 3.2 of the Application Document.

Is there one dominant soil type on the site (> 50% of soil column)?
Or can a geological setting be conservatively identified (i.e. allowing greater vapour transport)?

☒ Y - Proceed
☐ N - Consideration may be given to assuming the more conservative soil type, or may be given to a site-specific HRA (refer to Section 4.6 of the Application Document)

Has excavated area(s) been backfilled with more porous materials ?

☒ Y - Consideration should be given to adopting a more porous soil type (refer to Section 3.2 of the Application Document)
☐ N - Proceed

Does the site lithology contain rock formations
or soil with large cracks that can form preferential pathways?

☒ Y - The derived HSLs do not include lithologies with rock formations. Consideration may be given to using soil-vapour sampling or carrying out a site-specific HRA (refer to Section 4.6 of the Application Document)
☐ N - Proceed

Identify HSL soil type relevant to site and assessment (above impacts)

The soil profile properties have been based on a predominant soil texture grouping developed by the US Department of Agriculture. The 12 texture classes have been grouped into 3 groups: sand, silt and clay. The groupings of the classes are based on mean particle size and saturation porosities. Refer to Section 3.2 for further discussion on the soil properties.

HSL soil type selected:

☒ Y Sand – Properties selected to be representative of a coarse textured undisturbed soil profile. Consists of texture classes sand, sandy clay.

☒ Y Silt – Properties selected to be representative of a coarse textured undisturbed soil profile. Consists of texture classes silt, silty clay.

☐ Clay – Properties selected to be representative of a fine textured undisturbed soil profile. Consists of texture classes clay.

☐ Other – Including soil with large cracks (preferential pathways) and fractured rock (basalt, sandstone, siltstone, limestone) - refer to Section 4.6 of the Application Document. Soil vapour measurement is preferred to soil or groundwater. Due to fractures and preferential vapour pathways in rock, consideration should be given to overlying weathered soil, or to using HSLs for surface soil in sand.

For soil assessment (texture classification) undertaken in accord with AS 1726 the classifications of sand, silt and clay may be applied as coarse, fine with liquid limit less than 50%, and fine with liquid limit greater than 50% respectively.

Where there is uncertainty, laboratory analysis should be carried out. This may include parameters for detailed particle analysis and exact soil texture sub-class, and saturation porosity. Page 404 of 657

Step 4 – Impact media

Are there impacts to media other than soil and groundwater?
(e.g surface water, biota, odours etc)

Note: aesthetic issues (odours/staining/ecological impacts etc.) to be addressed separately

☐ N As well as human health assessment, consideration of other issues
such as ecological, aesthetics, etc. may be required.

Soils

Are there soil impacts remaining on the site?

☐ Y Y - Proceed
☐ N N - Go to groundwater section

Depth to soil impacts. Note if considering basements, depths need to be displaced e.g. a 3 m deep basement means surface to <1 m represents 3 m to <4 m.

(refer to Section 2.3.3 of the Application Document)

☐ surface to <1 m
☐ Y 1 m to <2 m
☐ Y 2 m to <4 m
☐ 4 m and deeper

☐ Displacement due to basement
Distance of displacement (m) _____

Is the site of interest an uncontrolled site where excavation activities such as construction
may result in subsurface soil contamination brought to surface in the future?

☐ N Consideration may be given to use of HSLs for direct contact and
surface HSLs for vapour intrusion, for deeper soils. A site management
plan may be used to address uncontrolled excavation at a site.
(refer to Sections 2.3.1, 3.4.1, and 4.7 of the Application Document)

Groundwater

Are there groundwater impacts beneath the site?

☐ Y Y - Proceed
☐ N N - Go to soil vapour section

Is the depth to groundwater less than 2 m?

☐ NA Y - The HSL values may not adequately address this scenario. A
site-specific HRA may be considered.
Soil vapour sampling may be used to assess vapour intrusion.
(refer to Section 2.3.3 of the Application Document)

Depth to groundwater impacts. Note if considering basements, depths should be displaced e.g. a 3 m deep basement means surface to 2 m represents 5 m (refer to Sections 2.3.3 of the
Application Document). With basements, groundwater HSLs may not adequately characterise risks where the groundwater level is within 2 m of basement foundation.

☐ 2 m to <4 m
☐ 4 m to <8 m
☐ 8 m and deeper

☐ Displacement due to basement
Distance of displacement (m) _____



Step 4 – Impact media (cont.)

Soil vapour

Has soil vapour sampling been used to characterise vapour intrusion at the site?

Depth to soil impacts. Note if considering basements, depths need to be displaced e.g. a 3 m deep basement means surface to <1 m represents 3 m to <4 m.
 (Refer to Section 2.3.3 of the Application Document.)

Y	Y			
Y	Y			

Displacement due to basement
 Distance of displacement (m)

Y - Proceed
 N - Proceed to Step 5

In using soil vapour sampling, please note the following:

- 1) It is recommended that soil vapour samples be taken as laterally close to a vapour source as possible (within or above).
- 2) Any sample taken within 1 m of the open air is subject to high levels of uncertainty due to atmospheric and meteorological effects. This includes the base and wall of excavation pits.
- 3) For sites subject to redevelopment with residential or commercial buildings, the soil vapour profiles are subject to change due to presence of concrete slabs. Caution is required on the use of soil vapour samples that are not within a soil source and in locations where buildings currently do not exist (refer to Section 1.6 of the Application Document).



Step 5 – Selection of relevant source concentrations

Soil concentrations

1. Is the investigation site likely to be subdivided into smaller lots?

Y - Statistical analysis using entire data set may not be applicable. Consideration may be given to using the maximums or using a sub-set for statistical analysis (refer to Section 3.4.1 of the Application Document)

N - Statistical analysis using entire data set may be applicable
2. Is the site public open space / recreational land where users are unlikely to be in the same location for extended period?

Y - Statistical analysis using entire data set may not be applicable. Consideration may be given to using the maximums or using a sub-set for statistical analysis (refer to Section 3.4.1 of the Application Document)

N - Statistical analysis using entire data set may be applicable

If statistical analysis is appropriate consideration should be given to the following methodology (refer to Section 3.4.1 of the Application Document):

1. Samples should be sub-divided into appropriate depth ranges as defined by HSLs (i.e. surface to <1 m, 1 m to <2 m, 2 m to <4 m, 4 m+). Note if considering basement, the appropriate displacement distance should be accounted for.
2. For each depth range, the statistical mean (e.g. 95% UCL arithmetic mean) soil concentration should be calculated for each chemical. One approach is described in the NSW EPA *Contaminated sites: Sampling design guidelines* (1995). The coefficient of variance test described in the document may be used to determine if the distribution is normal or lognormal. Consideration of other statistical methods may be adopted if justified (e.g. distribution does not fit a normal or lognormal distribution).
3. For samples with no detection, it is recommended to use half the detection limit during statistical analysis.
4. If the standard deviation is very large (due to outliers or low number of samples) the statistical mean may be higher than the maximum concentrations. In this case it is recommended to use the maximum.
5. It is recommended to keep note of maximum concentrations as well as statistical mean concentrations. Maximum concentrations may be required to address potential acute exposure issues.

Groundwater concentrations

Has floating product been identified in any well? N Y - Refer to point (a)

(a) If PSH is identified, dissolved phase is likely to contain chemicals at solubility limits. Proceed with HSL comparison, noting that if there is at least one chemical for which HSLs in groundwater is limiting (i.e. not all chemical HSLs are NL) then presence of PSH may be a potential vapour risk to site users (refer to Section 3.4.2 of the Application Document). Also note that the presence of PSH may trigger other legislative requirements for remediation/monitoring.

Is the area of interest represented by a single groundwater location or multiple ?

- Single - small area of interest such as residential dwelling may be represented by the maximum groundwater concentration if the dwelling location is unknown, otherwise if the building footprint is known, the groundwater well nearest to the point of interest may be used.

Multiple - where exposure may occur over larger areas such as recreational parkland, consideration may be given to averaging the concentrations across the area of interest.

In deciding which set of monitoring data is most useful for analysis consideration may also be given to:

- Historical results to determine trends in groundwater concentrations (i.e. the likelihood that concentrations may increase)
- Upgradient wells and background concentrations
- Groundwater flow direction

(Refer to Section 3.4.2 of the Application Document.)



Step 5 – Selection of Relevant Source Concentrations (cont)

Soil vapour concentrations

Is the area of interest represented by a single or multiple vapour location? Single - small area of interest such as residential dwelling may be represented by the maximum soil vapour concentration if the dwelling location is unknown, otherwise if the building footprint is known, the groundwater well nearest to the point of interest may be used.

Y Multiple - where exposure may occur over larger areas such as recreational parkland, consideration may be given to averaging the concentrations across the area of interest.

Are soil vapour samples measured in shallow soil less than 0.5 m from the surface where there is no existing slab or concrete paving? Y - Measurements are subject to influence from weather and atmospheric conditions and may not be considered reliable.

Are soil vapour samples measured in areas where there is no existing slab or concrete paving, and the site is planned to be redeveloped where a building will exist (residential/commercial/industrial use)? Y - Soil vapour samples not measured within a soil or groundwater source, may not be representative of the soil vapour in the future when a building is located on site. The placement of an impermeable barrier such as a concrete slab can cause build-up of soil vapour within the soil and sub-slab, above levels measured where there is no slab present. Note soil vapour measurements from within soil and groundwater sources are not subject to vapour build-up as the soil vapour is likely to be at its maximum concentration when located within the source.

Soil vapour measurements may be taken at multiple depths, including within the source zone, above the source zone, and directly under a building foundation. Each of the measurement depths should be considered individually.

Refer to Sections 3.4.3 and 1.6 of the Application Document.

Step 6 – HSL determination and combined vapour intrusion and direct contact

HSL determination

HSLs and saturation/solubility limits are presented in the Appendix B HSL tables. Select the appropriate HSLs for vapour intrusion from tables for:

- 1) Each selected receptor listed in Step 2
- 2) Dominant soil texture classification listed in Step 3
- 3) Source depth listed in Step 4

HSLs may be compared to soil/groundwater/soil vapour source concentrations determined in Step 5.
Note for TPH C6 to C10, BTEX should be subtracted from analytical result prior to comparing with HSL

1. Is the HSL value Not Limiting 'NL'? ☐ Y ☐ N Indicates that vapour reaches saturation point and cannot increase to a point which would result in an unacceptable health risk

☐ Y ☐ N Continue with Question 2 for groundwater, or proceed to Question 3

2. Is groundwater HSL not 'NL' and PSH identified in water? ☐ Y ☐ N May indicate potential vapour risk (refer to Section 3.4.2 of Application Document)

☐ Y ☐ N Proceed to Question 3

3. Are comparisons being made against soil HSLs? ☐ Y ☐ N Proceed to Question 4

☐ Y ☐ N Proceed to Step 5

4. Does direct contact need to be considered as well as vapour intrusion? ☐ Y ☐ N HSL-A Low-Density Residential - surface soils, and possibly subsurface soils if determined to be relevant (refer to Section 4.7 of Application Document). Proceed to 'Combined pathways exposure'

☐ Y ☐ N HSL-B High-Density Residential - surface soils. Proceed to 'Combined pathways exposure'

☐ Y ☐ N HSL-C Open Space Recreational - surface soils. Proceed to 'Combined pathways exposure'

☐ Y ☐ N HSL-D Commercial / Industrial - surface soils. Proceed to 'Combined pathways exposure'

☐ Y ☐ N Intrusive Maintenance Worker - down to 2 m. Proceed to 'Combined pathways exposure'

☐ Y ☐ N Proceed to Step 5

5. Do cross-scenario exposure need to be considered? ☐ Y ☐ N Proceed to 'Combined pathways exposure'

☐ Y ☐ N Proceed to Step 7

Combined pathways exposure

Refer to Section 3.3 of the Application Document.

Combined exposures may occur on the same property where indoor vapour intrusion occurs concurrently with outdoor direct contact.

Combined exposure may also occur on adjacent properties, e.g. vapour intrusion on residential property and direct contact on adjacent open space (park).

For the given scenarios/chemicals, list the HSLs.

Where a vapour intrusion HSL is Not Limiting (NL) the chemical / scenario does not need to be considered in the combined pathway exposure.

The combined exposure is assessed as follows:

Multiple exposure pathways:
$$\text{Cumulative Fraction} = \frac{C_{\text{Under Building}}}{\text{HSL}_{\text{Vapour Intrusion}}} + \frac{C_{\text{Outside Building}}}{\text{HSL}_{\text{Direct Contact}}}$$
 where vapour intrusion can refer to soil, groundwater or soil vapour source

Multiple exposure scenarios:
$$\text{Cumulative Fraction} = \frac{C_{\text{Land use 1}}}{\text{HSL}_{\text{Land use 1}}} + \frac{C_{\text{Land use 2}}}{\text{HSL}_{\text{Land use 2}}}$$
 where the HSLs may refer to HSLs for vapour intrusion or direct contact

If a given C/HSL fraction is less than 0.1, the contribution of risk may be considered insignificant and the cumulative exposure need not be assessed for this scenario.

Where a cumulative fraction is less than 1 risk is normally acceptable. Where the value exceeds 1 a site-specific assessment should be undertaken, or proceed to Step 7.

Step 7 – HSLs and adjustments (vapour intrusion)

HSL adjustments (vapour intrusion only)

For each adjustment, careful consideration and justification is required.

1. Vapour biodegradation (refer to Section 4.2 of Application Document)

Prior to applying attenuation factor for vapour degradation it is recommended to read the source documentation (Davis et al. 2009). The minimum requirements for allowing attenuation factors for vapour degradation are as follows:

1. Is there evidence of oxygen penetration? Y - Requires measurement of oxygen in soil gas with at least 5% at 1 m depth
(refer to Section 4.2.1 of Application Document)

Y	N
2. Is the source depth 2 m or deeper? Y - Continue to Point 3
(refer to Section 4.2.2 of Application Document)

Y	N
3. Does the slab have one side less than 15m length? Y - Degradation factor may apply. Less than 4 m depth, a factor of 10 may apply, 4 m and deeper, a factor of 100 may apply.
(refer to Section 4.2.3 of Application Document)

NA	N

2. Soil organic carbon content (refer to Section 4.3 of Application Document)

May be used to adjust soil HSLs only. Soil HSLs were based on fraction organic carbon content of 0.003. HSL may be adjusted if background levels of organic carbon content at the same depth as source is different from baseline. Background sample must not be contaminated with hydrocarbons. If surface soil, background sample in open space may not be appropriate to use if comparing for soil under slab.

Adjustment is linear, i.e. doubling the organic carbon will double the HSL. Applies only to soil HSL for vapour intrusion.

3. Air exchange rate (refer to Section 4.4 of Application Document)

HSLs are based on air exchange rate (AER) of 0.6 h^{-1} for residential and 0.83 h^{-1} for commercial.

Careful justification may be required prior to changing AER. Consideration should be given to weather conditions, practice of leaving doors/windows open, or closed in climate controlled building. New buildings tend to be more air tight to comply with energy saving regulations.

For soil and groundwater, adjustment is linear with respect to AER.

For soil vapour, adjustment is variable depending on soil type and depth.

Refer to the charts in Appendix D to determine the adjustment factor.

4. Moisture content (refer to Section 4.5 of Application Document)

HSLs may be adjusted if moisture content in soil is significantly different from baseline HSLs. The baseline moisture contents used were (dry wt) for sand 8%, silt 22% and clay 20%. Moisture content should be representative of long-term moisture content and not short-term result from recent rain event. Also note that for a development with future building where no building currently exists, moisture contents on site may not be representative for the future state of the site.

HSL scaling factors for different land use/chemicals/soils are presented in Appendix C of the Application Document and may be applied as described in Section 4.5.

Step 7 – HSLs and adjustments (vapour intrusion) (cont.) Saturation/solubility limits (soil and groundwater HSLs only) Apply the adjustments to the HSLs for vapour intrusion by multiplying by the determined factors. After applying the adjustments to the HSLs, is the revised HSL greater than the solubility / saturation limit? → ☐ Y - Indicates that the predicted source concentration to produce an unacceptable vapour risk is higher than the saturation point. The revised HSL is not limiting to vapour (NL). Note this does not apply to soils with direct contact. ☒ X N - Revised HSL may be compared with measured source concentrations.	
Multi-Pathway Exposure 1. Is inclusion of direct contact with soils required? → ☐ Y - Repeat Step 6 with Adjusted Vapour Intrusion HSLs and Direct Contact HSLs ☒ X N - Proceed to Question 2 2. Is cross-scenario exposure required to be assessed? → ☐ Y - Repeat Step 6 with Adjusted Vapour Intrusion HSLs and Direct Contact HSLs ☒ X N - Proceed to 'Screening assessment'	
Screening assessment Is the adjusted HSL less than source concentration? → ☐ Y - Indicates potential health risk ☒ N - Considered within acceptable health risks. If cancer endpoint (benzene) may also need to assess cancer risk level and cumulative cancer risk in Step 8 Is the maximum soil, groundwater or soil-vapour concentration greater than the HSL by more than one or two orders of magnitude? → ☐ Y - Indicates potential acute risk around hotspot ☒ N - Considered within acceptable health risks If the screening assessment indicates the potential for unacceptable health risk, consideration may be given to further investigations such as further contamination delineation, site-specific health risk assessment or site management. Before deciding the appropriate form of action considerations should include: - The magnitude of HSL exceedance - The nature of the source - The time frame required for managing health risks - Other statutory requirements	

Step 8 – Cancer risk assessment Acceptable cancer risk (Refer to Section 5.1 of Application Document) HSLs for benzene have been based on 1×10^{-5} cancer risk. In some jurisdictions it may be required to assess carcinogenic risks based on 1×10^{-6} cancer risk. 1) The HSLs are linearly related to acceptable risk. HSLs based on a cancer risk of 1×10^{-6} may be calculated by dividing the HSLs in Appendix B by a factor of 10. 2) If the HSL is NL (vapour only HSL), it is possible that it may become limiting if the HSL is within a factor of 10 of the soil saturation concentration (or solubility limit for groundwater). 3) If soil or groundwater source concentration is less than an order of magnitude of the saturation concentration / solubility limit (in Appendix B), then even dividing the non-limiting HSL by 10 would result in an acceptable risk. Hence there is no need to proceed further. 4) If soil or groundwater source concentration is within an order of magnitude of the saturation concentration / solubility limit it is recommended to calculate the revised HSL from the non-limiting HSL. This process is outlined as follows: Calculating revised HSL for 10^{-6} cancer risk from non-limiting HSL: 1) The non-limiting HSLs are presented in Friebel & Nadebaum 2011 (Part 1). 2) The derived HSLs are presented in Appendix F. 3) Find the pages that correspond to the source type (soil, groundwater, soil vapour) for the given scenario (residential / commercial / recreational / intrusive maintenance). Note indicator chemicals and TPH have been separated. 4) For the corresponding soil category, depth and chemical, the Vapour Intrusion HSL and saturation/solubility concentration is presented in the columns on the right. 5) If this HSL is divided by 10 and the result is greater than Csat (for soil) or saturation limit (for groundwater), then the revised HSL is still NL. Otherwise the result is the revised Vapour HSL.	Cumulative cancer risk (Refer to Section 3.6.1 of Application Document) HSLs for benzene have been based on 1×10^{-5} cancer risk. In most jurisdictions it is required to assess total carcinogenic risks based on 1×10^{-5} cancer risk. If HSLs are not NL for benzene and another carcinogenic chemical is identified, such as PAHs, follow the procedure outlined in Section 3.6.1. The cumulative fraction may also be applied to more than two chemicals. Note that multiple sources should be considered. For example, a resident may be exposed through direct contact with PAHs in surface soil, but also benzene vapours from soil and groundwater. For vapour risk (benzene), the risk contribution should consider the greatest risk for the receptor from all vapour sources. Because multiple sources do not have an additive effect, the source with the greatest risk needs to be identified (refer to Section 3.5 for discussion on multiple vapour sources). This means that for all sources/depts the source concentration should be divided by their respective HSLs to calculate the benzene contribution to cumulative risk. The highest fraction determines which source poses the greatest risk to receptors. The same may be carried out for carcinogenic PAHs. The sum of the highest benzene fraction and the highest PAH fraction results in the highest possible cumulative fraction.

APPENDIX H

Glen Helen Discovery Park Groundwater Monitoring Event – May 2023 Sampling and Analysis Quality Plan (Tierra Environment Pty Ltd, 2023)





**Glen Helen Discovery Park
Groundwater Monitoring Event -
May 2023
Sampling and Analysis Quality Plan**

Prepared for
Ngurratjuta/Pmara Ntjarra Aboriginal
Corporation

11 May 2023

Tierra Environment Pty Ltd
ABN 84 111 615 680

PO Box 815
Mitcham SA 5062
08 8373 2512
general@tierra.com.au

**Glen Helen Discovery Park
Groundwater Monitoring Event - May 2023
Sampling and Analysis Quality Plan**

Prepared for
Ngurratjuta/Pmara Ntjarra Aboriginal Corporation

11 May 2023

Document Status

	Name	Signature	Date
Approved for Issue ☒	Prepared by <u>Daryl Burrows</u>		<u>11/05/2023</u>
Revision <u>A</u>	Reviewed by <u>Lauren Harvey</u>		<u>11/05/2023</u>

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APPENDIX A

SITE PLAN

APPENDIX B

DATA QUALITY INDICATORS

1 INTRODUCTION

1.1 General

This Sampling and Analysis Quality Plan (SAQP) has been prepared by Terra Environment on behalf of Ngurratjuta/Pmara Ntjarra Aboriginal Corporation ICN for groundwater investigations in the vicinity of two underground storage tanks (UST). The aim of these investigations is to develop the wells on site and investigate the quality and contamination status of the groundwater.

1.2 Site Definition

The site subject to investigation comprises of the following:

Description	Glen Helen Discovery Park
Address	8495 Namatjira Drive, Mount Zeil
Area	71,800m ²
Certificate of Title	CUFT 849 Folio 156
Plan Reference	Survey Plan A 000315 NT Por 830
Council	MacDonnell Regional Council
Zoning	No Zone
Owners	G'day Group Pty Ltd

A plan of the site is provided in Appendix A.

General site information is presented in Section 2.1.

1.3 Background

The following assessment reports for the site are available:

- Glen Helen Groundwater Investigation West MacDonnells National Park 1991-1995 – Power and Water, Water Resources Branch May 1996.
- Discovery Parks Glen Helen Lodge Preliminary Site Investigation for Fuel Leakage from UPSSs Low Ecological Services February 2021.
- Glen Helen Lodge Ngurratjuta/Pmara Ntjarra Aboriginal Corporation Underground Petroleum Storage System's Fuel Contamination Detailed Site Investigation (DSI) – Low Ecological Services December 2021. Note this seems to be an uncompleted draft version of the March 2022 report.
- Glen Helen Discovery Parks Fuel Contamination from Underground Petroleum Storage System: Investigation and Remediation Report Low Ecological Services March 2022.
- Glen Helen Lodge Discovery Parks Fuel Contamination from Underground Petroleum Storage System: A Progress Update Report January 2023 – Low Ecological Services.

Steve Kirsanovs of Kirs Environmental has been engaged as the site contamination auditor. The scope of work and this SAQP will be submitted to the Auditor for review and comment and if required revision prior to commencing works.

1.4 Objectives

This SAQP has been prepared for the implementation of groundwater well development and an additional groundwater monitoring event.

The SAQP is prepared to ensure that the groundwater investigation works for the site are undertaken in accordance with the Amended National Environment Protection (Assessment of Site Contamination) Measure 1999, Schedule B2, Section 5 ("Systematic planning for collection of environmental data").

The SAQP specifies the proposed sampling and analytical testing program and nominates Data Quality Objectives (DQO) and Indicators (DQI) to quantify the precision, accuracy, representativeness, completeness and comparability of the analytical results. The SAQP has been developed with reference to the "7-Step" process outlined in Amended ASC NEPM Schedule B2, Appendix B.

1.5 Dissemination of Information

The following will be implemented to ensure that the content of this SAQP will be available to all relevant staff and stakeholders:

- Endorsement for this SAQP will be sought from the site contamination auditor.
- This SAQP will be read and understood by all field staff prior to works commencing on-site.
- A copy of the document will be retained on site by Terra staff throughout the field investigations.

1.6 Communications and Workers Health and Safety

The following will be implemented:

- Field staff will carry a mobile phone for communication.
- The field team will carry a first aid kit.
- A Safe Work Method Statement will be prepared for use by site staff.
- Any accident or incident involving or observed by project staff during the course of the investigation will be reported immediately to the site owner or its representative.

1.7 Limitations Applying to the Proposed Investigations

The following limitations may apply:

- Access to wells – Recent earthworks at the site may have covered or destroyed the wells.
- Access to groundwater – Fluctuations of groundwater level in wells may inhibit the purging and sampling activities.

2 STATUS AND BACKGROUND INFORMATION

2.1 Current Site Conditions

Based on a review of available aerial photography and provided information the following can be noted about the site.

- The site is located on the inner bend of the Finke River with gently rolling hills to the north and steeper ridge lines to the south across the Finke River.
- The site is used for park style accommodation (Discovery Park) with bar and restaurant, motel and hostel style rooms and camp sites.
- Where the tank sites and groundwater wells are located is unsealed carpark and access road which has been recently improved (earthworks undertaken).
- 150m to the north is water treatment ponds.

2.2 Previous Environmental Investigations

2.2.1 Low Ecological Services 2021 PSI

A Preliminary Site Investigation for the site was prepared in February 2021.

A summary of key findings of the PSI are as follows:

- Contamination Extent – There is fuel contamination of soil immediately surrounding both underground systems down to a rocky layer or bedrock at approximately 3m. Lab results indicate that fuel in the soil surrounding the tanks is at sufficient concentration to potentially pose an ecological risk in this area of ecological significance.
- Vapour intrusion – Vapour intrusion risk is not of concern in public open spaces such as the area around the fuel systems, carpark and lawns.
- Direct contact – Surface contamination was only observed in the immediate vicinity of the bowzers so there is limited opportunity for direct contact with contaminated soil in this case.
- Groundwater – Local groundwater was not encountered in any of the hand auger sample holes at the site. More investigation is required to understand if local groundwater has been contaminated. Groundwater extraction for drinking water is from bores approximately 1070m northeast upgradient of the fuel systems.
- Ecological Considerations – The site is surrounded by the West MacDonnell National Park and adjacent to the Finke River and Glen Helen Gorge and waterhole. The site is in an area of ecological significance with sensitive ecological receptors nearby. Given the setting, the potential ecological risks are perhaps of most concern.
- Ecological Screening Levels (ESLs) for contaminated soil are generally applicable to the top 2m of soil profile, however greater depths should be considered in arid areas such as Glen Helen (NEPM 2013). Hydrocarbon concentrations in all soil samples analysed by the laboratory were such that NEPM ESLs were exceeded for all samples.
- Conclusion – There is fuel contamination of soil immediately surrounding both underground fuel tank systems down to a rocky layer or bedrock at approximately 3m. Lab results indicate that fuel in the soil surrounding the tanks is at sufficient concentration to potentially pose an ecological risk in this area of ecological significance. There are minimal risks to human health from the contaminated soils due to the open location.

2.2.2 Power and Water, Water Resources Branch 1996 Groundwater Report

This report was commissioned to assess water quality and aquifer yields in the vicinity of the park prior to its construction. The assessed water would ultimately be used as a supply to the park. Key findings are as follows:

- Shallow groundwater and surface water supplies associated with the Finke River in this area are invariably non-potable and are not considered a viable resource.
- From the drilling at the Living Area approximately 8 km east of Glen Helen and the results from bores RN 6146 and RN 12021, it was hypothesised that no potable groundwater was present north of the ridgeline which runs in an east-west direction immediately south of the resort.
- It can be seen that, in the Goyder Formation at least, the groundwater gradients slope towards the waterhole, from both the west and east. The siting and design of the resort infrastructure should recognise that the Finke River is the lowest point in the system, is a discharge zone and acts as a sink in the local area.
- From the hydrochemistry of the different waterholes and from the water levels of the Goyder Formation (Figure 5) it appears that the surface water in the Glen Helen area is, to some degree at least dependent on, and connected with the groundwater contained in the aquifers of the different formations. It is beyond the scope of this report to undertake further comment on the relationship between the groundwater and surface water apart from stating that there is a connection.

2.2.3 Low Ecological Services December 2021 DSI Report

This report appears to be an uncompleted draft version of the March 2022 report, refer Section 2.2.4.

2.2.4 Low Ecological Services March 2022 Investigation and Remediation Report

Key findings of this report are as follows:

- Ngurratjuta Aboriginal Corporation commissioned Territory Electrical and Refrigeration (Territory Electrical) to examine the fuel system for leaks in February 2021. This resulted in Low Ecological Services (LES) being engaged by Territory Electrical to undertake a Preliminary Site Investigation (PSI) of fuel contamination in the soil surrounding the UPSS. The PSI showed hydrocarbon contaminated soils by use of minimally invasive hand auguring around the underground tanks.
- Phase 2 of the DSI with the drilling rig, found bedrock was less than 3.5 mbgl, no water table was present, a levy bank (likely based on rock) formed a geological gully around the tank pits, fuel contaminated soil was localized to the diesel and Opal fuel tank pits and immediate surrounds and the contamination did not extend to drill hole sample points, which were drilled down to bedrock, located 6 m to 90 m downslope of the UST pit area, along the natural drainage line.
- Due to the ecological sensitivity of the area, in July 2021, the NT EPA issued a s48 Notice requiring the investigations, remediation and validation works to be completed under an environmental audit program under the relevant provisions of the Waste Management and Pollution Control Act 1998.
- The WMS soil vapour results indicated that there is no vapour intrusion risk to people occupying the nearby buildings or to invasive maintenance workers and the groundwater sample analysis detected no levels of hydrocarbons above LOR indicating that the hydrocarbon contamination had not migrated into the Finke River.
- The diesel and petrol pits were lined and backfilled with clean imported soil. A perforated vent pipe system, designed by LES and agreed upon by Mr Kirsanovs (Auditor), was installed in both pits to increase aeration and natural remediation of the soil at the bottom of the pits.
- The findings from each phase of this investigation prove that the migration of hydrocarbon contamination off site is not occurring. There is no evidence of contamination beyond the pits, all proximal soil and water samples were uncontaminated. The source of the fuel leak has been removed, pits have been lined, the consistent layer of bedrock at ~2.7 mbgl and the clay soils will limit further migration of the residual hydrocarbon contamination. Hence the ecological risk is negligible. Furthermore, there is no risk to human health from the residual in-situ contaminated soil in the open car park area in which the tank pits are located, given the contaminated soil is deeper than 1.2 m below the ground surface.

- Thus, the findings of this investigation show that the lateral and vertical extent of the residual localized contamination will not pose a risk to human health, the environment, or management of the site, given that the current and proposed medium-term future use of this area within the site as a carpark and lawn area as agreed upon by the new land owners, Discovery Parks.

2.2.5 Low Ecological Services January 2023 Update Report

This report appears to be an uncompleted draft version. A summary of the key points from the draft report is provided below. It should be noted that the final version of this report should be reviewed once its completed.

A review of the draft report found:

- LES installed 4 groundwater monitoring wells in May 2022.
- Soil samples were collected during the drilling of the wells and analysed for TRH, BTEX and metals. Concentrations of TRH were detected in soil sample MW1-6m. TRH was not detected in the lower sample for this well (MW1-10m).
- Groundwater monitoring was undertaken on 11 November 2002 however due to the recent placement of gravel in the area only well MW1 could be found.
- During the site visit on the 11 November sheen was observed on the surface of the Finke River. Black soil in the river was also observed. A sample of the soil was collected and analysed for metals, TRH and BTEX. Results for TRH and BTEX were less than the limits of reporting.
- LES returned to the site on the 15 November and found all four wells. All wells were subsequently sampled and samples analysed for TRH and BTEX. All wells reported concentrations of TRH above the limits of detection with the highest concentrations reported in MW4. BTEX was also detected in MW2 and MW4.
- Another round of monitoring was undertaken in December 2022. Approximately 80L to 100L were bailed from the wells (assuming collectively) before the wells were left to recover and sampled.
- Concentrations of TRH and BTEX were less than the limits of reporting in MW1 and MW3 while concentrations of TRH and BTEX were detected in MW2 and MW4.
- The report concluded that additional development of the wells should be undertaken, sampling should be undertaken using hydra-sleeves and that monitoring should continue biannually (one event in wet season and one in dry season) for the next three years.

3 SAMPLING, ANALYSIS AND DATA QUALITY OBJECTIVES

3.1 General

The DQO process is used to define the type, quantity and quality of data needed to support decisions relating to the environmental condition of a site. It provides a systematic approach for defining the criteria that a data collection design should satisfy, including when, where and how to collect samples or measurements; determination of tolerable decision error rates; and the number of samples or measurements that should be collected.

This plan has been prepared to clearly document the requirements of the assessment program including:

- quantitative DQOs - including sample location numbers, sample collection frequency, sample analysis frequencies and QA/QC requirements
- a plan to achieve pre-determined DQOs - through describing the site sampling program and procedures, nominated investigation criteria and screening levels
- procedures to be undertaken if the data does not meet the expected DQOs to still achieve the project outcomes

The objective of the investigation for the site is to provide information to allow:

- a comparison to ANZG and ADWG criteria based selected environmental values as per the method detailed in Part 5 Division 2 of the Victorian Government Gazette No S245 dated May 2021
- a comparison to NEPM HSLs to assess the risk of vapour intrusion

The objectives of this SAQP are to provide a detailed description of the key site investigation requirements to be undertaken in order to meet the overall project objective, in accordance with Northern Territory legislative and Amended ASC NEPM guideline requirements, the latter specifically relating to the preparation and implementation of a SAQP.

3.2 Step 1 – State the Problem

As part of a due diligence assessment two underground fuel tanks were identified as having potentially leaked. Further investigations (soil, soil vapour and groundwater) were undertaken and fuel contamination was identified in the soil in the vicinity of the fuel tanks. While TRH and BTEX were previously detected in groundwater wells MW2 and MW4 the current status of the groundwater is currently undetermined as the groundwater wells have not been properly developed which can have an impact on the representativeness of collected water samples. In addition as the wells have not been surveyed groundwater flow direction has not been established. While the flow is likely to be towards the nearby Finke River the aquifer (based on preliminary logs of material) may be a fracture rock aquifer and as such flow is not necessarily consistent with the topography like in an alluvial aquifer. Establishing the reduced water levels in wells is needed to determine the flow direction of the aquifer.

3.3 Step 2 – Identify the Decision

The decision will be to assess whether the known hydrocarbon soil contamination in the vicinity of the fuel tanks has resulted in impacts to groundwater. The comparison of results against the screening criteria will form part of that decision process.

Groundwater investigation results are considered required to allow a comparison against, ANZG and ADWG criteria for protected environmental values as specified in Section 3.4.5.

Relevant guidelines to be used as part of the assessment will include:

- Northern Territory of Australia Water Act 1992
- Northern Territory of Australia Water Regulations 1992
- Northern Territory of Australia Waste Management and Pollution Control Act 1998
- Victoria Government Gazette No. S 245

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2018 (ANZG)
- Australian Drinking Water Guidelines 2011 (ADWG)
- Amended National Environment Protection (Assessment of Site Contamination) Measure 1999
- AS5667.1-1998: Water quality – Sampling, Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples
- AS5667.11-1998: Water quality – Sampling, Guidance on sampling of groundwaters

3.4 Step 3 – Identify Inputs into the Decision

The inputs required to make the decision stated in Step 2 are identified in the DQO process and include:

- Consideration of the site's history
- Consideration of the results of previous site investigations
- Collection of groundwater samples and lab analyses
- Consideration of the site's current condition
- Consideration of the site's future use

3.4.1 Investigation scope considerations

The following considerations apply:

- The scope of investigations is limited to the uppermost groundwater aquifer in the vicinity of the UST's.
- The monitoring event will be limited to existing groundwater wells at the site in the vicinity of the UST's.
- All operational wells will be surveyed for height and position.
- All operational wells will be developed by means of a combination of a disposable bailer and surging the bailer and a tubing with a footvalve and surging¹. This will be undertaken until the sediment load in the recovered water significantly decreases (this is typically a minimum of at least 3 well volumes but often more).
- There will be a one day equilibration period between development and purging and sampling.
- All operational wells will be gauged prior to purging and sampling.
- All operational wells will be purged until field parameters become stable or a well runs dry (although the latter is not desirable).
- All operational wells will be assessed for groundwater sheen, odours and free product (the latter by using an interface probe).
- All operational wells will be sampled for laboratory analysis (refer to Section 3.8.2 for the laboratory program).

3.4.2 Laboratory analysis methodology

Analysis of primary samples, intra-laboratory samples, rinsate, field blank and trip blank samples will be conducted by Eurofins. Analyses of inter-laboratory samples will be undertaken by Envirolab Services. The laboratories hold National Association of Testing Authorities (NATA) registration for the parameters listed in the following table:

¹ Wells with a large water column (nominally 3m or more) are typically best developed with tubing and footvalve as the tubing can reach the bottom of the well where as a bailer often can not. Bailer tend to be more efficient at surging the well and loosening sediment in the gravel pack annulus. The method used will be determined on site by an experienced environmental scientist and may depending on the conditions be a combination of both methods.

Parameter	Analytical Method	Limits of Reporting (mg/L unless otherwise stated)
Metals (Pb)	Eurofins: USEPA 6020A	0.001
	Envirolab: APHA 3120 USEPA 200.8, USEPA 3005A (prep), USEPA 6020A)	0.001
TRH	Eurofins: LTM-ORG-2010 TRH C6-C40	0.02-0.1
	Envirolab: USEPA 8020A, 8260, 8000	0.05-0.1
BTEXN	Eurofins: USEPA 8260	0.001
	Envirolab: USEPA 8260	0.001
MTBE	Eurofins: USEPA 8260	0.001
	Envirolab: USEPA 8260	0.001

3.4.3 Internal laboratory quality control

Internal laboratory quality control will include the following: reagent blanks, method blanks, matrix spikes, matrix spike duplicates, surrogate spikes, reference materials and laboratory control samples (refer also to the Amended ASC NEPM, Schedule B3).

3.4.4 Quality assurance/quality control

- Analysis of 1 intra laboratory and 1 inter laboratory duplicate and 1 rinsate for TPH, BTEXN, MTBE and lead.
- Analysis of 1 trip blank sample for BTEXN.

3.4.5 Assessment criteria

Acceptance criteria will be selected based on the environmental values (EVs) applicable to the site.

The NT contaminated Land Guideline (section 11.5) requires that environmental audits be completed in accordance with the State where the Auditor is accredited, in this case Victoria. On this basis the selection of the EVs was undertaken as per the method detailed in Part 5 Division 2 of the Victorian Government Gazette No S245 dated May 2021. The document specifies that EVs should be based on the TDS (Table 5.3) and then indicators and objectives are based on selected EVs (Table 5.4).

Therefore for the Glen Helen site TDS was based on the TDS level in one of the wells on site and reported TDS levels of nearby production wells which ranged from 1,220ppm to 3,200ppm. Based on this Groundwater Segment B with a TDS range of 1,201mg/L – 3,100mg/L was selected as the most representative. For Segment B the following environmental values apply:

- Water dependent ecosystems and species
- Potable mineral water supply
- Irrigation
- Stock Watering
- Industrial and commercial use
- Primary contact recreation
- Traditional Owner cultural values
- Buildings and structures
- Geothermal properties

Based on the selected environmental values and in consideration of the limited scope of analysis (analysing for lead, TRH, BTEXN, MTBE), groundwater results will be compared to the following indicators as specified in Table 5.4:

- Aquatic ecosystems default guideline values for 99% species protection for freshwater from the 2018 Australian and New Zealand Guidelines for Fresh & Marine Water Quality (ANZG)
- Health and aesthetic guideline values provided in Table 10.6 of the 2011 Australian Drinking Water Guidelines (ADWG)

Results will be compared to the lowest recognised criterion for each analyte (shown in bold in the results summary table).

For a Tier 1 risk assessment of vapour intrusion, health screening levels are provided in Schedule B1 of the ASC NEPM. The health screening levels (HSLs) considered most appropriate is "Groundwater HSL for Vapour Intrusion, HSL A/B, 8m+, Clay Soils", on the basis of the most conservative soil type, the land use scenario and the depth to groundwater.

3.4.6 Presence of LNAPL

During well gauging a Solinst 122 Interface Meter will be used to check for the presence of LNAPL in each well. Where LNAPL is detected the thickness will be determined and the well will not be sampled. In addition during purging and sampling recovered water will be inspected for the presence of LNAPL.

3.4.7 Presence of odour and sheen

During purging and sampling activities the purged water will be observed for the presence of odour and sheen.

3.5 Step 4 – Define the Study Boundaries

The site is defined on the plan provided in Appendix A.

3.6 Step 5 – Develop a Decision Rule

The results of the groundwater analytical testing will be compared to adopted assessment criteria.

Data Quality Objectives (DQOs) for the site will be in accordance with the Amended ASC NEPM.

Data Quality Indicators (DQIs) to be adopted to assess the precision, accuracy, documentation, completeness, representativeness and comparability of the data are summarised in Appendix B.

3.7 Step 6 – Specify Limits on Decision Errors

3.7.1 General

To validate the quality and quantity of both the field and laboratory data being used in the decision making process, Quality Assurance/Quality Control (QA/QC) objectives have been developed. QA/QC procedures will be implemented in accordance with Australian Standard AS4482.1.

The accepted probability of making a Type II error (false negative) for this investigation has been set at 5%.

3.7.2 Decision error protocol

The decision error protocols adopted for the QA/QC program are as identified in Appendix B.

3.7.3 Rectifying non-conformances

Where non-conformances in the decision error protocols are identified the reason for the non-conformance will be investigated and clearly identified within the assessment report. The discussion will also state whether the identified non-conformance is likely to impact the quality of the data obtained for the investigation of the site.

Where a non-conformance is reported by the analytical laboratories, the laboratory will be contacted to identify the reason for the non-conformance and affected samples may be re-analysed to ensure the representativeness of the results.

In the event that the stated level of confidence in the decision cannot be achieved (in this case 95%) during the hypothesis testing approach, additional collection of samples and/or analysis of additional samples may

be required. Any recommended additional works would be outlined in a proposal to be considered for approval by the Client.

3.7.4 Laboratory analytical procedures

Laboratories used for the investigation will be NATA accredited and will use NATA endorsed analytical methods (where available).

3.8 Step 7 – Optimise the Design for Obtaining Data

The condition of the wells and the site will be reviewed prior to sampling and during gauging to ensure the most appropriate sampling technique is used and to identify sampling constraints (if any) posed by site conditions. At this stage the proposed method is using a low follow bladder pump with dedicated twin tubing and dedicated disposal bladder for each well.

3.8.1 Sampling methodology

The sampling methodology to be adopted for the investigation will be undertaken in accordance with the Amended ASC NEPM. A brief description of the proposed methodology is provided in Section 3.8.6 of this report.

3.8.2 Sampling pattern, frequency and analysis

Samples will be collected from the 4 groundwater wells MW1, MW2, MW3 and MW4. A plan showing the locations of the groundwater wells is presented in Appendix A.

Field parameters will be measures as follows:

- pH, conductivity, redox, temperature, dissolved oxygen

The proposed laboratory scope is as follows:

- Analysis of samples from MW1 to MW4 for TRH, BTEXN, MTBE, lead

3.8.3 Sampling team

The Project Team will include the following members and responsibilities as outlined below.

Role	Team Member	Contact Details
Client Contact	Amy Driver	08 8951 1911 amyd@ngur.com.au
Reporting Manager	Daryl Burrows	0402 097 295 daryl@tierra.com.au
Project Manager and Client Liaison	Daryl Burrows	0402 097 295 daryl@tierra.com.au
Peer Review	Tom Dolling	08 8373 2512 tom@tierra.com.au
Field Program Manager and OH&S Manager	Daryl Burrows	0402 097 295 daryl@tierra.com.au
Field Team	Daryl Burrows/ Lauren Harvey (if Daryl is unavailable)	08 8373 2512
Reporting	Daryl Burrows/ Lauren Harvey	08 8373 2512

3.8.4 Field instrument calibration and maintenance

The water quality meter used during purging activities will be sourced from Kennards. The unit will be calibrated by Kennards prior to issue.

3.8.5 Field data and record keeping

Sampling sheets will be completed in the field and contain information regarding the depth to groundwater, weather, purging method and equipment, litres purged, temperature, dissolved oxygen concentration, conductivity, pH, redox, appearance of the water and other information or observations made.

Groundwater well locations will be placed on a plan and contours from groundwater gauging data will be generated.

3.8.6 Sample collection and preservation

Sampling will be undertaken in accordance with Schedule B2 of the ASC NEPM.

The primary laboratory will supply appropriate sample bottles for the type of analysis that is to be undertaken. Bottles will be labelled prior to going on site. Sample bottles for individual wells will be removed from the site vehicle immediately after purging and prior to sampling. Bottles will be labelled with the appropriate location designation.

The hydraulic characteristics at the site are not currently known. It has been assumed that laminar flow and therefore low flow is able to be achieved in the wells during the monitoring event. If this is not the case in any particular well the well will be purged with drawdown until either the field readings are stable or the well runs dry. In the event the well runs dry the well will be left until the water level has recovered to at least 75% of its original level and then sampled.

During this event groundwater wells are to be purged and sampled using a low flow bladder pump.

All wells will be purged prior to sampling until dissolved oxygen, redox potential, conductivity, pH and temperature readings, measured in the field using a multi parameter water quality meter, have stabilised. Purged water will be stored in 200L drums and disposed of at a licenced liquid waste facility.

3.8.7 Sample preservation and transport

Samples will be stored in an esky with ice prior to transportation to the laboratory to ensure that acceptable storage conditions are achieved as relevant to the type of analyses to be undertaken. Samples will be shipped to the laboratory within 48 hours of sampling under Chain of Custody documentation.

3.8.8 Decontamination

Disposable gloves will be worn during all sampling activities to prevent contact with potentially toxic compounds and changed between samples to prevent cross contamination.

A new disposable bladder pump and dedicated twin tubing will be used for each well to minimise the potential for cross contamination.

The Solinst Interface meter used during groundwater gauging and the body of the bladder pump will be decontaminated by washing in detergent (e.g. Decon 90) and water and subsequent rinsing with water prior to the commencement of field work, between each groundwater well and at the completion of field work. This will be undertaken to minimise the potential for cross contamination of samples. The water quality meter will not be decontaminated as it will be located after the sampling position and as such sampled water will not come in contact with the meter.

3.8.9 Reporting

A report will be prepared based on reporting guidelines in the Amended ASC NEPM.

APPENDIX A
SITE PLAN



Notes:

1. Groundwater well locations and the extent of the former tank pits are approximate based on plan provided by Low Ecological Services.

MW1

Groundwater Well

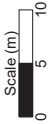


Figure 1 - Site Plan and Sampling Locations
Glen Helen Discovery Park
Groundwater Monitoring Event - May 2023
Sampling & Analysis Quality Plan
Rev A, 11 May 2023

APPENDIX B
DATA QUALITY INDICATORS

Glen Helen Discovery Park
Groundwater Monitoring Event - May 2023

DQI - Completeness A measure of the amount of useable data (expressed as %) from a data collection activity			
Field considerations	Laboratory considerations	Comments	Completeness DQIs adopted for this program
All critical locations sampled All samples collected SOPs appropriate and complied with Experienced sampler Documentation correct	All critical samples analysed according to SAQP All analytes analysed according to SAQP Appropriate methods and PQLs Sample documentation complete Sample holding times complied with	The required percentage completeness should be specified in the SAQP. All required data must be obtained for critical samples and chemicals of concern. Incompleteness is influenced by: - field performance problems (access problems, difficulties on site, damage) - laboratory performance problems (matrix interference, invalid holding times) - matrix problems	- All field work to be completed in accordance with the SAQP. Where this cannot be achieved, alternative sampling approaches / locations will be undertaken where possible. An acceptance level of 95% has been considered appropriate. - Samples to be collected from each well - Field engineer / scientist to be adequately experienced/trained in each task to be undertaken or supervised by an adequately experienced/trained person - Field sampling sheets to be completed - Samples to be analysed within laboratory specified holding times - Primary and secondary laboratory methods are as listed in the SAQP
DQI - Comparability The confidence (expressed qualitatively) that data may be considered to be equivalent for each sampling and analytical event			
Field considerations	Laboratory considerations	Comments	Comparability DQIs adopted for this program
Same SOPs used on each occasion Experienced sampler Climatic conditions (temperature, rainfall, wind, ...)	Sample analytical methods used (including clean-up) Sample PQLs (justify/quantify if different) Same laboratories (justify/quantify if different) Same units (justify/quantify if different)	Same approach to sampling (SOPs, holding times...) Quantify influence from climatic or physical conditions Samples collected, preserved, handled in same manner (filtered, same containers)	- Field work to be completed in accordance with the SAQP - Field engineer / scientist to be adequately experienced/trained in each task to be undertaken or supervised by an adequately experienced/trained person - Groundwater samples to be collected using the same method, i.e. low flow bladder pump - Refer SAQP for primary laboratory methods - Same media to be reported with same units (mg/L or ug/L for water) - Samples to be stored in laboratory supplied containers, in a chilled cool box and transported to laboratory under chain of custody documentation

Glen Helen Discovery Park
Groundwater Monitoring Event - May 2023

DQI - Representativeness The confidence (expressed qualitatively) that data are representative of each media present on the site			
Field considerations	Laboratory considerations	Comments	Representativeness DQIs adopted for this program
Appropriate media sampled according to SAQP All media identified in SAQP sampled	All samples analysed according to SAQP	Samples must be collected to reflect the characteristics of each media Sample analyses must reflect properties of field samples Homogeneity of the samples Appropriate collection, handling, storage and preservation Detection of laboratory artefacts, e.g. contamination blanks	- Groundwater only to be sampled as specified in the SAQP - Groundwater samples to be collected in accordance with AS4482.1 in appropriately preserved bottles and stored in chilled cool box for transport to the laboratory to minimise volatile losses - Refer accuracy (bias) for laboratory blank info
DQI - Precision A quantitative measure of the variability (or reproducibility) of data			
Field considerations	Laboratory considerations	Comments	Precision DQIs adopted for this program
SOPs appropriate and complied with	Analysis of: - laboratory and interlaboratory duplicates - field duplicates - laboratory-prepared volatile trip spikes	Measured by the coefficient of variance or standard deviation of the mean or by RPDs Field duplicates measure field and laboratory precision Laboratory duplicates measure analytical precision	- All field work to be completed in accordance with the SAQP. - Field duplicates (inter and intra laboratory) to be collected and analysed as indicated in the SAQP. RPDs to be calculated for inter and intra laboratory duplicates, with the objective of all RPDs calculated being 0% to 50% for concentrations 10 to 30 times the limits of reporting and 0% to 30% for concentrations 30 times greater than the limits of reporting. Where exceedances greater than these tolerances occur, the reason for the high RPD value will be investigated and further action will be taken if necessary. These reasons may be related to low sample concentrations where a small actual difference in concentration results in a large RPD value, in which case no further action will be required. - Laboratory internal QC to include duplicate samples for each analyte and will conform with the following: - Surrogate spike recoveries to be between the laboratories stated criteria (varies per analytes); - Matrix spike recoveries to be between the laboratories stated criteria (varies per analytes); - Contaminants below detection limits for field blank samples and rinsate and trip blank samples; - Matrix duplicate/laboratory duplicate RPDs to be less than 30%.

Glen Helen Discovery Park
Groundwater Monitoring Event - May 2023

DQI - Accuracy (bias) A quantitative measure of the closeness of reported data to the true value			
Field considerations	Laboratory considerations	Comments	Accuracy (bias) DQIs adopted for this program
SOPs appropriate and complied with	Analysis of: • field blanks • rinsate blanks • reagent blanks • method blanks • matrix spikes • matrix spike duplicates • surrogate spikes • reference materials • laboratory control samples	Bias introduced: • by chemicals during handling or transport • from contaminated equipment • from contaminated reagents • during laboratory analysis • during laboratory preparation and analysis (may be high or low) • precision of preparation and analytical method	■ All field work to be completed in accordance with this SAQP. ■ Laboratories to be National Association of Testing Authorities (NATA) accredited for the analyses performed (where available) ■ The frequency of duplicate, trip blank, and rinsate sampling and testing will be as listed in the SAQP. ■ Laboratory internal QC to include as outlined in NEPM Schedule B(3): ○ reagent blanks ○ method blanks ○ matrix spikes ○ matrix spike duplicates ○ surrogate spikes ○ reference materials ○ laboratory control samples

APPENDIX I

Groundwater Monitoring Event May 2023 (Tierra Environment Pty Ltd, June 2023)





**Glen Helen Discovery Park
Groundwater Monitoring Event
May 2023**

Prepared for
Ngurratjuta/Pmara Ntjarra Aboriginal
Corporation

7 July 2023

Tierra Environment Pty Ltd
ABN 84 111 615 680

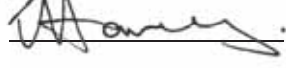
PO Box 815
Mitcham SA 5062
08 8373 2512
general@tierra.com.au

**Glen Helen Discovery Park
Groundwater Monitoring Event
May 2023**

Prepared for
Ngurratjuta/Pmara Ntjarra Aboriginal Corporation

7 July 2023

Document Status

	Name	Signature	Date
Approved for Issue ☒	Prepared by <u>Daryl Burrows</u>		<u>07/07/2023</u>
Revision <u>A</u>	Reviewed by <u>Lauren Harvey</u>		<u>07/07/2023</u>

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GROUNDWATER GAUGING AND PURGING RECORDS

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RESULTS SUMMARY TABLES

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APPENDIX F

LABORATORY REPORTS

1 INTRODUCTION

1.1 General

This report has been prepared by Terra Environment Pty Ltd (Terra) for the Ngurratjuta/Pmara Ntjarra Aboriginal Corporation (NPNAC). It documents the development, sampling and analytical analyses of three existing groundwater wells and the sampling and analytical analyses of two surface water samples at and in the vicinity of the Glen Helen Discovery Park. A plan showing the location of the site is provided as Figure 1 in Appendix A.

1.2 Site Details

The site subject to investigation comprises of the following:

Description	Glen Helen Discovery Park
Address	8495 Namatjira Drive Mount Zeil
Area	71,800m ²
Certificate of Title	CUFT Volume 849 Folio 156
Plan Reference	NT POR 830
Council	MacDonnell Regional Council
Zoning	No Zone
Owners	G'DAY Group Holdings

The area subject to investigations consisted of the site as detailed above and two sampling locations (up-stream and down-stream of the now removed fuel tank locations) within the Finke River to the west and south of the site.

1.3 Background & Previous Investigations

The Glen Helen Discovery Park is currently owned by the G'DAY Group Holdings, the umbrella company for Discovery Parks. Prior to their ownership the site was owned by NPNAC. Before Discovery Parks purchased the site they undertook due diligence investigations at the site. This initially constituted what was referred to by Low Ecological Services (LES – who undertook the work) as a “high level environmental due diligence inspection of the Glen Helen Lodge”. From this, two underground storage tanks were identified and because of their age they were flagged as a risk. To address this Discovery Parks commissioned LES to undertake a preliminary site investigation (PSI) which then triggered further investigations and remedial works as detailed below:

Discovery Parks Glen Helen Lodge Preliminary Site Investigation for Fuel Leakage from UPSSs, 25 February 2021 – Low Ecological Services

The scope of work of this investigation was as follows:

- Desktop review to understand the site environment context and fuel systems history.
- Determine the locations of underground fuel storage tanks and infrastructure on the site.
- Sample soils adjacent and beneath the two underground fuel tanks and collect soil samples at various depths down to below the base of the tanks.
- Test all soil samples on-site for the presence of fuel vapours using a portable photo ionisation detector (PID).
- Select representative soil samples based on location, depth, and PID vapour concentrations and have them laboratory analysed for the presence of hydrocarbons and heavy metals.
- Report on the findings of the above.

LES concluded that there is fuel contamination of soil in the immediate vicinity of both UST's down to a rocky layer at approximately three metres. LES concluded that the results,

"indicate that fuel in the soil surrounding the tanks is at sufficient concentration to potentially pose an ecological risk in this area of ecological significance. There are minimal risks to human health from the contaminated soils due to the open location."

From this LES recommended,

"Additional sampling and testing is required to determine the lateral and vertical extents of contamination from both underground fuel systems to assess the risks that the contamination poses, and develop a remediation or management strategy."

Glen Helen Lodge Ngurratjuta/Pmara Ntjarra Aboriginal Corporation Underground Petroleum Storage System's Fuel Contamination Detailed Site Investigation (DSI), 8 December 2021 – Low Ecological Services

To resolve the fuel contamination risks prior to settlement of the property sale NPNAC contracted Territory Electrical to remove the UST's and the associated infrastructure and for LES to further delineate the extent and nature of contamination. The following scope of work was undertaken:

- Desktop review to understand the site environment context and fuel systems history.
- Sample soil from the walls and base of each of the fuel tank pits after removal of the fuel systems.
- Sample soil excavated from the pits and stockpiled during tank removal works.
- Sample soils from the greater perimeter of the two (2) underground fuel tanks at various distances and depths to determine the extent of fuel migration from the source.
- Test all soil samples on-site for the presence of fuel vapours using a portable PID.
- Select representative soil samples based on location, depth, and PID vapour concentrations and have them laboratory analysed for the presence of hydrocarbons and heavy metals.
- Remove all contaminated excavated soil from site.
- Sample and analyse excavated soil to determine level of contamination.
- Dispose of excavated soil appropriately (TRH > 1000mg/kg = Adelaide Cleanaway, TRH < 1000mg/kg = Alice Springs Landfill).
- Backfill tank pits with clean imported material and install perforated vent pipes for aeration purposes.
- Deploy 6 passive diffusion samplers in 1.5m deep soil bores in varying locations around the backfilled tank pits and nearby buildings and have the samples analysed by the laboratory to confirm there is not a vapour risk for buildings.
- Sample shallow groundwater adjacent to the Finke River and have the samples analysed by the laboratory to confirm hydrocarbons have not migrated to the Finke River waterhole.
- Assess the risks of identified contamination and consider remediation options.
- Report on the findings of the above.

LES concluded the following:

- Migration of hydrocarbon contamination off site is not occurring.
- There is no evidence of contamination beyond the pits.
- The source of the fuel leak has been removed.
- The consistent layer of bedrock at ~2.7 mbgl and the clay soils will limit further migration of the residual hydrocarbon contamination. Hence the ecological risk is negligible.
- There is no risk to human health from the residual in-situ contaminated soil in the open car park area in which the tank pits are located. This was confirmed in the soil vapour sampler results having low vapour readings that would not pose health risks to persons inside nearby buildings.

- The lateral and vertical extent of the residual localized contamination will not pose a risk to human health, the environment, or management of the site, given that the current and proposed medium-term future use of this area within the site as a carpark and lawn area.

Glen Helen Lodge Discovery Parks Fuel Contamination from Underground Petroleum Storage System: Investigation and Remediation Report, March 2022 – Low Ecological Services

Key findings of this report are as follows:

- Ngurratjuta Aboriginal Corporation commissioned Territory Electrical and Refrigeration (Territory Electrical) to examine the fuel system for leaks in February 2021. This resulted in Low Ecological Services (LES) being engaged by Territory Electrical to undertake a Preliminary Site Investigation (PSI) of fuel contamination in the soil surrounding the UPSS. The PSI showed hydrocarbon contaminated soils by use of minimally invasive hand auguring around the underground tanks.
- Phase 2 of the DSI with the drilling rig, found bedrock was less than 3.5 mbgl, no water table was present, a levy bank (likely based on rock) formed a geological gully around the tank pits, fuel contaminated soil was localized to the diesel and Opal fuel tank pits and immediate surrounds and the contamination did not extend to drill hole sample points, which were drilled down to bedrock, located 6m to 90m downslope of the UST pit area, along the natural drainage line.
- Due to the ecological sensitivity of the area, in July 2021, the NT EPA issued a s48 Notice requiring the investigations, remediation and validation works to be completed under an environmental audit program under the relevant provisions of the Waste Management and Pollution Control Act 1998.
- The WMS soil vapour results indicated that there is no vapour intrusion risk to people occupying the nearby buildings or to invasive maintenance workers and the groundwater sample analysis detected no levels of hydrocarbons above LOR indicating that the hydrocarbon contamination had not migrated into the Finke River.
- The diesel and petrol pits were lined and backfilled with clean imported soil. A perforated vent pipe system, designed by LES and agreed upon by Mr Kirsanovs (Auditor), was installed in both pits to increase aeration and natural remediation of the soil at the bottom of the pits.
- The findings from each phase of this investigation prove that the migration of hydrocarbon contamination off site is not occurring. There is no evidence of contamination beyond the pits, all proximal soil and water samples were uncontaminated. The source of the fuel leak has been removed, pits have been lined, the consistent layer of bedrock at ~2.7 mbgl and the clay soils will limit further migration of the residual hydrocarbon contamination. Hence the ecological risk is negligible. Furthermore, there is no risk to human health from the residual in-situ contaminated soil in the open car park area in which the tank pits are located, given the contaminated soil is deeper than 1.2 m below the ground surface.
- Thus, the findings of this investigation show that the lateral and vertical extent of the residual localized contamination will not pose a risk to human health, the environment, or management of the site, given that the current and proposed medium-term future use of this area within the site as a carpark and lawn area as agreed upon by the new land owners, Discovery Parks.

Glen Helen Lodge Discovery Parks Fuel Contamination from Underground Petroleum Storage System: A Progress Update Report, January 2023 – Low Ecological Services

This report appears to be an uncompleted draft version. A summary of the key points from the draft report is provided below. It should be noted that the final version of this report should be reviewed once its completed.

A review of the draft report found:

- LES installed 4 groundwater monitoring wells in May 2022.

- Soil samples were collected during the drilling of the wells and analysed for TRH, BTEX and metals. Concentrations of TRH were detected in soil sample MW1-6m. TRH was not detected in the lower sample for this well (MW1-10m).
- Groundwater monitoring was undertaken on 11 November 2002 however due to the recent placement of gravel in the area only well MW1 could be found.
- During the site visit on the 11 November sheen was observed on the surface of the Finke River. Black soil in the river was also observed. A sample of the soil was collected and analysed for metals, TRH and BTEX. Results for TRH and BTEX were less than the limits of reporting.
- LES returned to the site on the 15 November and found all four wells. All wells were subsequently sampled and samples analysed for TRH and BTEX. All wells reported concentrations of TRH above the limits of detection with the highest concentrations reported in MW4. BTEX was also detected in MW2 and MW4.
- Another round of monitoring was undertaken in December 2022. Approximately 80L to 100L were bailed from the wells (assuming collectively) before the wells were left to recover and sampled.
- Concentrations of TRH and BTEX were less than the limits of reporting in MW1 and MW3 while concentrations of TRH and BTEX were detected in MW2 and MW4.
- The report concluded that additional development of the wells should be undertaken, sampling should be undertaken using hydra-sleeves and that monitoring should continue biannually (one event in wet season and one in dry season) for the next three years.

1.4 Objectives

The objective of the investigation for the site is to provide information to allow:

- a comparison to ANZG and ADWG criteria based selected environmental values as per the method detailed in Part 5 Division 2 of the Victorian Government Gazette No S245 dated May 2021
- a comparison to NEPM HSLs to assess the risk of vapour intrusion

1.5 Scope of Works

The scope of work that was proposed (based on the clients and Auditor's requirements) prior to inspecting the site was as follows:

Development, Sampling and Survey

- Preparation of a sampling analytical quality plan and submission to the auditor for approval prior to commencement of field works
- Gauging of wells prior to development
- Development of wells (with bailers including surging of the water column so as to agitate the well annulus and remove sediments) and collection of waste water in drums for later disposal
- Equilibration period of one day (i.e. no sampling of wells) after development for wells to recover
- Purging of wells by low flow sampling technique until field parameters (pH, conductivity, temperature, redox and dissolved oxygen) stabilise
- Collection of samples from wells immediately after purging is complete
- Collection of intra-laboratory duplicate, inter-laboratory duplicate, rinsate (from pump housing, the only re-useable piece of equipment) and field blank and trip blank
- Analysis of all primary samples, duplicate samples, rinsate and field blank for TPH, BTEXN, MTBE, lead.
- Analysis of trip blank sample for BTEXN

In addition the wells were surveyed by a licenced surveyor to enable an approximate flow direction to be obtained.

At the completion of the investigation all waste water from development and purging was sent to a liquid waste disposal facility in Alice Springs for treatment and disposal.

Revisions to Scope

Upon arriving on site the work undertaken was required to be altered for the following reasons. Mitigation measures are discussed as relevant:

- The groundwater wells were not exposed at the surface, they were buried under gravel and had to be located by digging (only three of the four could be found).
- Only one well was found on day 1 and we could not be sure if additional wells would be located so in discussion with the Auditor's representative 2 creek water samples were added to the scope of investigations.
- The 1 day equilibration period on day 2 could not be applied as day 2 was dedicated to finding the buried wells. Two more were found and developed on this day.
- The standing water level in the wells were significantly higher than as indicated in previous investigations.
- The higher standing water level and the sediment load within the wells could not be removed adequately with bailer development and as Waterra tubing and foot valves were on hand they were used to successfully remove the sediment load.

1.6 Relevant Standards and Guidelines

Groundwater investigations were undertaken based on the following documents:

- Northern Territory of Australia Water Act 1992
- Northern Territory of Australia Water Regulations 1992
- Northern Territory of Australia Waste Management and Pollution Control Act 1998
- Victoria Government Gazette No. S 245
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2018 (ANZG)
- Australian Drinking Water Guidelines 2011 (ADWG)
- Amended National Environment Protection (Assessment of Site Contamination) Measure 1999
- AS5667.1-1998: Water quality – Sampling, Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples
- AS5667.11-1998: Water quality – Sampling, Guidance on sampling of groundwaters

2 INVESTIGATION METHODOLOGY

2.1 Groundwater Well Development

Due to recent earth works at the site gravel was placed in the carpark where the wells were located resulting in them being buried. Reference points and offsets were not measured as part of the previous investigations and as a result the only way the wells could be located was by using past photographs and digging for them. Three wells were located over day 1 (29th May) and day 2 (30th May), fully uncovered and developed as detailed below.

The standing water levels were expected to be between 13m and 19m below the surface based on previous investigations and subsequently development with bailers was proposed. However as the water levels were actually between 5m and 6m below the surface indicating a water column in the well of between approximately 9m and 14m, Waterra tubing and foot valves were used for development which was more appropriate for this length of water column and available liquid waste storage.

The following records of development were recorded:

Well	Depth to Water (m bgl)	Depth to sediment at Start (m bgl)	Depth to sediment at completion (m bgl)	Volume of water/ sediment removed (L)	Comments
MW1	6.158	12.5	18.55	115	Significant sediment load was removed from this well and it was difficult to develop as initially the bailer marble then the foot valve marble regularly jammed due to sand.
MW3	5.984	9.6	12.7	80	This well is recorded as 15m deep in the installation report however at 12.7m the extracted water was relatively free of sediment and the bottom felt hard when the Waterra tube hit it. Well is possibly of the order of 12.7m deep.
MW4	5.244	13.5	17.8	70	First 10L was dark grey and had a rotten odour, then quickly went to dark tan then tan with no rotten odour, there was a slight 'muddy' odour. Sediment load was not as significant in this well.

During development fuel odours and sheen were not observed. The odour in the first 10L of MW4 was a rotten odour similar to rotting organic matter and not fuel or decomposed fuel.

2.2 Well Status

The status of the wells as of 31 May 2023 was as follows:

Groundwater Well	Status
MW1	Operational
MW2	Not located
MW3	Operational
MW4	Operational

2.3 Well Gauging, Purging and Sampling

Gauging, purging and sampling of groundwater wells was undertaken by an experienced environmental scientist on 31 May 2023.

A Solinst 122 Oil/Water Interface Meter was used to gauge the depth to groundwater and to investigate the presence of light non-aqueous phase liquid (LNAPL). No LNAPL was observed during gauging. Groundwater gauging records are provided in Appendix B.

Groundwater purging and sampling was initially undertaken after gauging activities using a low flow bladder pump, twin tubing (air and return water), a QED controller and a disposable bladder for well MW4. The pump casing was cleaned with Decon 90 and rinsed with demineralised water prior to use and between each location. MW3 was commenced with the low flow sampling equipment however the new pump had not been filled with compressor oil by the supplier and the motor seized approximately 1.5L into commencement on MW3. Purging and sampling was switched to bailer for MW3 and MW1.

During the low flow sampling of MW4 the groundwater levels were monitored and the flow rate of the pump adjusted up or down to ensure low flow was achieved. Bailing of MW1 and MW3 was undertaken to minimise agitation, the bailer was lowered into the water rather than dropped and allowed to sink into the water column rather than raising and dropping (like is done when developing with a bailer). Wells were purged under both methods until dissolved oxygen, redox potential, conductivity, pH and temperature readings, measured in the field using a YSI Pro Plus multifunctional water quality meter, had stabilised. The meter was calibrated by the supplier prior to use. A calibration certificate is provided in Appendix E. Groundwater well purging records are provided in Appendix B.

After the completion of purging activities samples were taken from the wells. Prior to going on site sample bottles had been labelled with groundwater well designations. Appropriate sampling bottles were used, and all samples were stored in an esky with ice prior to transportation to the laboratory to ensure that appropriate storage conditions were achieved as relevant to the type of analyses to be undertaken.

2.4 Surface Water Sampling

Surface water sampling was undertaken by bailer. A bailer was tethered with a thin cord and cast into the creek and allowed to sink. Once the bailer sunk it was retrieved with the cord and decanted into appropriate sampling bottles and stored in an esky with ice prior to transportation to the laboratory. Field parameters (dissolved oxygen, redox potential, conductivity, pH and temperature) were recorded using a YSI Pro Plus multifunctional water quality meter.

2.5 Quality Control Sampling

Quality control sampling was undertaken as provided in the following table.

Type of quality sample	Number of samples
Intra Laboratory Duplicate	1 sample
Inter Laboratory Duplicate	1 sample
Rinsate Samples	1 sample
Field Blank Samples	1 sample
Trip Blank Samples	1 sample

The procedure for collecting quality samples was the same as for normal samples. The rinsate sample was collected from the pump casing by pouring demineralised water supplied by the secondary laboratory into the pump casing and then into the rinsate bottles.

2.6 Tracking of Samples

Tracking of samples was undertaken using Chain of Custody (COC) documentation. COCs were sent to the laboratories with instructions for the analyses required. The laboratories checked the condition and number

of samples and signed and returned signed COCs to confirm the receipt of samples. Copies of COCs are provided in Appendix F.

2.7 Analytical Testing

Analyses of primary samples, intra-laboratory samples, rinsate, field blank and trip blank samples were conducted by Eurofins. Analysis of inter-laboratory samples were undertaken by Envirolab Services. The laboratories hold National Association of Testing Authorities (NATA) registration for the parameters listed in the following table:

Parameter	Analytical Method	Limits of Reporting	Number of Samples
Lead	Eurofins: LTM-MET-3040 Metals in Waters by ICP-MS	0.001	5+ (1+1+1+0)
	Envirolab: METALS-022 by ICP-MS-ORS	various	(1)
TRH	Eurofins: LM-LTM-ORG2010 TRH C6-C40	0.1, 0.02, 0.05	5+ (1+1+1+0)
	Envirolab: P&T / GC-MS / GC-FID, USEPA 8020A, 8260, 8000	0.01, 0.05, 0.1	(1)
BTEX	Eurofins: LTM-ORG-2010 BTEX and Volatile TRH	0.001, 0.002, 0.003	5+ (1+1+1+1)
	Envirolab: P&T / GC-MS, USEPA 8260B	0.001, 0.002	(1)
MTBE	Eurofins: LTM-ORG-2150 VOCs in Soils Liquid and other Aqueous Matrices (USEPA 8260)	0.001	5+ (1+1+1+0)
	Envirolab: P&T / GC-MS, USEPA 8260B	0.001	(1)

Notes:

- Units are in mg/L unless otherwise stated
- Quality in the table (within brackets) refers to Eurofins intra-laboratory duplicate, rinsate, field blank and trip blank samples respectively and Envirolabs inter-laboratory duplicate sample

3 QUALITY ASSESSMENT

Tierra Environment conducts investigations in accordance with the principles of quality assurance and quality control (QA/QC). The Tierra QA/QC principles include:

- use of established procedures and suitably qualified field personnel for environmental sampling
- documentation of chain-of-custody and sample handling and storage
- use of NATA registered laboratories (where possible)
- use of intra and inter laboratory field duplicates samples and rinsate, field blank, trip blank or trip spike samples

Quality of investigation outputs is maintained by ensuring:

- all staff are appropriately trained
- safety standards are defined and implemented
- good housekeeping practices are adopted during all phases of the investigation
- complete records of fieldwork, samples and data are maintained

Specific quality control procedures conducted for this investigation include:

- the use of appropriate sample collection and handling procedures
- the use of appropriately skilled and experienced personnel
- the application of decontamination procedures where appropriate to minimise cross contamination
- the extraction and analysis within appropriate handling times
- the use of an independent, NATA accredited laboratory for analysis (where possible)
- the collection and analysis of quality samples, e.g. blind duplicates, split duplicates, and internal laboratory duplicates, rinsate, field blank, trip blank and matrix spike/matrix spike duplicates

Based on the QA/QC information listed in this report in Appendix D, the results are considered to be of an appropriate standard and it is concluded that:

- field investigation and sample preservation methods are appropriate for the investigations reported
- the analytical methods used for site assessment are of appropriate precision and accuracy, and that the sensitivity and selectivity of the analytical methods are appropriate for the assessment of risks
- the precision and accuracy criteria set out in the QA/QC plan, for a given method and matrix, meet the performance expected of the reference method
- the quality of data supplied by the analytical laboratory meets the objectives of the testing laboratory's quality plan for blanks, spikes, control samples, laboratory duplicates and holding times

4 ACCEPTANCE CRITERIA

Acceptance criteria were selected based on the environmental values (EVs) applicable to the site.

The NT Contaminated Land Guideline (section 11.5) requires that environmental audits be completed in accordance with the State where the Auditor is accredited, in this case Victoria. On this basis the selection of the EVs was undertaken as per the method detailed in Part 5 Division 2 of the Victorian Government Gazette No S245 dated May 2021. The document specifies that EVs should be based on the TDS (Table 5.3) and then indicators and objectives are based on selected EVs (Table 5.4).

Therefore for the Glen Helen site TDS was based on the TDS level in one of the wells on site and reported TDS levels of nearby production wells which ranged from 1,220ppm to 3,200ppm. Based on this Groundwater Segment B with a TDS range of 1,201mg/L – 3,100mg/L was selected as the most representative. For Segment B the following environmental values apply:

- Water dependent ecosystems and species
- Potable mineral water supply
- Irrigation
- Stock Watering
- Industrial and commercial use
- Primary contact recreation
- Traditional Owner cultural values
- Buildings and structures
- Geothermal properties

Based on the selected environmental values and in consideration of the limited scope of analysis (analysis for lead, TRH, BTEXN and MTBE only), groundwater results were compared to the following indicators as specified in Table 5.4:

- Aquatic ecosystems default guideline values for 99% species protection for freshwater from the 2018 Australian and New Zealand Guidelines for Fresh & Marine Water Quality (ANZG)
- Health and aesthetic guideline values provided in Table 10.6 of the 2011 Australian Drinking Water Guidelines (ADWG)

For a Tier 1 risk assessment of vapour intrusion, health screening levels are provided in Schedule B1 of the ASC NEPM. The health screening levels (HSLs) considered most appropriate is "Groundwater HSL for Vapour Intrusion, HSL A/B, 4m to <8m, sand soils", on the basis of the most conservative soil type, the land use scenario and the depth to groundwater.

5 INVESTIGATION RESULTS

5.1 Field Observations

Records of groundwater gauging and purging of wells are presented in Appendix B. In summary the following water quality parameters were recorded after purging of groundwater and after sample collection of surface water:

Well	MW1	MW3	MW4	FR1	FR2
Permit Number	-	-	-	-	-
Depth to water	6.13m	5.98m	5.26m	-	-
pH	6.8	6.6	6.7	6.8	7.1
Conductivity ($\mu\text{S/cm}$)	4,605	4,160	3,748	4,441	4,330
Dissolved oxygen (mg/L)	1.0	0.9	2.6	11.4	9.0
Redox (mV)	-131	-132	-146	-108	-68
Odour	None	Muddy	Muddy	None	None
Discolouration	None	None	None	None	None
LNAPL	None	None	None	None	None

Based on the depths to water and survey results reduced water levels were calculated and groundwater contours were generated (refer Figure 2 in Appendix A). The groundwater contours indicate flow is to the south, south-west towards the Finkel River approximately 100m to the south. This is consistent with what would be expected for alluvial sediments in such close proximity to a water way.

5.2 Analytical Findings

Results for the analytes described in this section are presented in Appendix C. Original laboratory reports are presented in Appendix F.

TRH, BTEX and MTBE was not detected in any of the groundwater wells.

Lead was detected in MW1, MW3 and MW4 at concentrations of 0.01mg/L, 0.056mg/L and 0.002mg/L respectively exceeding ANZG 99% freshwater criteria of 0.001mg/L. MW3 also exceeded ADWG criteria of 0.01mg/L.

Surface water samples collected from the Finkel River returned results below the limits of reporting for all analytes.

5.3 Results Comparison

The 2023 groundwater results were compared to previous results obtained by LES in November 2022 and December 2022.

In November 2022 TRH was detected in all wells¹ while TRH was only detected in MW2 and MW4 in December 2022². No TRH was detected above the limits of reporting in May 2023.

A table with current and historical concentrations is provided in Appendix C.

¹ It should be noted that the groundwater wells were not developed after installation and before the sampling event in November.

² A summary table or laboratory report of the December 2022 results was not available for review therefore comparison is based on the discussion provided in the LES report.

6 CONCEPTUAL SITE MODEL

6.1 General

As summarised in Schedule B2 of the NEPM, a conceptual site model (CSM) is a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors.

The CSM identifies complete and potential pathways between known or potential sources and receptors.

Where the pathway between a source and a receptor is incomplete, the exposure to chemical substances via that pathway cannot occur. The following preliminary CSM forms the basis for assessing the risk related to potential source – pathway – receptor linkages.

6.2 Chemicals of Potential Concern and Potential Sources

Previous investigations identified that fuel had leaked from an underground storage system resulting in petroleum hydrocarbons present in the groundwater. An additional round of groundwater monitoring was undertaken by Terra after redeveloping the wells. Based on the analytical findings of the latest round of groundwater monitoring the following chemicals of potential concern (COPC) were identified:

PCA	COPC	Mobility/ Persistence	Potential Location	Potential Media
Presence of an underground storage tank	Lead	Low mobility /high persistence	In the vicinity of the former USTs	Groundwater

6.3 Potential Receptors

The following significant receptors were identified on or in proximity of the site under consideration of the proposed use of the site for open space use and the identified sources:

Receptor	Detail	Location
Current site users	Members of the public	On or in proximity of the site
	Operational staff and maintenance workers	On or in proximity of the site
Finke River	-	Approximately 100m south of the former USTs

6.4 Potential Exposure Pathways

The fundamental concept of risk assessment is that there should be an exposure pathway linking the source of contamination and the exposed population. Where this linkage exists, an assessment of the nature and significance of the exposure pathway is required to determine the level of risk.

The following potential exposure pathway assessment was undertaken:

Receptors	Potential source	Exposure pathway assessment	Complete pathway	Comments
Members of the public	Lead	Dermal contact with groundwater	Unlikely	Wells are secured and groundwater unlikely to be accessed
Operational staff and maintenance workers		Dermal contact with groundwater and intake via direct ingestion of groundwater	Unlikely	Wells are secured and groundwater unlikely to be accessed

Receptors	Potential source	Exposure pathway assessment	Complete pathway	Comments
Finke River		Dermal contact with fresh water	No	Lead was not detected in the samples collected from the Finke River
		Discharge into the fresh water environment	Possible	It is not clear if lead is associated with the tanks or a naturally occurring variability based on available data

7 SUMMARY

Investigation objectives

The objective of the investigation for the site is to provide information to allow:

- a comparison to ANZG and ADWG criteria based selected environmental values as per the method detailed in Part 5 Division 2 of the Victorian Government Gazette No S245 dated May 2021
- a comparison to NEPM HSLs to assess the risk of vapour intrusion

Status of site contamination

Based on field and analytical results a summary of interpreted groundwater conditions below the site are as follows:

- Reduced water levels ranged from 623.91mAHD to 623.941mAHD.
- Local groundwater flow is generally to the south, south-west towards the Finke River approximately 100m to the south.
- LNAPL, discolouration, fuel odours and sheens were not observed in purged or sampled waters.
- Lead was detected in all wells above ANZG 99% freshwater criteria of 0.001mg/L. MW3 also exceeded ADWG criteria of 0.01mg/L.
- All other analytical results were below the limits of laboratory reporting and complied with acceptance criteria.

Risks to human health and the environment

The CSM identified that it is unlikely that a complete exposure pathway exists between the identified potential chemicals of concern and human receptors, assuming that groundwater is not extracted for use

Risks to the Finke River are expected to be unlikely as there appears to be only remnant concentrations of lead in the groundwater near the tank locations (now removed). As there has only been one sampling event where lead was analysed it is not clear if it is associated with the tanks or naturally occurring variability.

Recommendations

As part of the proposed works the development of a simple ongoing groundwater quality monitoring plan (GQMP) to cover monitoring of groundwater applicable to the regional climate and expected seasonal variation of groundwater conditions over a 12 month period will be prepared. This will be undertaken after the Auditor has reviewed this report and in consultation with the Auditor and his expectations. Based on the findings of this investigations key tasks beyond what was already proposed should include the following:

- Allocate 1 day to attempt to find the remaining well and if found develop it and include it in the sampling regime.
- Undertake repair of the surface completion of the wells to raise them to the surface and install a more substantial finish (steel gatic with concrete surround).
- Further investigation of lead concentrations including a time series of at least 3 rounds.
- Further monitoring to confirm that other chemicals remain below the limits of laboratory reporting.

The GQMP should be submitted to the Auditor for comment prior to its implementation.

8 LIMITATIONS OF USE

Site contamination is generally a product of man-made processes and therefore exhibits characteristics and properties that vary from place to place and can change with time. Contamination assessments involve gathering and assimilating limited facts about these characteristics and properties in order to better understand or predict the status of contamination on a particular site under certain conditions.

The facts reported and utilised in this document were obtained by inspection, excavation, sampling, testing, and other means of investigation or from the client. They are directly relevant only to the ground at the place where and time when an investigation was carried out.

Any interpretation or recommendation given in this report is based on judgment and experience and not on greater knowledge of the facts than the sources of information indicate. The interpretations and recommendations are opinions provided for the sole use by the Ngurratjuta/Pmara Ntjarra Aboriginal Corporation and in accordance with a specific brief.

Tierra Environment does not represent that the information or interpretation contained in this document addresses completely existing features such as surface and subsurface contamination, groundwater and geotechnical conditions or ground or contamination behaviour on a subject site or of particular materials.

The responsibility of Tierra Environment Pty Ltd is solely to the Ngurratjuta/Pmara Ntjarra Aboriginal Corporation. It is not intended that this document be relied upon by any third party other than a site contamination auditor appointed by the Ngurratjuta/Pmara Ntjarra Aboriginal Corporation to undertake a site contamination audit. Tierra Environment does not undertake any duty or accept any responsibility to any other parties who may rely upon this document.

APPENDIX A
FIGURES



Notes:

1. The extent of the former tank pits are approximate based on a plan provided by Low Ecological Services.
2. The position of MW1, MW3 and MW4 is based on a survey. The position of MW2 is approximate and based on a plan provided by Low Ecological Services.
3. Groundwater contours generated by Surfer software with a grid generated using triangulation with linear interpolation.

Figure 1 - Groundwater Well Locations
 Glen Helen Discovery Park
 Groundwater Monitoring Event - May 2023
 Rev A, 6 July 2023



1. The surface water sampling locations are approximate and based on field records.

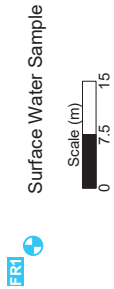


Figure 2 - Surface Water Sampling Locations
Glen Helen Discovery Park
Groundwater Monitoring Event - May 2023
Rev A, 7 July 2023

APPENDIX B
GROUNDWATER GAUGING AND PURGING RECORDS

Mount Helen Discovery Park
Groundwater Monitoring Event - May 2023

Summary of Groundwater Gauging



Well No.	Easting	Northing	Date	Well Depth (m)	Depth to Water (m)	Well Elevation (m AHD)	Groundwater Level (m AHD)	Metres of Water in Well (m)	Volume of Water Removed (L)	LNAPL Present / Thickness
MW1	262720.334	7378611.51	31/05/2023	19	6.134	630.044	623.910	12.87	60	No
MW2	-	-	-	15	-	-	-	-	-	-
MW3	262736.91	7378605.75	31/05/2023	15	5.979	629.898	623.919	9.02	60	No
MW4	262765.902	7378608.39	31/05/2023	19.5	5.258	629.199	623.941	14.24	12*	No

Notes: * Well purged using low flow

Time	Depth (m)	Purged (L)	Temp (°C)	DO (%)	DO (mg/L)	SPC (µs/cm)	Cond (µs/cm)	TDS (ppm)	pH	Redox (mV)	Appearance (colour, turbidity, odour, sheen)
-	-	0	27.7	5.6	0.44	4346	4567	-	7.08	-93.1	Very slightly tan, very slightly cloudy, no odour, no sheen
-	-	10	28.5	9.8	0.75	4332	4612	-	6.88	-120.4	Very slightly tan, very slightly cloudy, no odour, no sheen
-	-	20	28.5	13.1	1	4337	4604	-	6.82	-129.5	Very slightly tan, very slightly cloudy, no odour, no sheen
-	-	30	28.4	13.2	1.02	4338	4599	-	6.81	-129.4	Very slightly tan, very slightly cloudy, no odour, no sheen
-	-	40	28.4	13.1	1.02	4340	4600	-	6.8	-130.1	Very slightly tan, very slightly cloudy, no odour, no sheen
-	-	50	28.4	13.3	1.02	4340	4602	-	6.8	-130.3	Very slightly tan, very slightly cloudy, no odour, no sheen
-	-	60	28.4	13.3	1.01	4342	4605	-	6.8	-130.7	Very slightly tan, very slightly cloudy, no odour, no sheen
Sampled											
Purging should continue until measurements for pH are within 0.05 pH unit; conductivity within 3%; DO within 10%; Redox within 10mV and Temperature within 0.5 °C over three successive measurements											

Time	Depth (m)	Purged (L)	Temp (°C)	DO (%)	DO (mg/L)	SPC (µs/cm)	Cond (µs/cm)	TDS (ppm)	pH	Redox (mV)	Appearance (colour, turbidity, odour, sheen)
9:40	-	0	27.4	7	0.55	3565	3718	-	7.41	-58.3	Slightly tan, cloudy, muddy odour, no sheen
-	-	10	26.8	14	1.11	3115	3215	-	6.93	-106.3	Slightly tan, cloudy, slight muddy odour, no sheen
-	-	20	27.9	11.4	0.88	3698	3905	-	6.63	-126.5	Slightly tan, cloudy, slight muddy odour, no sheen
-	-	30	27.7	11.2	0.88	3918	4087	-	6.55	-127.5	Slightly tan, cloudy, slight muddy odour, no sheen
-	-	40	27.7	12.8	0.9	3958	4140	-	6.65	-129.3	Slightly tan, cloudy, slight muddy odour, no sheen
-	-	50	27.7	12.9	0.92	3980	4156	-	6.64	-130.7	Slightly tan, cloudy, slight muddy odour, no sheen
10:25	-	60	27.7	13.1	0.93	3985	4160	-	6.64	-131.9	Slightly tan, cloudy, slight muddy odour, no sheen
Sampled											

Purging should continue until measurements for pH are within 0.05 pH unit; conductivity within 3%; DO within 10%; Redox within 10mV and Temperature within 0.5 °C over three successive measurements

Groundwater Purging Record Sheet



Client: N/PN Aboriginal Corporation Project: Glen Helen GME Location: East side	Job no: ARZ 23 069.01 Date: 31/05/2023 Logged: DPB	Well No. MW4
Depth to Groundwater: 5.258m / 5.15m Weather: Fine & 6°C Purging Method: Low flow Purging Equipment: Start Time: 7:20am Finish Time:	Comments: No drawdown	

Time	Depth (m)	Purged (L)	Temp (°C)	DO (%)	DO (mg/L)	SPC (µs/cm)	Cond (µs/cm)	TDS (ppm)	pH	Redox (mV)	Appearance (colour, turbidity, odour, sheen)
7:30	5.16	0	19.2	30.4	2.78	3711	3282	-	7.42	12.6	tan, cloudy, slight rotten odour, no sheen
7:37	5.16	1	23.3	29.5	2.47	3747	3661	-	6.8	-57.6	tan, cloudy, slight rotten odour, no sheen
7:40	5.17	2	24.1	30.5	2.71	3750	3682	-	6.49	-80	tan, cloudy, slight muddy earthy odour, no sheen
7:44	5.17	3	24.2	25.5	2.11	3744	3683	-	6.43	-109.1	tan, cloudy, slight muddy earthy odour, no sheen
7:48	5.17	4	24.1	28.9	2.41	3756	3685	-	6.55	-117.5	tan, cloudy, slight muddy earthy odour, no sheen
7:53	5.17	5	24.1	32.8	2.61	3751	3690	-	6.52	-129.3	tan, slightly cloudy, slight muddy earthy odour, no sheen
7:56	5.17	6	24.7	31.6	2.52	3740	3730	-	6.61	-132.4	tan, slightly cloudy, slight muddy earthy odour, no sheen
8:01	5.17	7	24.7	33.7	2.72	3739	3731	-	6.65	-138.1	tan, slightly cloudy, slight muddy earthy odour, no sheen
8:05	5.17	8	24.8	30.8	2.49	3744	3714	-	6.68	-141	tan, slightly cloudy, slight muddy earthy odour, no sheen
8:09	5.17	9	24.8	31.3	2.55	3748	3738	-	6.68	-145.3	tan, slightly cloudy, slight muddy earthy odour, no sheen
8:14	5.17	10	25.1	31.3	2.58	3757	3744	-	6.66	-143.9	tan, slightly cloudy, slight muddy earthy odour, no sheen
8:18	5.17	11	25	31.5	2.61	3760	3746	-	6.66	-144.3	tan, slightly cloudy, slight muddy earthy odour, no sheen
8:22	5.17	12	25	31.6	2.61	3760	3748	-	6.66	-145.7	tan, slightly cloudy, slight muddy earthy odour, no sheen
Sampled											

Purging should continue until measurements for pH are within 0.05 pH unit, conductivity within 3%, DO within 10%, Redox within 10mV and Temperature within 0.5 °C over three successive measurements

Client: N/PN Aboriginal Corporation Project: Glen Helen GME Location: Finke River		Job no: ARZ 23 069.01 Date: 31/05/2023 Logged: DPB	Well No. FR1 & FR2
Depth to Groundwater: - Weather: Fine & Purging Method: Purging Equipment: Start Time: Finish Time:		Comments:	

[illegible]

APPENDIX C
RESULTS SUMMARY TABLES

2023 Sample Results

Glen Helen Discovery Park
Groundwater Monitoring Event - May 2023

	Metals	PAH	BTEX					TRH								Solvents					
		Naphthalene	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	C6-C10	C6-C10 less BTEX (F1)	C10-C16	C10-C16 less NAPHTHALENE (F2)	C16-C34	C34-C40	C10 - C40 (Sum of total)	C6 - C9	C10 - C14	C15 - C28	C29-C36	+C10 - C36 (Sum of total)	MTBE
	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
EQI	0.001	10	1	1	1	2	1	3	0.02	0.02	0.05	0.05	0.1	0.1	100	20	50	100	100	100	0.001
ADWG 2015 Aesthetic				3	25			20													
ADWG 2015 Health	0.01		1	300	800			600													
ANZG (2018) Freshwater 99%	0.001	2.5	600				200														
NEPM GW HSL A/B Vapour Intrusion, 4m-8m, Sand		NL	800	NL	NL			NL	1			1									

Location	Sample Date	mg/L	µg/L	mg/L	µg/L	mg/L	µg/L	mg/L	µg/L	mg/L	µg/L	mg/L	µg/L	mg/L	µg/L	mg/L	µg/L	mg/L	µg/L	mg/L	µg/L	mg/L	µg/L
FR1	31/05/2023	<0.001	<10	<1	<1	<1	<1	<1	<1	<3	<0.02	<0.02	<0.05	<0.05	<0.1	<0.1	<100	<20	<50	<100	<100	<100	<0.001
FR2	31/05/2023	<0.001	<10	<1	<1	<1	<1	<1	<1	<3	<0.02	<0.02	<0.05	<0.05	<0.1	<0.1	<100	<20	<50	<100	<100	<100	<0.001
MW1	31/05/2023	0.01	<10	<1	<1	<1	<1	<1	<1	<3	<0.02	<0.02	<0.05	<0.05	<0.1	<0.1	<100	<20	<50	<100	<100	<100	<0.001
MW3	31/05/2023	0.056	<10	<1	<1	<1	<1	<1	<1	<3	<0.02	<0.02	<0.05	<0.05	<0.1	<0.1	<100	<20	<50	<100	<100	<100	<0.001
MW4	31/05/2023	0.002	<10	<1	<1	<1	<1	<1	<1	<3	<0.02	<0.02	<0.05	<0.05	<0.1	<0.1	<100	<20	<50	<100	<100	<100	<0.001

	Metals	PAH	BTEX						TRH								Solvents										
			Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	C6-C10	C6-C10 less BTEX (F1)	C10-C16	C10-C16 less NAPHTHALENE (F2)	C16-C34	C34-C40	C10 - C40 (Sum of total)	C6 - C9	C10 - C14	C15 - C28	C29-C36	+C10 - C36 (Sum of total)	MTBE						
	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L							
EQUL	0.001	10	1	1	1	2	1	3	0.02	0.02	0.05	0.05	0.1	0.1	100	20	50	100	100	100	0.001						
ADWGG 2015 Aesthetic				3	25			20																			
ADWGG 2015 Health	0.01		1	300	800			600																			
ANZG (2018) Freshwater 99%	0.001	2.5	600				200																				
NEPM GW HSL A/B Vapour Intrusion, 4m-8m, Sand		NL	800	NL	NL			NL	1			1															
Location	Sample Date																										
MW1	15/11/2022	-	<5	<1	<2	<2	<2	<2	0.04	0.04	<0.1	<0.1	<0.1	<0.1	<100	40	<50	<100	<50	<50	-						
MW1	13/12/2022	-	<5	<1	<2	<2	<2	<2	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1	<20	<20	<50	<100	<50	<50	-						
MW1	31/05/2023	0.01	<10	<1	<2	<1	<3	<2	<0.02	<0.02	<0.05	<0.05	<0.1	<0.1	<100	<20	<50	<100	<100	<100	<0.001						
MW2	15/11/2022	-	6	4	2	<2	<2	<2	0.1	0.09	0.15	0.14	0.11	<100	0.26	110	140	110	<50	250	-						
MW2	13/12/2022	-	6	4	-	-	-	-	0.06	-	-	-	-	-	-	60	-	-	-	-	-						
MW2	31/05/2023								Not Located																		
MW3	15/11/2022	-	<5	<1	<2	<2	<2	<2	0.03	0.03	<0.1	<0.1	<0.1	<0.1	<0.1	30	<50	<100	<50	<50	-						
MW3	13/12/2022	-	<5	<1	<2	<2	<2	<2	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1	<20	<20	<50	<100	<50	<50	-						
MW3	31/05/2023	0.056	<10	<1	<2	<1	<3	<2	<0.02	<0.02	<0.05	<0.05	<0.1	<0.1	<100	<20	<50	<100	<100	<100	<0.001						
MW4	15/11/2022	-	<5	<1	<2	<2	<2	<2	0.73	0.73	<0.1	<0.1	<0.1	<0.1	<0.1	740	60	<100	<50	60	-						
MW4	13/12/2022	-	-	-	-	-	-	-	0.03	-	-	-	-	-	-	30	-	-	-	-	-						
MW4	31/05/2023	0.002	<10	<1	<2	<1	<3	<2	<0.02	<0.02	<0.05	<0.05	<0.1	<0.1	<100	<20	<50	<100	<100	<100	<0.001						

APPENDIX D
QA/QC ASSESSMENT

D.1 Field QA/QC Procedures

Field methodology

The field methodology described in Section 2 is considered appropriate and applicable to site conditions encountered during field works and groundwater characteristics reported by the laboratories.

Sample preservation

The primary laboratory supplied clean bottles for groundwater samples and rinsate and field blank samples. The bottles were labelled prior to field work based on a predetermined sampling program. On site the bottles were filled with water and stored in an esky with ice. At the end of the day samples were stored in a refrigerator if not sent to the laboratories. During transportation to the laboratories the samples were packed in eskies with ice and packaging to avoid damage.

Field Equipment Calibration

Kennards Hire provided a YSI Pro Plus multifunction water quality meter for use on 31 May 2023. Kennards calibrated the equipment prior to delivery. A copy of the calibration certificate is provided in Appendix E.

D.2 Data Quality Indicators

D.2.1 Completeness

Completeness is expressed as a percentage of usable data from a data collection activity. The following factors were considered and assessed:

Field and laboratory considerations	Achieved
All critical locations sampled	No, well MW2 could not be located
All samples collected (e.g. all available wells)	No, well MW2 could not be located
Standard operating practices (SOPs) listed in Section 2 - appropriate and complied with	Yes
Experienced field personnel utilised	Yes
Field documentation appropriate and complete	Yes
All critical samples analysed	Yes
All critical analytes analysed	Yes
Appropriate methods and practical quantitation limits (PQL)	Yes
Sample documentation complete	Yes
Sample holding times complied with	Yes

Completeness is influenced by field performance issues (e.g. access, site restrictions, damage to sampling infrastructure) and laboratory performance issues (e.g. matrix interference, holding times). A percentage completeness of 95% is considered acceptable. The above assessment indicates that the achieved percentage completeness is greater than 95%.

D.2.2 Comparability

Comparability is expressed qualitatively to indicate that data may be considered to be equivalent for each sampling and analytical event.

Field and laboratory considerations	Results
Same SOPs used on each occasion	Standard operating practices as listed in Section 2
Same sampling procedures	Yes, refer Section 2.3
Experienced sampler	Environmental scientist with 26 years experience
Climatic conditions (temperature, rainfall, wind)	No climatic influences
Same types of samples collected	Yes, specific laboratory prepared water bottles
Same analytical methods used (including clean-up)	Yes
Sample PQLs	Standard, see below
Same laboratories	Yes
Same units	Yes

Laboratory PQLs were above selected criteria for naphthalene.

D.2.3 Representativeness

Representativeness is expressed qualitatively to indicate that data is representative of each medium present on the site.

Field and laboratory considerations	Achieved
Appropriate media sampled according to field observations	Yes
All media identified during field work sampled	Yes
All samples analysed according to field observations	Yes
Samples were reasonably homogeneous	Yes

The above assessment indicates that data is representative of each medium encountered on the site.

D.2.4 Precision

Precision is a quantitative measure of the variability of data.

Field and laboratory considerations	Achieved
Standard operating procedure appropriate and complied with	Yes
Analysis of intra and inter laboratory duplicates	Yes
Analysis of laboratory duplicates	Yes, refer to Section 2.5

Duplicate samples were collected to provide an indication of the reliability of the sampling and analysis process. Duplicate groundwater samples were analysed for the majority of parameters. Duplicate sample results are presented in the quality assessment data provided at the end of this appendix.

Relative Percentage Differences (RPDs) for intra-laboratory (or field) and inter-laboratory duplicate samples were calculated and are presented at the end of this appendix.

All calculated RPDs were within the acceptable limits of 0% to 50% for concentrations 10 to 30 times the limits of reporting and 0% to 30% for concentrations 30 times greater than the limits of reporting.

The above assessment indicates that observed data variability (or reproducibility) is acceptable.

D.2.5 Accuracy

Accuracy is a quantitative measure of the closeness of reported data to the true value. Bias could be introduced by chemicals during collection/handling or transport, from contaminated equipment, from contaminated reagent, during laboratory analysis, during laboratory preparation or by the analytical method.

Field and laboratory considerations	Achieved
Standard operating procedure appropriate and complied with	Yes
Analysis of rinsates, field blanks and trip blanks	Yes
Analysis of laboratory method blanks, control samples, spike samples and duplicates	Yes, refer below
Analysis of laboratory prepared volatile trip spikes	No

Rinsate, field blank and trip blank samples were collected as follows:

Date	Rinsate collected from	Field blank collected	Trip blank used
31/05/23	Pump casing	Yes	Yes

The rinsate and field blank sample were analysed for TRH, BTEX, MTBE and lead. Results were below the limits of detection.

The trip blank sample was analysed for BTEX and results were below the limits of detection indicating cross contamination of volatile analytes did not occur between the samples.

Rinsate, field blank and trip blank results are provided at the end of this appendix.

During the analysis of samples, Eurofins conducted internal QA/QC procedures including the analysis of laboratory method blanks, control samples, spike samples and duplicates. Results of these QA/QC procedures complied with the laboratory's acceptance criteria as presented in its reports. Laboratory reports for method blanks, control samples, spike samples and duplicates are provided in Appendix F.

D.3 Field QA/QC

The following information on field QA/QC is provided.

Issue	Achieved
Replicate samples are split in the field and submitted to two separate laboratories in accordance with the requirements of NEPM Schedule B3	Yes, refer to Section 2.5
The sampling program includes assessment of all relevant environmental media, i.e. groundwater	Yes
Sample collection, handling and transportation procedures are documented and appropriate	Yes, refer to Section 2.2
Sampling is representative of site conditions, based on the selection of appropriate numbers of sampling points	Yes, refer to Section 2.2
Experienced field team members	Yes, refer to Section D.2.2
Sampling methods	Yes, refer to Sections 2.2
Evidence of appropriate decontamination procedures carried out between sampling events	Yes, refer to Section 2.2
Completed purging records for each well, showing time, location, initials of sampler, duplicate locations, duplicate type, site observations and weather conditions	Yes, refer to Appendix B

Issue	Achieved
Completed chain-of-custody documentation	Yes, refer to Appendix F
A statement of duplicate frequency for intra-laboratory and inter-laboratory duplicate samples, appropriate splitting techniques and duplicate sample results	Yes, refer to Section 2.5
Field blank results, background sample results, rinsate sample results, laboratory-prepared trip spike results for volatile analytes and trip blank results	Results presented in Appendix Background and trip spike samples were not collected.

D.4 Laboratory QA/QC

The following information on laboratory QA/QC is provided.

Issue	Achieved
Appropriate methodologies for each potential contaminant in the matrix in laboratories accredited for those analyses by NATA	Yes, refer to Section 2.7
Appropriate practical quantitation limits (PQLs) for the chemicals of concern for use in the assessment of risk	Yes, refer to Section 2.7
COCs, comparison of holding times, analytical methods, laboratory accreditation, laboratory performance	Yes, refer to Section D.2
Results of blind duplicate samples (intra laboratory duplicates)	Yes, refer Section D.2.4

D.5 QA/QC Discussion

Quality assurance and quality control was conducted based upon Tierra Environment's environmental investigation principles to ensure that data of known quality is reported. The required scope of sample numbers, analytical testing and quality testing was achieved. Specific aspects of the investigation used to achieve appropriate QA/QC results are summarised below:

Field Procedures	The investigations, including the collection of duplicates, are of a standard that provides confidence in the quality of the samples collected. Field procedures were undertaken in accordance with NEPM requirements and EPA guidelines.
Analytical Procedures	The laboratories used for analytical work are NATA registered for the analyses undertaken. The laboratories' internal QA/QC results indicate that analytical information provided by the laboratories is reliable.
Sample Tracking	Chain of Custody documentation was used for the transport of all samples to the laboratories.
Sample Preservation and Storage	Samples were placed in containers supplied by the laboratories and placed in chilled eskies for transport to the laboratories.
Sample Holding Times	The required holding times were adhered to.
Data Transcription	Summary tables were generated from laboratory supplied CSV files using ESDAT software.
Laboratory Limits of Reporting	Results below the laboratory's limits of reporting were also generally below acceptance criteria. The exceptions listed in Section D.2.2 are recognised.
Field Equipment Calibration	The field equipment used was appropriately calibrated.

Intra Laboratory Duplicate Sample	The primary laboratory's processes by which its results are obtained are generally considered to be acceptable in terms of the precision/repeatability of those results.
Inter Laboratory Duplicate Sample	The primary laboratory's processes by which its results are obtained are considered to be acceptable in terms of their accuracy of those results (i.e. in terms of how close the results are to their 'true' value).
Rinsate, Field Blank and Trip Blank Samples	Results indicate that the equipment used for the collection of samples did not impact on the results. Trip blank results show that cross contamination of volatiles did not occur.
Laboratory Internal Quality Control	Results obtained from laboratory internal quality control samples were within the acceptable limits of repeatability, chemical extraction and detection. Details of laboratory quality control measures are provided on laboratory certificates.

Based on the QA/QC information listed in this report, the results are considered to be of an appropriate standard and it is concluded that:

- field investigation and sample preservation methods are appropriate for the investigations reported
- the analytical methods used for site assessment are of appropriate precision and accuracy, and that the sensitivity and selectivity of the analytical methods are appropriate for the assessment of risks
- the precision and accuracy criteria set out in the QA/QC plan, for a given method and matrix, meet the performance expected of the reference method
- the quality of data supplied by the analytical laboratory meets the objectives of the testing laboratory's quality plan for blanks, spikes, control samples, laboratory duplicates and holding times



SDG		6/05/2023		6/05/2023		6/05/2023		Interlab_D	
Sample ID	Sample Date	MW1-A	MW1-X	RPD	MW1-A	MW1-X	RPD	MW1-Y	RPD
		31/05/2023	31/05/2023		31/05/2023	31/05/2023		31/05/2023	
ChemName	Units	EQL							
BTEX									
Benzene	µg/l								
Ethylbenzene	µg/l								
Toluene	µg/l								
Xylene (m & p)	µg/l								
Xylene (o)	µg/l								
Xylene Total	µg/l								
Metals									
Lead	mg/l								
PAH									
Naphthalene	µg/l								
Solvents									
MTBE	mg/l								
TPH									
C10-C16	mg/l								
C10-C16 less NAPHTHALENE (F2)	mg/l								
C16-C34	mg/l								
C34-C40	mg/l								
C6 - C9	µg/l								
C10 - C14	µg/l								
C15 - C28	µg/l								
C29-C36	µg/l								
+C10 - C36 (Sum of total)	µg/l								
C10 - C40 (Sum of total)	µg/l								
C6-C10 less BTEX (F1)	mg/l								
C6-C10	mg/l								

*RPDs have only been considered where a concentration is greater than 1 times the EQL.

**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 50 (10-30 x EQL); 30 (> 30 x EQL))

***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory



SDG	6/05/2023	6/05/2023	6/05/2023
Field_ID	2023053FB1	20230531R1	20230531TB1
Sampled_Date	31/05/2023	31/05/2023	
Sample_Type	Field_B	Rinsate	Trip_B

ChemName	Units	EQL		
BTEX				
Benzene	µg/l	1	<1	<1
Ethylbenzene	µg/l	1	<1	<1
Toluene	µg/l	1	<1	<1
Xylene (m & p)	µg/l	2	<2	<2
Xylene (o)	µg/l	1	<1	<1
Xylene Total	µg/l	3	<3	<3
Metals				
Lead	mg/l	0.001	<0.001	
PAH				
Naphthalene	µg/l	10	<10	<10
Solvents				
MTBE	mg/l	0.001	<0.001	
TPH				
C10-C16	mg/l	0.05	<0.05	<0.05
C10-C16 less NAPHTHALENE (F2)	mg/l	0.05	<0.05	<0.05
C16-C34	mg/l	0.1	<0.1	<0.1
C34-C40	mg/l	0.1	<0.1	<0.1
C6 - C9	µg/l	20	<20	<20
C10 - C14	µg/l	50	<50	<50
C15 - C28	µg/l	100	<100	<100
C29-C36	µg/l	100	<100	<100
+C10 - C36 (Sum of total)	µg/l	100	<100	<100
C10 - C40 (Sum of total)	µg/l	100	<100	<100
C6-C10 less BTEX (F1)	mg/l	0.02	<0.02	<0.02
C6-C10	mg/l	0.02	<0.02	<0.02

APPENDIX E
CALIBRATION CERTIFICATES

EQUIPMENT CERTIFICATION REPORT

PGN9003871 WATER QUALITY METER – MULTIFUNCTION (YSI PRO PLUS)

Plant Number: 1088645 Serial Number: 21H104243

SENSOR	CONCENTRATION	SPAN 1	SPAN 2	TRACEABILITY	PASS
pH	pH 7.00 / pH 4.00	7.00 pH	4.00 pH	330737 380327	☒
Conductivity	12.88 mS/cm	12.88 mS/cm		367757	☒
Dissolved Oxygen	Sodium Sulphite / Air	0.0% in Sodium Sulphite	% Saturation in Air	123302	☒
ORP	240mV @ 20°C	240mV	-	337308 338782	☒

Battery Status <u>76</u> %	Temperature <u>15.1</u> °C
Electrodes Cleaned and Checked	

Note: Calibration solution traceability information is available upon request.

Checked By: Indira Trezise Date: 24/5/23 Signed: [Signature]

Accessories List:

User's Manual	pH Sensor	Conductivity/ Temp Sensor
Dissolved Oxygen Sensor	Redox (ORP) Sensor	Flow Cell
User Guide	Stainless Steel Restrictor	Spare Batteries
Calibration Cup		



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EQUIPMENT CERTIFICATION REPORT

PGN9003842-9003846 - INTERFACE METER

Plant Number: 235242 Serial Number: 237559

Probe Length: 60cm

ITEM	TEST	PASS	COMMENTS
Battery	Compartment / Capacity	☒ 8.8v	9v
Probe	Clean / Operation	☒	
Earth Lead	Check if equipped	☒	
Tape Check	Cleaned / Checked for cuts	☒	
Function test	At surface level	☒	

Checked By: Dylan Buchanan Date: 24/05/23 Signed: [Signature]

Accessories List:

Interface Meter	Tape Guide	Decon 90 Solution
Brush	Spare 9v Battery	Transport Box



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APPENDIX F
LABORATORY REPORTS

CHAIN OF CUSTODY RECORD



CLIENT DETAILS

Page 1 of 1

mg1

Company Name : Tierra Environment	Contact Name : Daryl Burrows	Purchase Order : NA	COC Number : T1904
Office Address : 570 Goodwood Rd Daw Park 5041	Project Manager : Daryl Burrows	Project Number : ARZ 23 069.01	QUOTE ID : 230526TIES
	Email for results : general@tierra.com.au	Project Name : Glen Helen	Esdat

Special Directions & Comments :		Analytes		Laboratory Address	
48 Hr Turnaround		Eurofins - Melbourne		6 Monterey Road, Dandenong South, VIC 3175	
				Phone: 03 8584 5000	
				Fax: 03 8564 5090	
				Email: EnviroSampleVic@eurofins.com	

	Sample ID	Date	Media	Containers						Sample Comments	
				500P	250A	50P	250A	VIAL	125mL A		
1	NW1-A	31-May-23	Water					3			
2	NW1-X	31-May-23	Water					3			
3	NW3-A	31-May-23	Water					3			
4	NW4-A	31-May-23	Water					3			
5	FR1-A	31-May-23	Water					3			
6	FR2-A	31-May-23	Water					3			
7	20230531R1	31-May-23	Water					3			
8	20230531FB1	31-May-23	Water					3			
9	20230531TB1	31-May-23	Water					3			
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											

Relinquished By: Daryl Burrows		Laboratory Staff Adelaide		Laboratory Staff Melbourne		Turn around Time		Method Of Shipment	
Date & Time : 31/05/23 2pm		Received By: Daryl Burrows		Received By: Daryl Burrows		24 Hrs	48 Hrs	☒ Courier	
Signature:		Signature: Daryl Burrows		Signature: Daryl Burrows		5 Days	10 Days	☐ Hand Delivered	
Report Number :		Report Number :		Report Number :				☐ Postal	

Tierra Environmental Pty Ltd
PO Box 360
Mitcham
SA 5062



NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition
Arrangement for the mutual recognition of the
equivalence of testing, medical testing, calibration,
inspection, proficiency testing scheme providers and
reference materials producers reports and certificates.

Attention: **Daryl Burrows**

Report **995898-W**
Project name **GLEN HELEN**
Project ID **ARZ 23 069.01**
Received Date **Jun 05, 2023**

Client Sample ID			MW1-A	MW1-X	MW3-A	MW4-A
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M23- Jn0009270	M23- Jn0009271	M23- Jn0009272	M23- Jn0009273
Date Sampled			May 31, 2023	May 31, 2023	May 31, 2023	May 31, 2023
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-C36 (Total)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1) ^{N04}	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C10-C16	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C16 less Naphthalene (F2) ^{N01}	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	69	72	81	82
Volatile Organics						
Methyl-tert-Butyl Ether	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene ^{N02}	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Heavy Metals						
Lead	0.001	mg/L	0.010	0.018	0.056	0.002

Client Sample ID			FR1-A	FR2-A	20230531R1	20230531FB1
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M23-Jn0009274	M23-Jn0009275	M23-Jn0009276	M23-Jn0009277
Date Sampled			May 31, 2023	May 31, 2023	May 31, 2023	May 31, 2023
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-C36 (Total)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1) ^{N04}	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C10-C16	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C16 less Naphthalene (F2) ^{N01}	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	83	68	90	94
Volatile Organics						
Methyl-tert-Butyl Ether	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene ^{N02}	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Heavy Metals						
Lead	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001

Client Sample ID			20230531TB1
Sample Matrix			Water
Eurofins Sample No.			M23-Jn0009278
Date Sampled			Not Provided ^{I12}
Test/Reference	LOR	Unit	
BTEX			
Benzene	0.001	mg/L	< 0.001
Toluene	0.001	mg/L	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002
o-Xylene	0.001	mg/L	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003
4-Bromofluorobenzene (surr.)	1	%	84
Volatile Organics			
Naphthalene ^{N02}	0.01	mg/L	< 0.01

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Eurofins Suite B2			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	Jun 05, 2023	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Jun 05, 2023	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Jun 05, 2023	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Melbourne	Jun 05, 2023	14 Days
- Method: LTM-ORG-2010 BTEX and Volatile TRH			
Heavy Metals	Melbourne	Jun 05, 2023	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Volatile Organics	Melbourne	Jun 05, 2023	7 Days
- Method: LTM-ORG-2150 VOCs in Soils Liquid and other Aqueous Matrices (USEPA 8260)			

Internal Quality Control Review and Glossary

General

- Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
- All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
- All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
- Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
- Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
- SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
- Samples were analysed on an 'as received' basis.
- Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
- This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	µg/L: micrograms per litre
ppm: parts per million	ppb: parts per billion	%: Percentage
org/100 mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit		

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (<i>bis</i> -tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

- Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
- Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
- pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
- Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
- For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
- Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test			Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
Method Blank								
Total Recoverable Hydrocarbons								
TRH C6-C9			mg/L	< 0.02		0.02	Pass	
TRH C10-C14			mg/L	< 0.05		0.05	Pass	
TRH C15-C28			mg/L	< 0.1		0.1	Pass	
TRH C29-C36			mg/L	< 0.1		0.1	Pass	
TRH C6-C10			mg/L	< 0.02		0.02	Pass	
TRH >C10-C16			mg/L	< 0.05		0.05	Pass	
TRH >C16-C34			mg/L	< 0.1		0.1	Pass	
TRH >C34-C40			mg/L	< 0.1		0.1	Pass	
Method Blank								
BTEX								
Benzene			mg/L	< 0.001		0.001	Pass	
Toluene			mg/L	< 0.001		0.001	Pass	
Ethylbenzene			mg/L	< 0.001		0.001	Pass	
m&p-Xylenes			mg/L	< 0.002		0.002	Pass	
o-Xylene			mg/L	< 0.001		0.001	Pass	
Xylenes - Total*			mg/L	< 0.003		0.003	Pass	
Method Blank								
Volatile Organics								
Methyl-tert-Butyl Ether			mg/L	< 0.001		0.001	Pass	
Naphthalene			mg/L	< 0.01		0.01	Pass	
Method Blank								
Heavy Metals								
Lead			mg/L	< 0.001		0.001	Pass	
LCS - % Recovery								
Total Recoverable Hydrocarbons								
TRH C6-C9			%	115		70-130	Pass	
TRH C10-C14			%	115		70-130	Pass	
TRH C6-C10			%	115		70-130	Pass	
TRH >C10-C16			%	110		70-130	Pass	
LCS - % Recovery								
BTEX								
Benzene			%	115		70-130	Pass	
Toluene			%	117		70-130	Pass	
Ethylbenzene			%	98		70-130	Pass	
m&p-Xylenes			%	101		70-130	Pass	
Xylenes - Total*			%	101		70-130	Pass	
LCS - % Recovery								
Volatile Organics								
Methyl-tert-Butyl Ether			%	121		70-130	Pass	
Naphthalene			%	81		70-130	Pass	
LCS - % Recovery								
Heavy Metals								
Lead			%	98		80-120	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery								
Total Recoverable Hydrocarbons								
				Result 1				
TRH C6-C9	M23-Jn0009270	CP	%	103		70-130	Pass	
TRH C10-C14	M23-Jn0007935	NCP	%	76		70-130	Pass	
TRH C6-C10	S23-Jn0006258	NCP	%	128		70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
TRH >C10-C16	M23-Jn0007935	NCP	%	79			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	S23-Jn0006258	NCP	%	117			70-130	Pass	
Toluene	S23-Jn0006258	NCP	%	111			70-130	Pass	
Ethylbenzene	S23-Jn0006258	NCP	%	112			70-130	Pass	
m&p-Xylenes	S23-Jn0006258	NCP	%	115			70-130	Pass	
o-Xylene	S23-Jn0006258	NCP	%	116			70-130	Pass	
Xylenes - Total*	S23-Jn0006258	NCP	%	116			70-130	Pass	
Spike - % Recovery									
Volatile Organics				Result 1					
Methyl-tert-Butyl Ether	M23-Jn0009270	CP	%	77			70-130	Pass	
Naphthalene	S23-Jn0006258	NCP	%	93			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Lead	M23-Jn0006036	NCP	%	100			75-125	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Total Recoverable Hydrocarbons				Result 1	Result 2	RPD			
TRH C6-C9	M23-Jn0010336	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH C10-C14	M23-My0076820	NCP	mg/L	0.22	< 0.05	160	30%	Fail	Q15
TRH C15-C28	M23-My0076820	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH C29-C36	M23-My0076820	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH C6-C10	M23-Jn0010336	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH >C10-C16	M23-My0076820	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH >C16-C34	M23-My0076820	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH >C34-C40	M23-My0076820	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	M23-Jn0010336	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Toluene	M23-Jn0010336	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Ethylbenzene	M23-Jn0010336	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
m&p-Xylenes	M23-Jn0010336	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
o-Xylene	M23-Jn0010336	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Xylenes - Total*	M23-Jn0010336	NCP	mg/L	< 0.003	< 0.003	<1	30%	Pass	
Duplicate									
Volatile Organics				Result 1	Result 2	RPD			
Methyl-tert-Butyl Ether	M23-Jn0010336	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Naphthalene	M23-Jn0010336	NCP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Lead	M23-My0076691	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	N/A
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised by:

Amy Meunier	Analytical Services Manager
Carroll Lee	Senior Analyst-Volatile
Edward Lee	Senior Analyst-Organic
Harry Bacalis	Senior Analyst-Volatile
Mary Makarios	Senior Analyst-Metal



Glenn Jackson
Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

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CHAIN OF CUSTODY RECORD



ENVIROLAB
LABORATORY

A SUBSIDIARY OF ENVIRONMENTAL GROUP

Page 1 of 1

CLIENT DETAILS

Company Name:	Tierra Environment	Contact Name:	Daryl Burrows	Purchase Order:	NA	POC Number:	T1905
Office Address:		Project Manager:	Daryl Burrows	Project Number:	ARZ 23 069.01	Account ID:	185A025W2
		Email for results:	general@terra.com.au	Project Name:	Glen Helen	Event:	

Laboratory Address

Special Directions & Comments:	Envirolab - Melbourne 25 Research Drive, Clayton South, VIC 3168 Phone: 03 9333 2500 Fax: 03 9333 2521 Email: admin@envirolab.com.au

Sample ID	Date	Media	Metals			MTBE			BTEX			VOCs			Comments		
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	MMW2-Y	31-May-23	Water														
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	
16																	
17																	

Received By:	Daryl Burrows	Received By:		Turn around Time:	24 hrs	Method of Shipment:	☐ Courier ☒ Road Delivered ☐ Parcel
Date & Time:	31/05/23 2pm	Date & Time:		3 Days	10 Days		
Signature:		Signature:					
Report Number:		Report Number:					

For samples which require transportation between internal laboratories	Departing Signature:	Delivered Signature:	Date & Time:	Temperature:

ENVIROLAB
25 Research Drive
Clayton South VIC 3168
Job No: 37736
Date Received: 31/5/23
Time Received: 1:45pm
Discovered by: Daryl Burrows
Time: 3:00pm
Cooling: 0.8C
Security: 0.8C

Relinquished by
Jestira S
of Env
6/5

CERTIFICATE OF ANALYSIS 37736

Client Details

Client	Tierra Environment
Attention	Daryl Burrows
Address	31 Hauteville Tce, EASTWOOD, SA, 5062

Sample Details

Your Reference	<u>ARZ 23 069.01</u>
Number of Samples	1 Water
Date samples received	06/06/2023
Date completed instructions received	06/06/2023

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	08/06/2023
Date of Issue	08/06/2023
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. Tests not covered by NATA are denoted with *	

Results Approved By

Chris De Luca, Assistant Lab Manager

Authorised By

Pamela Adams, Laboratory Manager

vTRH(C6-C10)/BTEXN in Water		
Our Reference		37736-1
Your Reference	UNITS	MW2-Y
Date Sampled		31/05/2023
Type of sample		Water
Date extracted	-	07/06/2023
Date analysed	-	07/06/2023
TRH C ₆ - C ₉	µg/L	<10
TRH C ₆ - C ₁₀	µg/L	<10
TRH C ₆ -C ₁₀ less BTEX (F1)	µg/L	<10
Benzene	µg/L	<1
Toluene	µg/L	<1
Ethylbenzene	µg/L	<1
m+p-xylene	µg/L	<2
o-xylene	µg/L	<1
Naphthalene	µg/L	<1
Total +ve Xylenes	µg/L	<1
Total BTEX in water	µg/L	<1
Surrogate Dibromofluoromethane	%	107
Surrogate toluene-d8	%	99
Surrogate 4-BFB	%	96

TRH Water(C10-C40) NEPM		
Our Reference		37736-1
Your Reference	UNITS	MW2-Y
Date Sampled		31/05/2023
Type of sample		Water
Date extracted	-	07/06/2023
Date analysed	-	08/06/2023
TRH C ₁₀ - C ₁₄	µg/L	<50
TRH C ₁₅ - C ₂₈	µg/L	<100
TRH C ₂₉ - C ₃₆	µg/L	<100
Total +ve TRH (C10-C36)	µg/L	<50
TRH >C ₁₀ - C ₁₆	µg/L	<50
TRH >C ₁₀ - C ₁₆ less Naphthalene (F2)	µg/L	<50
TRH >C ₁₆ - C ₃₄	µg/L	<100
TRH >C ₃₄ - C ₄₀	µg/L	<100
Total +ve TRH (>C10-C40)	µg/L	<50
Surrogate o-Terphenyl	%	96

VOCs in water - Routine Level		
Our Reference	UNITS	37736-1
Your Reference		MW2-Y
Date Sampled		31/05/2023
Type of sample		Water
Date extracted	-	07/06/2023
Date analysed	-	07/06/2023
Methyl-tert-butyl ether (MTBE)	µg/L	<1
Surrogate Dibromofluoromethane	%	105
Surrogate toluene-d8	%	99
Surrogate 4-BFB	%	95

Method ID	Methodology Summary
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-023	Water samples are analysed directly by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water						Duplicate		Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			07/06/2023	[NT]	[NT]	[NT]	[NT]	07/06/2023	[NT]
Date analysed	-			07/06/2023	[NT]	[NT]	[NT]	[NT]	07/06/2023	[NT]
TRH C ₆ - C ₉	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	108	[NT]
TRH C ₆ - C ₁₀	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	108	[NT]
Benzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	107	[NT]
Toluene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	111	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	107	[NT]
m+p-xylene	µg/L	2	Org-023	<2	[NT]	[NT]	[NT]	[NT]	107	[NT]
o-xylene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Naphthalene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	115	[NT]
Surrogate Dibromofluoromethane	%		Org-023	102	[NT]	[NT]	[NT]	[NT]	98	[NT]
Surrogate toluene-d8	%		Org-023	98	[NT]	[NT]	[NT]	[NT]	100	[NT]
Surrogate 4-BFB	%		Org-023	96	[NT]	[NT]	[NT]	[NT]	98	[NT]

QUALITY CONTROL: TRH Water(C10-C40) NEPM					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			07/06/2023	[NT]	[NT]	[NT]	[NT]	07/06/2023	[NT]
Date analysed	-			08/06/2023	[NT]	[NT]	[NT]	[NT]	07/06/2023	[NT]
TRH C ₁₀ - C ₁₄	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	101	[NT]
TRH C ₁₅ - C ₂₈	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	125	[NT]
TRH C ₂₉ - C ₃₆	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	133	[NT]
TRH >C ₁₀ - C ₁₆	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	101	[NT]
TRH >C ₁₆ - C ₃₄	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	125	[NT]
TRH >C ₃₄ - C ₄₀	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	133	[NT]
Surrogate o-Terphenyl	%		Org-020	98	[NT]	[NT]	[NT]	[NT]	83	[NT]

QUALITY CONTROL: VOCs in water - Routine Level					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			07/06/2023	[NT]	[NT]	[NT]	[NT]	07/06/2023	[NT]
Date analysed	-			07/06/2023	[NT]	[NT]	[NT]	[NT]	07/06/2023	[NT]
Methyl-tert-butyl ether (MTBE)	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Surrogate Dibromofluoromethane	%		Org-023	100	[NT]	[NT]	[NT]	[NT]	100	[NT]
Surrogate toluene-d8	%		Org-023	98	[NT]	[NT]	[NT]	[NT]	99	[NT]
Surrogate 4-BFB	%		Org-023	95	[NT]	[NT]	[NT]	[NT]	98	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	
The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.	
Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

APPENDIX J

Fuel Contamination from Underground Petroleum Storage System: A Progress Update Report (LES, November 2023)



Glen Helen Lodge Discovery Parks



Low Ecological Services sampling a Monitoring Well

Fuel Contamination from Underground Petroleum Storage System: A Progress Update Report

April 2023

Report prepared by Katelyn Douglass, Miriam Kunde & Bill Low,

Low Ecological Services P/L
PO Box 3130, Alice Springs, NT 0871
Ph: (08) 89 555 222
Email: lowecol@lowecol.com.au
Web: www.lowecol.com.au



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DOCUMENT REVISION DETAILS

Date	Revision	Reviewer	Comments
24/11/2022	V0 (DRAFT)	– Low Ecological Services	Initial progress update report
12/12/2022	V1 (Draft)	– Low Ecological Services	Internal review
30/01/2023	V2 (DRAFT)	– Kirsas Environmental	Progress update report to Kirsas Environmental (Rachael Harman)
27/02/2023	V3(DRAFT)	– Low Ecological Services	Internal review by RF
14/03/2023	V3 (DRAFT)	-Kirsas Environmental	Draft sent for feedback, received feedback through Amy Driver (on 24 th April 2-23)
18/04/2023	V4 (DRAFT)	– Low Ecological Services	Draft sent for review to Bill Low
23/11/2023	V4	– Low Ecological Services	Reviewed Bill Low

DISCLAIMER

This document has been prepared by Low Ecological Services (LES) for Ngurratjuta Aboriginal Corporation. LES has prepared this document using the skill and care expected from professional scientists to provide factual and technical information and reasonable solutions to identified risks. It does not constitute legal advice.

ACKNOWLEDGEMENTS

LES would like to acknowledge Auditors Steven Kirsanovs and Rachael Harman for their expert contributions, Danesh Antia and Ryan Fritsch of LES for assistance during the field work. Well drilling was completed by Silver City Drilling Pty Ltd.

EXECUTIVE SUMMARY

Glen Helen Lodge is a tourism business on unzoned, Aboriginal Land (NT enhanced freehold). The land was owned by Ngurratjuta/Pmara Ntjarra Aboriginal Corporation and falls within the Tjoritja / West MacDonnell National Park and has been sold to Discovery Parks (DP) in 2020. Prior to the purchase of Glen Helen Resort, DP conducted a due diligence assessment (DD) of the Freehold lot and the lodge. The DD report indicated potential issue with leaking fuel from the Underground Storage Tanks (UST), and therefore, DP commissioned Low Ecological Services (LES) to assess the environmental aspects including soil hydrocarbon contamination from the fuel sales systems. In February 2021, Ngurratjuta Aboriginal Corporation commissioned Territory Electrical and Refrigeration (Territory Electrical) to examine the fuel system for leaks. This resulted in LES being contracted by Territory Electrical to conduct a Preliminary Site Investigation (PSI) of fuel contamination in the soil surrounding the UPSS. The PSI showed hydrocarbon contaminated soils by use of minimally invasive hand auguring around the underground tanks.

Ngurratjuta Aboriginal Corporation opted to contract Territory Electrical to remove the UPSS, and LES to undertake a Detailed Site Investigation (DSI) of the extent of contamination of the leaked hydrocarbons. On completion of excavation and removal of the tanks, the presence of fuel contamination under the Diesel and Opal Unleaded Petrol tanks down to bedrock has been confirmed. To assess the lateral extent of pollution, a conceptual site model of the potential depth and downslope extent of hydrocarbon from the USTs has been established. In April 2021, drilling has been conducted to verify level of contamination and distribution.

The assessments included gathering of background information, site inspections, soil sampling in proximity to, adjacent and beneath the underground fuel tank pits, in-situ testing of fuel vapours in soil with a Photoionization detector (PID), and laboratory analysis of selected soil, groundwater and soil vapour samples for hydrocarbons, heavy metals, and volatile organic compounds (VOCs). The results of this investigation were summarized in the previous report (Low *et al.* 2022). The source of the fuel leak has been removed, pits have been excavated to remove contaminated soil and aeration ag pipe installed; the consistent layer of bedrock at ~2.7 mbgl and the clay soils will limit further migration of any residual hydrocarbon contamination. Hence the ecological risk and risks to human health are now negligible.

Despite the negligible risks, long-term groundwater monitoring of the site has been initiated. Here we provide an update on the Glen Helen Lodge monitoring conducted by LES in 2022.

- In May 2022, LES contracted Silver City Drilling Pty Ltd to drill and establish 4 monitoring wells (MW). Two of these wells were drilled in the area the old fuel tanks were located. Two additional long-term MW were drilled down-slope to assess potential contamination from run-off or soil drainage.
- While drilling the MW, soil and water samples were taken and shipped to ALS Environmental for analysis. The soil samples taken in May 2022 showed low contamination at 6m depth at MW1 (Diesel petrol pit), and compound reads at MW2, MW3, and MW4 were under LOR levels.
- In November 2022, LES returned to Glen Helen Lodge to collect water samples from the MW. The analysis of these samples by ALS Environmental showed that the MW furthest away from point of contamination (MW4) unexpectedly had the highest read for C6-C9 (740 µg/L) and 730 µg/L for Total Recoverable Hydrocarbons in the C6-C10 fraction of all the monitoring wells. The heavy rainfall during June, September and October may have washed surface water contamination into MW4, which is in line of the surface water run-off. To rule out any error during sampling, LES decided to develop the wells and resample in December 2022.
- In December 2022, LES conducted well development and collected water samples of these four MWs. To ensure the quality of the sampling procedure, equipment blanks, trip blanks and sample blanks were included for analysis. The laboratory analysis of these samples showed no contamination in equipment, trip, and sample blanks, and no results above LOR for MW 1, and MW3. MW 2 had low levels of C6-C9 Fraction and C6-C10 fraction, suggesting very low level of petrol contamination. MW 4 had reads just above LOR for C6-C9 and C6-C10 Fraction (30 µg/L, with LOR= 20 µg/L), despite the sample blank, which was taken from this MW, showing no results above LOR. The level of contamination is low enough that it could fall within the recovery limits for the surrogates.

The report concludes that water sampling from these MW at Glen Helen Lodge should resume twice a year (1 sampling event during wet, and one during dry season) for the next three years (till 2026). A review after these three years will determine any future monitoring requirements.

ACRONYMS/GLOSSARY

Acronym	Definition
ALRA	Aboriginal Land Rights Act
APHA	American Public Health Association
AS	Alice Springs
BTEXN	Benzene, toluene, ethylbenzene, xylenes, and naphthalene. These are often found in unleaded fuels.
CSM	Conceptual site model (CSM) is a description of a site including the environmental setting, geological, hydrogeological and soil characteristics together with the nature and distribution of contaminants. Potentially exposed populations and exposure pathways are identified.
DSI	Detailed Site Investigation.
ESLs	Ecological screening levels (ESLs) for petroleum hydrocarbons, are the concentrations above which the NEPM recommends further appropriate investigation and evaluation will be required. They are generally applicable to the top 2 m of soil.
EPA	Environmental Protection Agency
HSLs	Health Screening Levels (HSLs) for selected petroleum compounds and fractions, applicable to assessing human health risk via the inhalation and direct contact pathways. They are the concentrations above which the NEPM recommends further appropriate investigation and evaluation will be required
F1	C6 - C10 Total Recoverable Hydrocarbons (TRH) fraction minus BTEX. Volatile Carbon chain fraction of total recoverable hydrocarbons (TRH) defined by the National Environment Protection (Assessment of Site Contamination) Measure 2013 (NEPM 2013) for contamination risk assessment. Petrol (unleaded and premium unleaded) is largely made up of C4-C12 fractions (CRC Care) and high-performance petrol with highly volatile additives are in this fraction.
F2	>C10 - C16 TRH fraction minus Naphthalene. Semi-volatile carbon chain fraction of TRH defined by NEPM 2013. Petrol (unleaded and premium unleaded) is largely made up of C4-C12 fractions and diesel fuel is predominantly comprised of C9-C21 fractions (CRC Care).
F3	>C16 – C34 TRH fraction. Non-volatile carbon chain fraction of TRH defined by NEPM 2013. Diesel fuel is predominantly comprised of C9-C21 fractions, and lubricating oils are comprised of longer carbon chain compounds >C18 (CRC Care).
F4	>C34 - C40 TRH fraction. Non-volatile carbon chain fraction of TRH defined by NEPM 2013. This fraction includes heavy oils and greases.
HSLs	Health screening levels (HSLs) for petroleum hydrocarbons are the concentrations above which the NEPM recommends further appropriate investigation and evaluation will be required. HSLs depend on physicochemical properties of soil, as these affect hydrocarbon vapour movement in soil, and the characteristics of building structures.
LOR	Limit of reporting. The lowest concentration at which laboratory analysis can detect the target substance in the sample material.
NEPM	National Environment Protection (Assessment of Site Contamination) Measure 2013 (NEPM 2013).
PID	Photoionization detector. Instrument which detects/measures VOCs. Often used to detect fuel vapours (volatile component) in soil contamination investigations.
PPM	Parts per million. Unit measure of concentration, often used for gas/air.
PSI	Preliminary Site Investigation.

TPH	Total Petroleum Hydrocarbons. A measure of the concentration of Hydrocarbons in a sample (soil or water).
TRH	Total recoverable hydrocarbons. Hydrocarbons that are recoverable from a sample via laboratory extraction with specific solvents.
UPSS	Underground Petroleum Storage System. Also refer to as underground fuel tank system(s)/pits.
US EPA	United States Environmental Protection Authority
UST	Underground Storage Tanks.
VOC	Volatile organic compound. VOCs are a group of carbon-based chemicals that easily evaporate at room temperature.
YSI	YSI is the maker of environmental monitoring instruments, sensors, software, systems, and data collection platforms for water quality monitoring and testing, and water velocity data.

GLEN HELEN TIMELINE

DATE	EVENT	COMMENTS
2020 Aug	GHL closed and ceased fuel sale	
2020 Oct	DD assessment by DP- site inspection on 27 th Oct.	No sign contamination found
2020 October	DP hired LES for DD	report found leaking fuel
2021 Feb	LES hired for PSI. PSI showed fuel contamination.	
2021 12 th Feb	LES soil sampling	
2021 Mar	Territory Electrical to remove UPSS	
2021 23 rd Mar	LES to conduct DSI (excavation of tanks) DSI Phase 1	
2021 23 rd Mar	LES soil sampling, soil vapour readings	
2021 28 th Apr	Drilling for soil samples (in 8 locations), Vapour PID readings, DSI Phase 2	Glen Helen Investigation and Remediation Report V8 with Appendices for Issue
2021 28 th Apr	LES soil sampling	Hydrocarbons were detected at low levels in the Opal petrol pit, high levels in the diesel pit.
2021 June	Ngurratjuta Aboriginal Corporation sold GH to Discovery parks	
2021 July	NT EPA issue of a s48 Notice (under Steven Krisanovs)	
2021 3 rd Sept.	LES soil sampling, WMS deployment, groundwater samples No soil vapour in risk levels, no groundwater contamination above LOR (= no contamination into the river), temporary MW Contaminated soil removal Disposal report and submitted to ASTC, RWMF Lining and backfilling with clean soil of petrol pits LES installed vent pipe system	DSI Phase 3
2022 27 th May	LES contracted Silver City Drilling to drill 4 monitoring wells (MW), soil and water samples were taken	

2022 Jun, Sep, Oct	Heavy rainfall made road in GHL unpassable; gravel was laid out, signage to MW was removed.	
2022 11 th Nov	LES reviewed site to collect water sample. Found only MW 1. Collected water from MW 1 and soil from the riverbed.	
2022 15 th Nov	LES returned to locate other wells, re-sampling of water from all 4 MW.	
2022 13 th Dec	LES Development of MW, sampling of MWs	

1. BACKGROUND

The Glen Helen Lodge located 130 km west of Alice (address 8495 Namatjira Drive, Mount Zeil, Northern Territory) is a tourism business on unzoned, Aboriginal Land (NT enhanced freehold). The land was owned by Ngurratjuta/Pmara Ntjarra Aboriginal Corporation and falls within the Tjoritja / West MacDonnell National Park.

Glen Helen was sold by the Ngurratjuta/Pmara Ntjarra Aboriginal Corporation (Ngurratjuta) to Discovery parks in June 2021. Prior to purchase, Discovery Parks conducted a Due Diligence assessment (DD) of the Lodge and Freehold Lota and commissioned LES to conduct an environmental assessment of the property, including soil hydrocarbon contamination from fuel and supply/storage system. This DD, conducted in October 2020, raised concerns that fuel leaks from the Underground Storage Tanks (UST) or associated plumbing from the Underground Petroleum Storage System (UPSS) may have occurred, which led to an examination of the fuel systems for potential leaks. In February 2021, Ngurratjuta Aboriginal Corporation assigned Territory Electrical to examine the fuel system leaks which then contracted LES to conduct a Preliminary Site Investigation (PSI) of fuel contamination in the soil adjacent the UPSS. The results of the PSI showed hydrocarbon contaminated soils around the underground tanks and the diesel bowser.

Prior to settlement of the property sale, in March 2021 Territory Electrical was contracted to remove the UPSSs and LES and to conduct a more detailed site investigation (DSI) of the extent of the contamination. The removal of the fuel systems confirmed the suspected fuel leakages from the Diesel and the Opal Unleaded Petrol tanks. To determine the lateral extent of the potential depth and downslope of hydrocarbon drilling took place in April 2021, introducing further investigations to confirm negligible ecological and health risks by use of soil vapour passive samplers and groundwater sampling. In June 2021, LES submitted a report to the NT EPA titled "Glen Helen Lodge Investigation for fuel leakage from UPSS".

In August 2021, following the submission of LES report and due to this site being ecologically sensitive, the NT EPA issued a s48 Notice to Ngurratjuta/Pmara Ntjarra Aboriginal Corporation (Ngurratjuta). This Notice requires the investigations, precautionary remediation and validation works to be completed under an environmental audit program adhering to the relevant provisions of the Waste Management and Pollution Control Act 1998. Ngurratjuta commissioned Steven Kirsanovs of Kirs Environmental, who is accredited under the Victorian EPA auditor scheme, to complete the environmental audit program. All

investigations and reporting have been completed under the oversight of Mr. Kirsanovs who will produce an environmental audit report as required under the s48 Notice.

In May 2022, AS Technical Drilling Services Pty Ltd was contracted by LES to establish 4 monitoring wells (MW) to further monitor groundwater contamination. During the drilling of the monitoring wells, LES took soil and water samples which were sent to Australian Laboratory Services Environmental Division Sydney for analysis. The samples were analysed for TRH/BTEXN/8 Metals and found very low levels of contamination, that pose no significant environmental impact or impact on human health.

1.1. SCOPE OF WORK

The contract required assessment of fuel contaminations from leakages of underground fuel tanks into the ground water. As such the following steps were involved.

- Drilling of 4 monitoring wells conducted in May 2022.
- During the drilling of the MW, samples were taken and sent to be analysed.
- Groundwater sampling and vapour sampling of those wells was conducted in November 2022.
- MW were developed and sampled on the 13th December 2022.
- A sampling and monitoring protocol has been established.

2. SAMPLING AND ANALYSIS QUALITY PLAN

SAMPLING DESIGN AND JUSTIFICATION:

Sampling of drilling soil samples were conducted in accordance with the sampling protocols outlined in the Glen Helen Report prepared in March (Low *et al.* 2022). Sampling of groundwater from the monitoring wells were conducted in accordance with the protocol outlined below.

2.1. MONITORING WELL SAMPLING PROTOCOL

2.1.1. Sampling equipment and PPE

For the monitoring of the wells at Glen Helen the following equipment is required:

- PPE: gloves, hat, sunscreen, water, steel cap boots, high-vis long sleeve and long pants clothing, sunglasses. Masks (if required).
- First aid kit
- YSI Professional Plus water quality meter
- Richter bore Dip tape (depth probe)
- Hand-held PID VOC monitor (MiniRae 3000)
- 2-3 water buckets (10L each)
- Sample containers (see image below)
- Data sheets + clipboard
- Pen/pencil/sharpies, zip-loc bags
- Mobile phones/ camera (with charging cable)
- Hand-held GPS (spare batteries) or tablet with GPS coordinates and a georeferenced map
- Shovel
- Handheld drill
- Bailers (one for each well)
- Esky and icepacks.
- GPS locations and images of the wells in their locations to assist with locating the wells.

Before going in the field, all equipment should be checked if it is clean, charged, calibrated and fully functional.

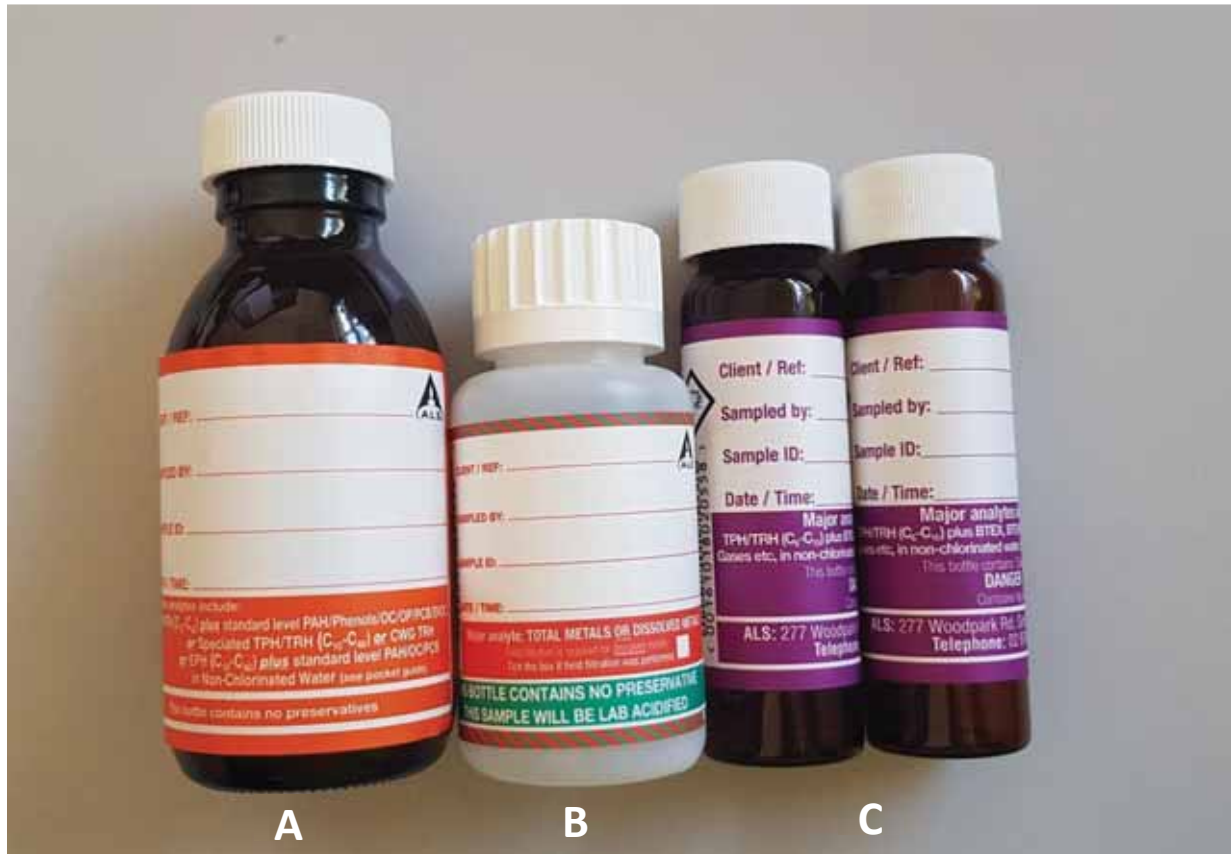


Figure 1: Water-sampling containers used for each monitoring well (from left to right):

- A) 100 ml amber glass bottle (without preservatives); Major analytes include TPH/TRH (C₁₀-C₄₀) plus standard level PAH/Phenols/OC/OP/PCB/SVOC or Speciated TPH/TRH (C₁₀-C₄₀) or CWG TRH or EPH (C₁₀-C₄₀) plus standard level PAH/OC/PCB in Non-Chlorinated Water.
- B) 60ml WW- Trace Metals plastic bottle (no preservatives),
- C) 2x 40ml amber glass vials. Major analytes include: TPH/TRH (C₆-C₁₀) plus BTEX, BTEXN, VOCs, or Alcohols or Gases etc, in non-chlorinated water. Vial contains Sulphuric acid.

2.1.2. Sampling methods and procedures

1. Locate well and carefully shovel dirt/gravel off the well cap
2. Remove the cap to the MW with handheld drill and take a PID reading immediately after (also log the time)
3. Take a DTW reading and record the time of reading
4. Take a bailer tube (one fresh tube per well) and bail 2L
5. Air Calibrate the YSI water quality meter and take YSI readings (Water temperature, Elect. Cond (mS/cm), DO%, DO (mg/L), Turbidity. Log the time of data collection)
6. Purge 20L-30L using the bailer

7. Take samples for TPH/TRH and BTEXN:
 - a. All bottles must be labelled as follows: Date/Time/Location/Well ID/Name of sampler
 - b. All bottles used must be laboratory approved, new, and clean sample containers
 - c. Bottles containing a preservative must not be overfilled/spilled when sampling the water. The Red and Purple Label bottles contain Nitric and Sulfuric Acid which is a corrosive liquid and should be handled with care. Wear appropriate PPE including gloves and eye protection when handling sample bottles. Ensure that the below procedures are followed correctly to avoid sample contamination.
 - d. Samples must be taken without any air bubbles or gaps in the container.
 - e. The container must be sealed thoroughly and stored on ice, standing upright immediately.
8. Return after 2h to take another PID and DTW reading (log the time)
9. Take YSI readings of 2L bail of recharge water (log the time).
10. Close the lid to the well, make sure the sample location is tidy when you leave.
(The wells require developing to purge silt from the drill holes to ensure maximum depth of well is available for monitoring.)

Note: Consult with auditors whether Equipment blanks, sample blanks, and trip blanks need to be taken prior each sampling event.

2.1.3. Preparing samples for shipment.

All samples taken were, tightly sealed, chilled, and transported to Alice Springs. Once in Alice Springs, the samples were sent via courier to ALS Sydney, all within recommended holding times. The samples were kept under chain of custody.

2.1.4. Data entry/management

All data recorded in the field was transferred in an excel spreadsheet as an electronic back-up and to avoid miss-communication. Additionally, the filled-in field forms were scanned and saved in the LES database. Visual observations from the field visit were photographed, and images were also saved in the LES database.

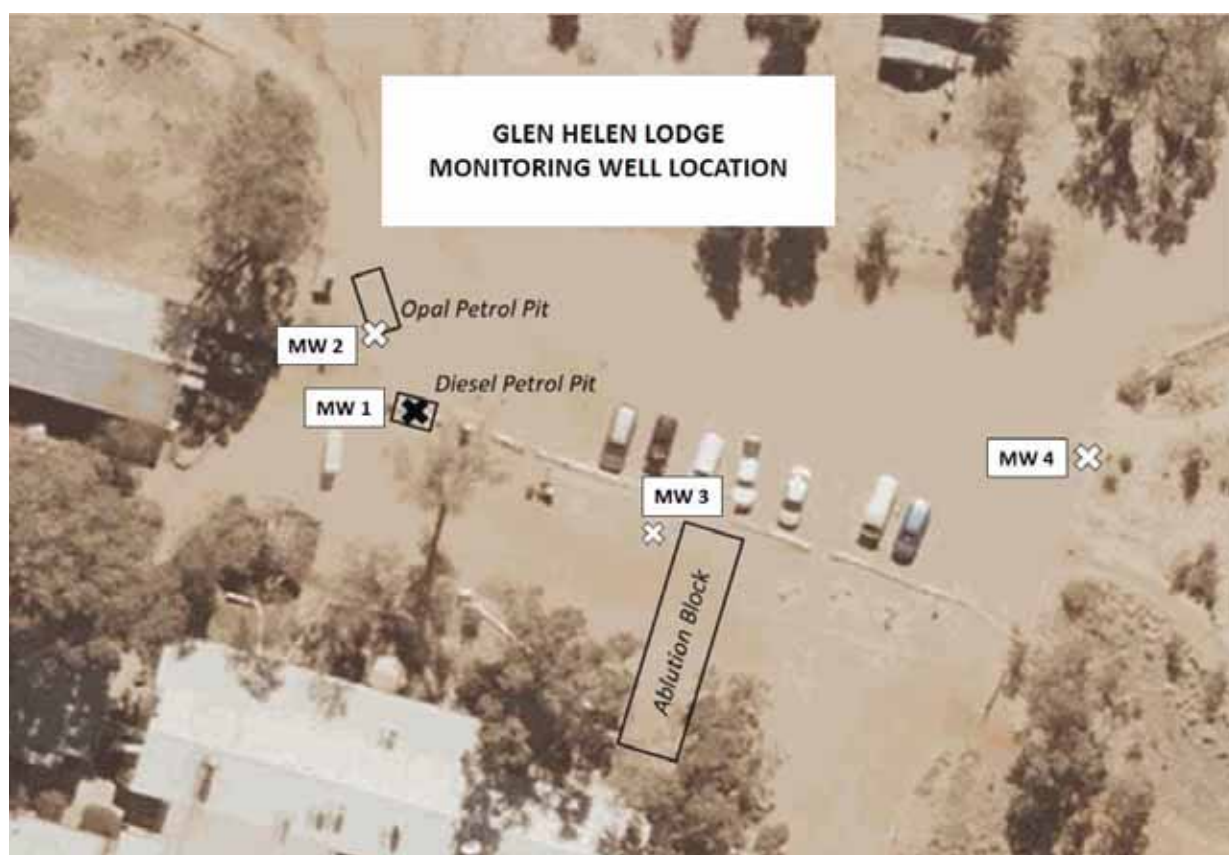
SECTION A: DRILLING AND SAMPLING OF MONITORING WELLS



3. INTRODUCTION

On the 27th of May 2022, LES contracted Silver City Drilling Pty Ltd. to install four monitoring wells at Glen Helen Resort (images in APENDIX A). Rachael Harman, a representative for auditor Steven Kirsanovs of Kirsa Environmental (accredited under the Victorian EPA auditor scheme) was present during the drilling to oversee the operation, ensuring that the procedure met all regulatory and environmental obligations.

3.1. GLEN HELEN LODGE MONITORING WELL DRILLING SUMMARY:



MW = Monitoring Well

✕ = Primary Drill Hole

⊠ = Additional drill holes

Figure 2: Map indicating the location of the 4 monitoring wells drilled. Wells DH1 and DH2 were established where the old underground tanks were positioned. Wells DH3 and DH4 were established to monitor the lateral flow of potential contamination.

3.1.1. Monitoring Well (MW) Summary:

DH1/MW1

- Rocky Layer 3-6m bgl
- Bedrock 4.9m bgl
- Groundwater depth 14m bgl
- Depth of well 19m
- 6m long perforated screen pipe installed at bottom of well
- Bottom bentonite plug installed at 19m bgl
- Mid-section bentonite plug installed ~9m bgl

DH2/MW2

- Rocky layer 3-6m bgl
- Groundwater depth 13m bgl
- Depth of well 15m
- 6m long perforated screen pipe installed at bottom of well
- Bottom bentonite plug installed at 15m bgl
- Mid-section bentonite plug installed ~9m bgl

DH3/MW3

- Rocky layer 3-6m bgl
- Groundwater depth 14m bgl
- Depth of well 15m
- 3m long perforated screen pipe installed at bottom of well
- Bottom bentonite plug installed at 15m bgl
- Mid-section bentonite plug installed ~9m bgl

DH4/MW4

- Rocky layer 3-6m bgl
- Groundwater depth 19.3m bgl
- Depth of well 19.5m
- 3m long perforated screen pipe installed at bottom of well
- Bottom bentonite plug installed at 19.5m bgl
- Mid-section bentonite plug installed ~9m bgl

All wells were completed with flush mounted and lockable covers to avoid standpipes above the ground surface. While the wells were drilled, vapour PID readings (*Table 1*) and samples were taken, in accordance with the sampling protocol described in Low Ecological Services, 2022, *Glen Helen Lodge Discovery Parks Fuel Contamination from Underground Petroleum Storage System: Investigation and Remediation Report*, prepared for Ngurratjuta/Pmara Ntjarra Aboriginal Corporation, LES Alice Springs.

4. RESULTS

In this section we report on the field and laboratory results obtained during the site visit in May 2022.

4.1. FIELD RESULTS

Table 1: PID readings of soil samples from Glen Helen Monitoring Wells.

During the drilling of the monitoring wells on the 27th of May, the following PID readings were taken:

Sample Location/ID	Depth from Surface (m)	Time	PID (ppm)	Soil Description & Other Notes	Lab Sample Taken
DH1/MW1	4.0	11:00:00 AM	19.7	Backfill	
	5.0	11:05:00 AM	21.5	Rock , Bedrock @ 4.9m bgl	
	6.0	11:10:00 AM	607.1	Rock	X
	7.0	11:15:00 AM	150.7	Yellow Claystone	
	8.0	11:20:00 AM	6.5	Yellow Claystone	
	9.0	11:25:00 AM	7.2	Yellow Claystone	
	10.0	11:30:00 AM	2.8	Yellow Claystone	X
	11.0	11:35:00 AM	2.8	Yellow Claystone	
	12.0	11:40:00 AM	1.4	Yellow Claystone	
	13.0	11:45:00 AM	15.2	Yellow Claystone Moist	X
	14.0	11:50:00 AM	1.4	Water!	
	15.0	11:55:00 AM	2.1	Water!	
	16.0	12:00:00 PM	7.4	Water!	
	17.0	12:05:00 PM	4.6	Water!	
	18.0	12:10:00 PM	3.3	Water! Quartz Sandstone	
DH2/MW2	3.0	1:20:00 PM	517.4	Backfill	
	6.0	1:25:00 PM	792.1	Rock Quartz	X
	9.0	1:30:00 PM	94	Yellow Claystone	
	12.0	1:35:00 PM	18.9	Yellow Claystone	
	13.0	1:40:00 PM	7.9	Yellow Claystone Moist	
	14.0	1:45:00 PM		Water!	

Glen Helen Fuel Contamination: Progress Report LOW ECOLOGICAL SERVICES (LES)

	15.0	1:50:00 PM	10	Water! Quartz Sandstone	X
DH3/MW3	3.0	4:00:00 PM	1.8	Topsoil	
	5.0	4:05:00 PM	3.5	Rock	X
	6.0	4:10:00 PM	1.4	Rock	
	7.0	4:15:00 PM	1.8	Black To Yellow Claystone	
	9.0	4:20:00 PM	2.2	Yellow Claystone	
	12.0	4:25:00 PM	0.8	Yellow Claystone	
	13.0	4:30:00 PM	0.9	Water! Yellow Claystone	
	15.0	4:35:00 PM	6.1	Water! Rock	X
DH4/MW4	3.0	5:00:00 PM	0.4	Topsoil	
	5.0	5:05:00 PM	3.9	Rock	X
	6.0	5:10:00 PM	1.8	Rock	
	8.0	5:15:00 PM	1.2	Loose Yellow Claystone	
	10.0	5:20:00 PM	4.3	Loose Yellow Claystone	X
	13.0	5:25:00 PM	1.8	Moist Yellow Claystone	
	14.0	5:30:00 PM		Hard Dense Moist Yellow Claystone	
	15.0	5:35:00 PM	1.2	Hard Dense Moist Yellow Claystone	
	17	5:40:00 PM	1.3	Moist Yellow Claystone	
	19.0	5:45:00 PM	0.4	Moist Yellow Claystone	
	19.3	5:50:00 PM	0.9	Water!	



Figure 3: Samples of the rock-portfolio taken during drilling MW1. These soil samples belong to the old diesel petrol pit and show mostly rock and yellow claystone.



Figure 4: Samples of the rock-portfolio taken during the drilling of MW 2 (Opal petrol pit). From left to right, back to front: Top layer (backfill), grey rock quartz, white is silt stone, yellow clay, yellow clay moist, water quartz sandstone.



Figure 5: Samples of the rock-portfolio taken during drilling of MW 3. From left to right, back to front: Top layer (backfill), grey rock quartz, white is silt stone, black to yellow clay, yellow clay, water rock.



Figure 6: Samples of the rock-portfolio taken during drilling of MW 4. From left to right, back to front: Top layer (backfill), grey rock quartz, loose yellow clay, yellow clay, water rock.

In filed observations were collected, and PID readings were taken (*Table 1, Fig. 3-6*). Laboratory samples of drilling soil were taken and sent to ASL to test for TRH/BTEXN/8 Metals analysis (this included soil samples that had a higher PID read). To ensure the accuracy of these results, the soil samples were shipped to Environmental Division Sydney to produce a Quality Control Report. The Quality Control Report concludes that no outliers occurred. The laboratory results are presented in the following section (*Table 2*).

4.2. LABORATORY RESULTS MAY 2022

Table 2: ALS Laboratory Results for the Soil Samples taken in May 2022.

SUMMARY LABORATORY ANALYSIS RESULTS FOR SOIL SAMPLES 27/05/2022

Analyte grouping/Analyte	Unit	LOR	Sample ID: Glen Helen 27/05/2022									
			MW1 6m	MW1 10m	MW1 13m	MW2 6m	MW2 13m	MW3 5m	MW3 15m	MW4 5m	MW4 6m	MW4 10m
Moisture Content	%	1	4.0	11.0	12.5	6.6	9.1	5.2	16.0	3.9	---	7.0
EG005(ED093) T: Total Metals by ICP-AES												
Arsenic	mg/kg	5	128	<5	7	97	<5	94	<5	57	31	<5
Cadmium	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium	mg/kg	2	5	7	8	10	11	4	2	6	4	12
Copper	mg/kg	5	<5	9	12	6	<5	<5	<5	5	<5	<5
Lead	mg/kg	5	8	9	14	6	<5	5	7	<5	5	<5
Nickel	mg/kg	2	14	8	13	8	49	10	4	10	10	35
Zinc	mg/kg	5	15	30	49	16	153	10	15	10	14	87
EG035T: Total Recoverable Mercury by FIMS												
Mercury	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EP080/071: Total Petroleum Hydrocarbons												
C6 - C9 Fraction	mg/kg	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
C10 - C14 Fraction	mg/kg	50	130	<50	<50	<50	<50	<50	<50	<50	<50	<50
C15 - C28 Fraction	mg/kg	100	910	<100	<100	<100	<100	<100	<100	<100	<100	<100
C29 - C36 Fraction	mg/kg	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
C10 - C36 Fraction (sum)	mg/kg	50	1040	<50	<50	<50	<50	<50	<50	<50	<50	<50
EP080S: TPH(V)/BTEX Surrogates												
1,2-Dichloroethane-D4	%	0.2	96.2	97.1	96.2	100	98.3	108	97.4	101	86.3	92.8
Toluene-D8	%	0.2	103	98.8	98.8	100	100	110	102	109	104	107
4-Bromofluorobenzene	%	0.2	93.8	93.8	90.9	96.2	94.6	103	92.4	101	87.7	93.2
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions												
C6 - C10 Fraction	mg/kg	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
C6 - C10 Fraction minus BTEX (F1)	mg/kg	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
>C10 - C16 Fraction	mg/kg	50	360	<10	<10	<10	<10	<10	<10	<10	<10	<10
>C16 - C34 Fraction (F3)	mg/kg	100	700	<50	<50	<50	<50	<50	<50	<50	<50	<50

Table 2 continued:

Analyte grouping/Analyte	Unit	LOR	Sample ID: Glen Helen 27/05/2022									
			MW1 6m	MW1 10m	MW1 13m	MW2 6m	MW2 13m	MW3 5m	MW3 15m	MW4 5m	MW4 6m	MW4 10m
>C34 - C40 Fraction (F4)	mg/kg	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C10 - C40 Fraction (sum)	mg/kg	50	1060	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50	360	<50	<50	<50	<50	<50	<50	<50	<50	<50
EP080: BTEXN												
Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Xylenes	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sum of BTEX	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

MW 1 (Diesel Petrol Pit) had elevated PID reads at 6 m (PID 607ppm) and 13 m (PID 15.2). Therefore, soil samples at these levels were taken and shipped for analysis.

The sample taken for MW1 at 6 m depth level contained longer carbon chain fractions in the Total Petroleum Hydrocarbon compounds (C10-C36 Fraction (sum): 1040 mg/kg, and in the Total Recoverable Hydrocarbon compounds (C10-C16 Fraction: 360 m/kg, C10-C40 Fraction 1060 mg/kg).

In the soil samples taken at MW1 at 10 m and at 13m, all compound results for the total Petroleum Hydrocarbons and Total recoverable Hydrocarbons were under the LOR.

Laboratory results for soil samples taken from MW 2 (Opal Petrol Pit), MW 3, and MW4 showed that the compounds tested for were under the LOR, despite MW2 at 6m depth level recording a high PID value (792.1 ppm).

The soil samples were also analysed for their metal content. Soil taken from all MW sites showed elevated levels for Arsenic in 5m-6m depth. The highest level of Arsenic (128 mg/kg) was in MW 1 at 6m depth. MW 2 had an elevated read for Zinc (153mg/kg) at 13 m depth in the yellow claystone soil layer.

5. DISCUSSION

The field and laboratory results from soil samples taken during the drilling of the monitoring wells showed reads for longer carbon chain fractions at MW1 at 6m depth. This suggests, that MW1 (former Diesel petrol pit) holds some Diesel contamination.

The rock profile for MW 1 shows that 6m depth holds a rock layer, and yellow clay at greater depth. Volatile particles such as diesel and petrol hydrocarbons can easily move through rock and sand, but do not move well through high density profile such as clay. Surface water may have washed contaminants from the surface through the top layers through to the rock layer, that sits on top of the yellow clay layer. The contaminant may then concentrate within the rock-layer as further penetration through the dense yellow clay hinders these particles. The recorded contamination may therefore be caused by surface water washing contaminants into lower levels, and not a contamination from ground water level. However, the highest reads for TRH in the C10-C40 fraction were 1040 mg/kg. The Health Screening Levels (HSL) for Recreational or open spaces are between 5,600 mg/kg - 7,400 mg/kg for direct contact with hydrocarbons in soil or water (Table below). Therefore, the detected hydrocarbons in the soil samples pose no health concern on this site.

Table 3: Soil Health Screening Levels as proposed by CRC CARE (2018).

SOIL HEALTH SCREENING LEVELS FOR DIRECT CONTACT (mg/kg)

Chemical	HSL-A Residential (Low Density)	HSL-B Residential (High Density)	HSL-C Recreational/ Open Space	HSL-G Commercial/ Industrial
Toluene	14,000.	21,000.	18,000.	99,000.
Ethylbenzene	4,500.	5,900.	5,300.	27,000.
Xylenes	12,000.	17,000.	15,000.	81,000.
Naphthalene	1,400.	2,200.	1,900.	11,000.
Benzene	100	140.	120.	430.
C6 - C10	4,400.	5,600.	5,100.	26,000.
>C10 - C16 Fraction	3,300.	4,200.	3,800.	20,000.
>C16 - C34 Fraction	4,500.	5,800.	5,300.	27,000.
>C34 - C40 Fraction	6,300.	8,100.	7,400.	38,000.

(CRC CARE 2018)

The Ecological screening levels (ESLs) for areas of ecological significance could not be assessed through the samples taken, as they only concern the top 3m soil layer which have not been sampled here.

The metal analysis of the soil samples showed a higher concentration for arsenic. Arsenic is a naturally occurring compound often associated with soil that is rich in iron, gold, or lead. Further it is a compound present in pesticides or wood preservatives and is consequently often associated with farming or mining operations. Arsenic is not water soluble unless when brought in contact with a strong acid. Therefore, a

surface water run-off appears unlikely. However, the higher levels of concentration at 5m -6 m are representative for the rocky layer in the soil profile for all MW. This supports the hypothesis that these levels of Arsenic are naturally occurring, indicating rock that has higher content of iron or gold in it. The Ecological investigation levels (EILs) for areas of ecological significance should on average not exceed 40 mg/kg (NEPM 2011, Schedule B1), but it is recognized that the EILs for metals depend on the site-specific soil portfolio and only applies to the top 2m of soil. In this case, we did not sample the top 2 m and hypothesis that this site is naturally arsenic rich.

The Health Investigation Levels (HILs) in the National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPM) notes a threshold level for arsenic derived in soil for an adult on a recreational site should not be above 3000 mg/kg. For a child aged between 2-3 years the HIL is at 300mg/kg and above for arsenic derived from soil. Consequently, detected arsenic level reading of 128 mg/kg do not cause a health concern on this site.

SECTION B: MONITORING WELL SAMPLING



6. INTRODUCTION

On the 11th of November, the LES team visited Glen Helen (GH) Lodge to sample the four monitoring wells installed in May 2022. Heavy rainfall in June, September and October caused the roads (which are dirt tracks around GH) to become impassable and gravel has been laid on top. When gravel was poured, signage for the MW was removed and wells buried under gravel. With a large GPS error margin and a small well diameter buried under gravel. During the visit on the 11th of November 2022, only MW 1 could be located and sampled. On the 15th of November, LES was able to locate and sample all MWs.

While the team was on site, the nearby Finke River has been visited to sample soil which looked black and had water with a clearly visible film on it (*Fig. 7 & 8*). As the sample area would be in line with the surface water run-off, the soil was sampled and sent to ALS Environmental to test for metals and signs of industrial pollution.



Figures 7 and 8: LES team member Danesh Antai inspecting water near the Finke River. The water appears to have a sheen on it. As it was a water source in line with the surface water run-off trajectory, it was decided to sample the soil and send it to ALS Environmental for analysis.

Soil and water samples were tested in accordance with the protocol outlined under the Method section of this document.

7. RESULTS

7.1. FIELD RESULTS FOR NOVEMBER 2022

The data LES gathered during the water sampling in November 2022 is shown in the table below (*Table 4*).

Table 4: Field Results November 2022.

Date	Site Code	Well Head Vapour Read (ppm) (aka PID read)	Time Sampled	Water tmp. (°C)	Elec. Cond. (mS/cm)	DO (%sat)	DO (mg/L)	pH	Turbidity (NTU)	Initial DTW (m)	Time (initial DTW)	DTW @sampling (m)	Time (DTW @sampling)
2022_11_11	DH 1/MW1	123.8 *	11:27:00 AM	29.7	5.106	10.3	0.76	7.24	2	6.27m	11:27:00 AM	/	/
2022_11_11	DH 1/MW1	58.6	11:30:00 AM	29.4	5.50	15.8	1.18	6.94	3-4	/	/	/	/
2022_11_11	DH 1/MW1	144	11:31:00 AM	/	/	/	/	/	/	/	/	6.29m	11:31:00 AM
2022_11_15	DH 1/MW1	142.8 *	12:42:00 PM	/	/	/	/	/	/	6.285	12:42:00 PM	/	/
2022_11_15	DH 1/MW1	39.5	12:47:00 PM	/	/	/	/	/	/	/	/	/	/
2022_11_15	DH 1/MW1	/	14:00:00 PM	29	5.21	33.2	2.5	6.93	2	/	/	6.285	14:00:00 PM
2022_11_15	DH 2/MW2	29.4	11:40:00 AM	/	/	/	/	/	/	6.225	11:40:00 AM	/	/
2022_11_15	DH 2/MW2	1.6	11:50:00 AM	/	/	/	/	/	/	/	/	/	/
2022_11_15	DH 2/MW2	/	13:50:00 PM	28.2	6.429	36.3	2.64	6.93	5	/	/	6.245	14:00:00 PM
2022_11_15	DH 3/MW3	14.4	12:15:00 PM	/	/	/	/	/	/	6.13	12:15:00 PM	/	/
2022_11_15	DH 3/MW3	4.1	12:30:00 PM	/	/	/	/	/	/	/	/	/	/
2022_11_15	DH 3/MW3	/	14:10:00 PM	28.5	5.062	28.8	2.19	6.95	5	/	/	6.145	14:10:00 PM
2022_11_15	DH4/MW4	0.9	12:30:00 PM	/	/	/	/	/	/	5.425	12:30:00 pm	/	/
2022_11_15	DH4/MW4	0.2	12:40:00 PM	/	/	/	/	/	/	/	/	/	/
2022_11_15	DH4/MW4	/	14:20:00 PM	29.7	4.856	27.1	2.06	7.35	1	/	/	5.45	14:20:00 PM

Next to PDI readings, water samples for each of the monitoring wells were collected and sent to ALS Environmental for analysis. While visiting the site, we also samples soil from Glen Helen Down Stream where the soil looked contaminated (*Fig. 7 & 8*).

7.2. LABORATORY RESULTS NOVEMBER 2022

Table 5: ALS Results for water samples from Glen Helen (November 2022).

Analyte grouping/Analyte	Sample ID: GH Water samples					
	Unit	LOR	MW 1	MW 2	MW 3	MW 4
EP080/071: Total Petroleum Hydrocarbons						
C6 - C9 Fraction	µg/L	20	40	110	30	740
C10 - C14 Fraction	µg/L	50	<50	140	<50	60
C15 - C28 Fraction	µg/L	100	<100	110	<100	<100
C29 - C36 Fraction	µg/L	50	<50	<100	<50	<50
C10 - C36 Fraction (sum)	µg/L	50	<50	250	<50	60
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions						
C6 - C10 Fraction	µg/L	20	40	100	30	730
C6 - C10 Fraction minus BTEX (F1)	µg/L	20	40	90	30	730
>C10 - C16 Fraction	µg/L	100	<100	150	<100	<100
>C16 - C34 Fraction (F3)	µg/L	100	<100	110	<100	<100
>C34 - C40 Fraction (F4)	µg/L	100	<100	<100	<100	<100
>C10 - C40 Fraction (sum)	µg/L	100	<100	260	<100	<100
>C10 - C16 Fraction minus Naphthalene (F2)	µg/L	100	<100	140	<100	<100
EP080: BTEXN						
Benzene	µg/L	1	<1	4	<1	<1
Toluene	µg/L	2	<2	<2	<2	3
Ethylbenzene	µg/L	2	<2	2	<2	<2
meta- & para-Xylene	µg/L	2	<2	<2	<2	<2
ortho-Xylene	µg/L	2	<2	<2	<2	<2
Total Xylenes	µg/L	2	<2	<2	<2	<2
Sum of BTEX	µg/L	1	<1	6	<1	3
Naphthalene	µg/L	5	<5	6	<5	<5
EP080S: TPH(V)/BTEX Surrogates						
1,2-Dichloroethane-D4	%	2	108	104	109	89.4
Toluene-D8	%	2	106	109	111	92.0
4-Bromofluorobenzene	%	2	108	108	106	91.2

The contamination originally occurred at MW 1 (Diesel Petrol Pit) and MW 2 (Opal Petrol Pit). MW 3 and MW4 were installed to monitor the movement of contaminants through a horizontal portfolio. The water samples taken from the MWs showed that MW 1 detected 40 µg/L for the C6-C9 fraction for the Total Petroleum and Total Recoverable Hydrocarbons.

MW 2 (Opal Petroleum Pit site) contained 110µg/L for the C6-C9 Fraction and 250 µg/L the longer hydrocarbon chains C10-C36 Fraction. Whereas MW 3 had reads that were non-significant (above LOR but within the potential error margin), MW 4 had the highest read for C6-C9 (740 µg/L) and 730 µg/L for Total Recoverable Hydrocarbons in the C6-C10 fraction.

Table 6: ALS results for soil samples from Glen Helen (November 2022).

Sample ID: GH Down Stream

Analyte grouping/ Analyte	Unit	LOR	GH Down Stream
EA005: Moisture Content			
Moisture Content	%	1	21.8
EG005(ED093) T: Total Metals by ICP-AES			
Arsenic	mg/kg	5	<5
Cadmium	mg/kg	1	<1
Chromium	mg/kg	2	<2
Copper	mg/kg	5	<5
Lead	mg/kg	5	<5
Nickel	mg/kg	2	<2
Zinc	mg/kg	5	5
EG035T: Total Recoverable Mercury by FIMS			
Mercury	mg/kg	0.1	<0.1
EP080/071: Total Petroleum Hydrocarbons			
C6 - C9 Fraction	mg/kg	10	<10
C10 - C14 Fraction	mg/kg	50	<50
C15 - C28 Fraction	mg/kg	100	<100
C29 - C36 Fraction	mg/kg	100	<100
C10 - C36 Fraction (sum)	mg/kg	50	<50
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	%	0.2	84.5
Toluene-D8	%	0.2	92.4
4-Bromofluorobenzene	%	0.2	86.8
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions			
C6 - C10 Fraction	mg/kg	10	<10
C6 - C10 Fraction minus BTEX (F1)	mg/kg	10	<10
>C10 - C16 Fraction	mg/kg	50	<50
>C16 - C34 Fraction (F3)	mg/kg	100	<100
>C34 - C40 Fraction (F4)	mg/kg	100	<100
>C10 - C40 Fraction (sum)	mg/kg	50	<50
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50	<50
EP080: BTEXN			
Benzene	mg/kg	0.2	<0.2
Toluene	mg/kg	0.5	<0.5
Ethylbenzene	mg/kg	0.5	<0.5
meta- & para-Xylene	mg/kg	0.5	<0.5
ortho-Xylene	mg/kg	0.5	<0.5
Total Xylenes	mg/kg	0.5	<0.5
Sum of BTEX	mg/kg	0.2	<0.2
Naphthalene	mg/kg	1	<1

Out of precaution, LES took a soil sample downstream at the riverbed, as the soil had a black colour and the water appeared to carry a film. All Compounds for this soil sample were within or under the LOR. The soil samples taken downstream Finke River had values all under LOR, with exception for zinc with 5mg/kg, where LOR= 5mg/kg (so zinc was just detectable but not considered elevated) (Table 6).

8. DISCUSSION

The soil sample taken downstream from Finke River showed no level of contamination. Discolouration and the film on the river may therefore be natural deposit from rocks and algae growth.

The water samples taken from MW 1 (old Diesel Petroleum Pit) had low elevated levels for C6-C9 Fraction (40µg/L), indicating a very low level of contamination for short hydrocarbons, consistent with Diesel contamination. MW2 (old Petrol petroleum Pit) had elevated reads for the C6-C9 Fraction (110µg/L) and the longer hydrocarbon chains C10-C36 Fraction (250 µg/L), suggesting contamination consistent with petroleum. MW3, adjacent to MW2, had almost negligible level of contamination for the C6-C9 Fraction (30µg/L), with reads just above LOR but likely within margin of error for detectability.

MW4, the well furthest away from the spill sites, had the highest reads for hydrocarbon compounds consistent with Diesel and Petroleum contamination (C6-C9: 740 µg/L and 730 µg/L for Total Recoverable Hydrocarbons in the C6-C10 fraction). One possible explanation for the higher level of contaminants in MW4 could be explained by the above average rainfall that occurred in June, September, and October 2022. Although MW 4 is the well furthest away from MW 1 and MW2 (sites of original contamination), the surface runoff at Glen Helen Lodge would wash surface water from MW2 to MW4, bypassing MW3 which is located higher in elevation. During the drilling of the MWs, an underground sonar was used to scan the underground for any service lines. During this sonar scan of the GH Lodge area, it was identified that the GH Lodge (and MW3) are located on the slope of a rocky ridge which would impact the surface water runoff. Surface water would be channelled from the road towards MW1 and MW2, bypassing MW3 and pool in MW4 (*Fig. 9*).

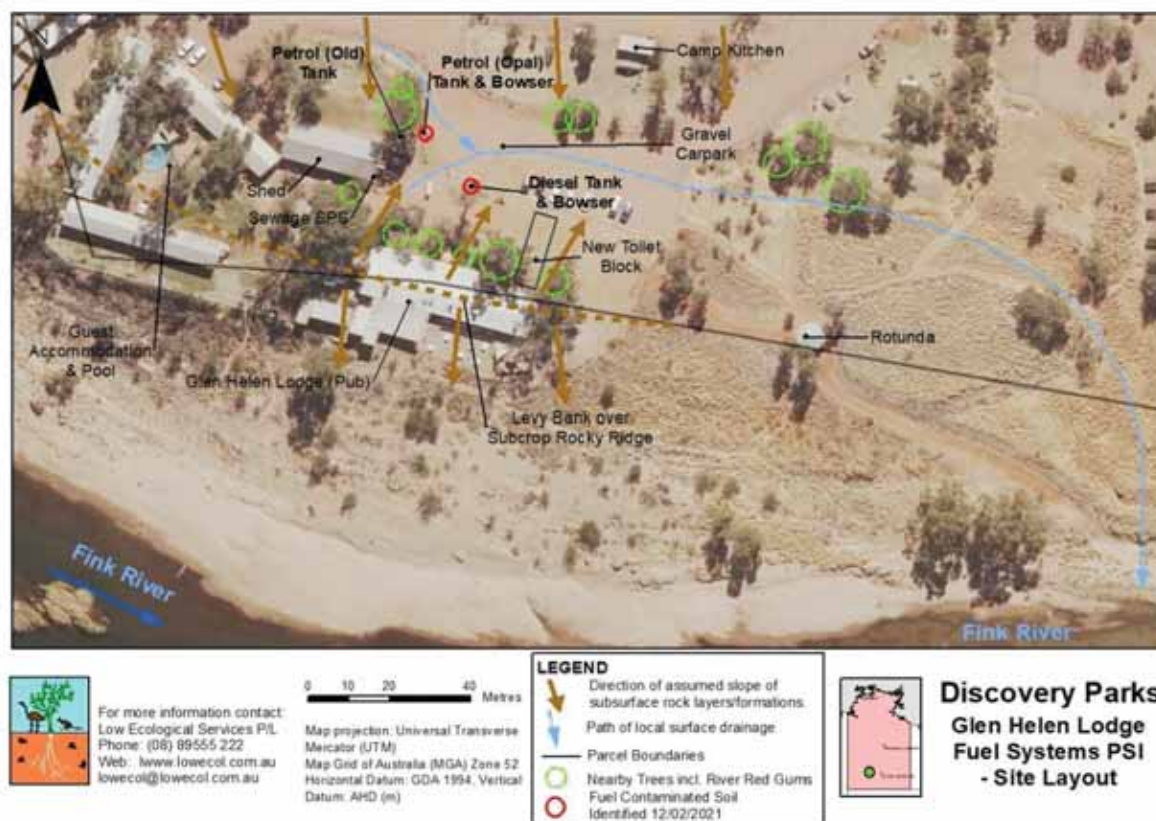


Figure 9: Map of Glen Helen Lodge (Discovery Park) showing the surface water flow directions.

As the concentration of contaminant in MW4 is high in comparison to the original locations of contamination (MW1 and MW2). Additionally, MW4 has not had any indication of pollution when soil was sampled in May 2022. Although surface water run off could explain the contamination in MW4, the action level for C6-C9 Fraction is at the 500µg/L (HIDOH 2017). Therefore, LES consulted Kirs Environmental about these results, and it was agreed to develop the MWs and resample water from these wells to test whether a sampling error may have occurred.

Despite the elevated levels of contamination in MW 4 and low levels of contamination in MW2, the field and laboratory results of the soil and water samples taken from the monitoring wells show an overall low level of pollution. Even elevated PID readings showed low levels of hydrocarbon in the laboratory result.

9. FUTURE MONITORING AND RECOMMENDATIONS

To ensure the correctness of the reads and to gain a better understanding of the contamination in the MWs, the following monitoring recommendations were made:

1. Develop the MW.
2. Resample water from the developed MW with Equipment blank, trip blank, and sample blank.
3. Consult with Steven Kirsas Environmental regarding the results and discuss next plan of action.

SECTION C: WELL DEVELOPMENT AND MW SAMPLING DECEMBER 2022



10. INTRODUCTION

In November 2022 LES sampled the MWs at Glen Helen Lodge and found MW 4 (the well furthest away from the contamination source at MW 1 and MW2) had the highest concentration for the C6-C9 Fractions of the wells sampled. LES and Kirsas Environmental agreed that LES returns to Glen Helen to develop the MWs and resample the water after the development.

On the 13th of December 2022, LES developed the MWs and re-sampled all four wells, including an Equipment blank, trip blank and a sample blank for control purposes.

11. METHOD

LES developed the wells by hand-bailing the wells. After bailing 80-100 L out of the wells, the well was left to recover for 40 min -2h prior to collecting the water sample. Sampling occurred in accordance with the method outlined in Glen Helen Report prepared in March (Low *et al.* 2022) and as described in the "Sampling methods and procedures" section of this report (P.14). To ensure the quality of sampling, LES further collected an equipment blank, a sample blank (here MW4), and a trip blank.

12. RESULTS

The equipment blank, the trip blank and the sample blank had all reads below the LOR for all compounds tested. MW1 (old diesel petrol pit) and MW 3 also had reads under LOR for all compounds tested (*Table 7*).

MW 2 (Opal petrol pit) and MW 4 had reads for the C6-C9 Fraction in Total Petroleum Hydrocarbons and in the C6-10 Fraction in Total Recoverable Hydrocarbons: WM 2 (60 µL/L) and WM4: (30 µL/L).

MW 2 had reads above threshold for Benzene (4 µL /L with threshold and LOR at 1 µL/L), Naphthalene (6 µL /L with threshold at 2.5 µL /L), and Sum of BTEX (4 µL /L).

Table 7: ALS results for water samples from Glen Helen (December 2022).

Analyte grouping/Analyte	Unit	LOR	Sample ID: GH Water samples				Equipment Blank	Sample Blank	Trip Blank
			MW 1	MW 2	MW 3	MW 4			
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	µg/L	20	<20	60	<20	30	<20	<20	<20
C10 - C14 Fraction	µg/L	50	<50	<50	<50	<50	<50	<50	<50
C15 - C28 Fraction	µg/L	100	<100	<100	<100	<100	<100	<100	<100
C29 - C36 Fraction	µg/L	50	<50	<50	<50	<50	<50	<50	<50
C10 - C36 Fraction (sum)	µg/L	50	<50	<50	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	µg/L	20	<20	60	<20	30	<20	<20	<20
C6 - C10 Fraction minus BTEX (F1)	µg/L	20	<20	60	<20	30	<20	<20	<20
>C10 - C16 Fraction	µg/L	100	<100	<100	<100	<100	<100	<100	<100
>C16 - C34 Fraction (F3)	µg/L	100	<100	<100	<100	<100	<100	<100	<100
>C34 - C40 Fraction (F4)	µg/L	100	<100	<100	<100	<100	<100	<100	<100
>C10 - C40 Fraction (sum)	µg/L	100	<100	<100	<100	<100	<100	<100	<100
>C10 - C16 Fraction minus Naphthalene (F2)	µg/L	100	<100	<100	<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	µg/L	1	<1	4	<1	<1	<1	<1	<1
Toluene	µg/L	2	<2	<2	<2	<2	<2	<2	<2
Ethylbenzene	µg/L	2	<2	<2	<2	<2	<2	<2	<2
meta- & para-Xylene	µg/L	2	<2	<2	<2	<2	<2	<2	<2
ortho-Xylene	µg/L	2	<2	<2	<2	<2	<2	<2	<2
Total Xylenes	µg/L	2	<2	<2	<2	<2	<2	<2	<2
Sum of BTEX	µg/L	1	<1	4	<1	<1	<1	<1	<1
Naphthalene	µg/L	5	<5	6	<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	%	2	106	107	106	108	105	106	106
Toluene-D8	%	2	98.6	99.5	95.0	96.3	92.2	100	96.8
4-Bromofluorobenzene	%	2	105	106	94.4	94.4	99.5	94.5	102

13. DISCUSSION

The equipment blank showed that the equipment used for sampling the MW was free of contamination. The trip blank confirmed that no contamination of the samples occurred during the transport between sample location and laboratory facility. The sample blank was taken from MW4 as this was the well that had unexpected reads of hydrocarbons in November 2022 and LES aimed to rule out that contamination during sampling or an unlikely mix-up of samples occurred in November. The sample blank taken from MW4 showed no results above LOR and is therefore considered free of contamination. It is worth mentioning here that the November sample with the low reads in the C6-C9 fraction was taken after months of unusual high rainfall, and before the well was developed. Therefore, this sample may still have held contamination from capping during the drilling of the MWs as well as C6-C9 Fraction residue from surface water runoff during the rain events. Further, in December LES sampled MW4 after the MW has been developed through hand bailing. The sample blank was taken from the same well minutes after. The laboratory results showed reads slightly above LOR in the sample for MW4 but showed no reads above LOR of the same well in the sample blank. It is likely that any residue of C6-C9 Fraction floating on the water surface has been scooped up when taking the sample MW4 and may have been clear of C6-C9 residue in the sample taken immediately after for the sample blank.

The samples taken from the MWs showed overall very low levels or no pollution. MW1 (Diesel Petrol Pit) had no detectable levels for any of the tested compounds and could therefore be considered free of contaminants. MW3 also has no compounds above LOR and could be considered free of contaminants.

MW2 (Opal Petrol Pit) had reads for the C6-C9 (60 µg/L) in the Total Petroleum Hydrocarbons, and the C6-C10 -BTX Fraction (60 µg/L) in the Total Recoverable Hydrocarbons, indicating low levels of contamination. However, levels under 300 µg/L do not require immediate action other than further monitoring of the wells.

MW 2 had elevated reads for Benzene (4 µL) and Naphthalene (6 µL /L). Although the NHMRC/NRMMC (2011) sets a threshold at 1 µL for Benzene, NEPC (2013) sets the action levels for Benzene at levels of 800 µL /L and above. The threshold levels for Naphthalene are at 2.5 µL/L and above (ANZG 2018) and the action level at 70 µL/L (ANZECC 2000).

14. CONCLUDING REMARKS & FUTURE RECOMMENDATIONS

The hydrocarbon contamination that occurred due to a leakage of underground tanks has been mitigated at the site by removing the tanks, and the correct removal and disposal of the contaminated soil. Drilling and development of monitoring wells also indicated that the contamination levels are not likely to pose any harm or detriment to the health of people, to groundwater environments, or to the health of the land and wildlife on site. However, the Ecological screening levels (ESLs) on site have not been determined. Although the MWs at GH Lodge indicate that contamination of soil and groundwater are within safe levels for humans, LES and Kirsas Environmental propose that the site is monitored and managed as follows:

- An additional MW development effort applying an extraction pump may assist with removing any contaminant residue and would allow for a better understanding where contamination may come from.
- Future groundwater sampling should be conducted using hydra-sleeves to ensure correct readings through less disturbance of the water column.
- Water sampling from the MWs at Glen Helen Lodge should resume twice a year (one sampling event during wet, and one during dry season) for the next three years (till 2026). A review after these three years will determine any future monitoring requirements.

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APPENDIX A: PHOTOGRAPHS

Photographs taken during Monitoring Well drilling on the 27th of May 2022.

 A photograph showing a yellow and black LMX100 ground penetrating radar unit mounted on a yellow three-wheeled cart. The unit has a screen and several buttons. It is parked on a reddish-brown dirt surface. A person's legs and feet are visible in the background.	Figure 10. <i>LMX100 ground penetrating radar used to locate metallic and non-metallic utilities and depth of soil to geological base.</i>

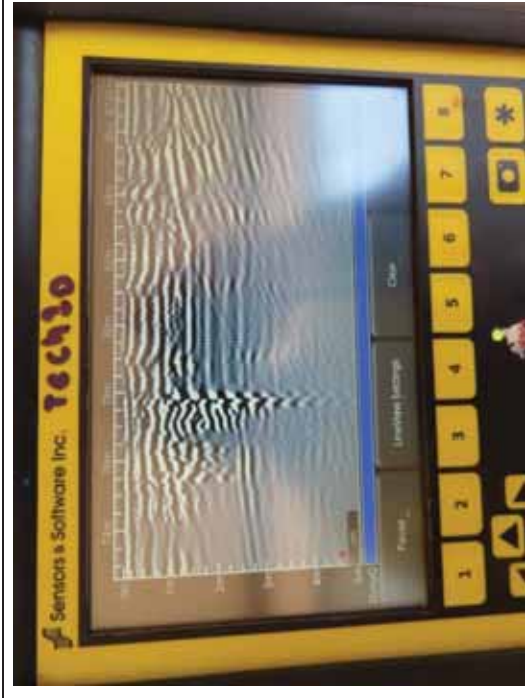


Figure 11.

Mini report on underground utilities as located by radar. The colour bar at the bottom of the image identifies the data quality obtained:

White = No Data (too fast!) | Yellow=

Moderate quality | Light blue = Better quality

| Dark Blue = Highest quality

Here the report showed highest quality reading when looking for underground utilities and depth to rock strata at Glen Helen.



Figure 12.

Shramm 685 truck mounted drill rig.

To drill the monitoring wells, LES hired Silver City Drilling Pty Ltd which supplied a mounted drill rig and trained and qualified staff to operate the machinery.



Figure 13.
Air drilling of the monitoring wells.



Figure 14: Wet drilling of the monitoring wells. After introducing FOAM X PLUS Foaming agent for Fresh and Saline water (MUDEX, Innovative Drilling), wet drilling commenced.

	Figure 15. <i>The pipe for a monitoring well is in place.</i>

Pictures taken during the water sampling in November 2022.



Figure 16:

Ryan Fritsch and Dansh Antia digging for MW 4. Heavy rainfall in June, September, and October caused challenging road conditions at Glen Helen Lodge, requiring gravel to be laid out to make the roads accessible again. During the gravelling of the road, signposts to the monitoring wells were removed and the monitoring wells buried.

APPENDIX B: DRILLING RISK ASSESSMENT (SECTION A)



Job Safety Analysis for Drilling and Soil Sampling

Job Title	Glen Helen Resort – Soil Sampling
Area/Location	Within and adjacent to car park and former UG fuel tanks
Brief description of Job	Sample soils/rock from drilling operation with hand tools (Shovel and 50mm hand Auger in approved locations)

Participants

Name	Position	Signature	Date
	Environmental Consultant		
Katelyn Douglas	Environmental Consultant		
	Environmental Consultant		

Fieldwork Contacts

Site Contacts	Pre-arranged contact time
NA	NA
Alice Springs Contacts	Pre-arranged contact time
LES Office: 08 8955 5222	NA
Satellite phone:	0417 160 807
Mobile phone numbers:	Katelyn – 0474 722 120
Emergency Contacts	
Emergency 000 or 112	
NT Police Force 131 444 (non-emergency)	
NT Fire and Rescue 08 8999 3473 (non-emergency)	
Alice Springs Hospital 08 8951 7777	
SPOT System	
Spot system will be carried for emergency only.	

Job Safety Analysis

Task	Hazard	Control Measures
Travelling long distances by car to from site.	Traffic hazard due to other vehicles on road. Fatigue	Obey speed limit and all road markings and signs. Drive appropriately for weather/road conditions. Multiple people travelling in the vehicle, swap drivers regularly
Working in active resort area car park	Impact by vehicles.	Have traffic management blocking off carpark access so no traffic can enter carpark where work will be undertaken. Park vehicle well clear of road within carpark. Wear high vis PPE.
Working near active drilling rig	Machinery, chemicals, sharp objects causing injury or harm, , dust, drill rods falling from height.	Work area away from any assessed hazards. Safety briefing obtained from drill operator. Have appropriate PPE including hard hat.
Excavation in area with potential new underground services	Penetrating live underground services can cause injury or harm.	Work area assessed with sUG services locator and check with construction supervisor Graham to determine where no underground services are located. Use of hand tools, slow and careful digging. Wearing appropriate PPE
Potentially contaminated soil sampling	Contact with contaminants which may cause an adverse reaction.	Wear appropriate PPE (long trousers and long sleeve shirt, high ankle boots, safety glasses and nitrile gloves when handling soil/tools). Carry first aid kit, and water and soap for hand washing.
Fieldwork	Sun Exposure, sunburn, skin cancer dehydration, etc.	Hydrate sufficiently prior to and during fieldwork. Avoid excessive exposure to sun. Wear appropriate PPE: • Wide brim hat and long pants; • Sunscreen and long sleeve shirt with SPF rating; • Safety glasses; • High ankle boots; and • Gloves (as required).
Field work	Personal injury due to tripping/falling	Wear boots suitable for working around equipment with high ankles. Assess path/area before walking. Do not rush. Keep tools clear of work area when not in use. Carry first aid kit.
Manual Handling	Back injury while carrying tools/equipment etc.	Do not lift more than comfortable (20kg or less). Use correct lifting techniques (bend at the knees).

		Use tools or another person to assist.
Fieldwork	Snake bites.	Be aware of possible snake habitat and be alert to possible presence of snakes near the river and in long grass. Wear long trousers and high ankle boots. Snake bandage in first aid kit.

APPENDIX C: CHAIN OF CUSTODY (SECTION A)

[illegible]

APPENDIX D: CERTIFICATE OF ANALYSIS (SECTION A)



CERTIFICATE OF ANALYSIS

Page : 1 of 8

Work Order
: ES2219074

Client
: LOW ECOLOGICAL SERVICES

Contact
: MR BILL LOW

Address
: PO BOX 3130
ALICE SPRINGS NT, AUSTRALIA 0871

Telephone
: +61 08 89 555 222

Project
: Glen Helen Drilling Soil Samples

Order number
: BL20220530

C-O-C number
: ---

Sampler
: Katelyn Douglass

Site
: ---

Quote number
: EN/333

No. of samples received
: 10

No. of samples analysed
: 10

Laboratory
: Environmental Division Sydney

Contact
: Customer Services ES

Address
: 277-289 Woodpark Road Smithfield NSW Australia 2164

Telephone
: +61-2-8784 8555

Date Samples Received
: 01-Jun-2022 08:00

Date Analysis Commenced
: 05-Jun-2022

Issue Date
: 10-Jun-2022 13:34



Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories		Accreditation Category
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW

APPENDIX D

RIGHT SOLUTIONS | RIGHT PARTNER

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Work Order : ES2219074
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen Drilling Soil Samples

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

Λ = This result is computed from individual analyte detections at or above the level of reporting

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benzo(a)anthracene (0.1), Chrysene (0.01), Benzo(b+h) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1,2,3-cd)pyrene (0.1), Dibenz(a,h)anthracene (1.0), Benzo(g,h,i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- EP071: Results of sample MW1-6m have been confirmed by re-extraction and re-analysis.

Glen Helen Fuel Contamination: Progress Report LOW ECOLOGICAL SERVICES (LES)

Page : 3 of 8
Work Order : ES2219074
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen Drilling Soil Samples



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID												
Compound	CAS Number	LOR	Sampling date / time	Unit	MW1-6m		MW1-13m		MW2-6m		MW2-13m			
					27-May-2022 12:00	ES2219074-001	27-May-2022 12:25	ES2219074-002	27-May-2022 12:05	ES2219074-003	27-May-2022 14:00	ES2219074-004	27-May-2022 14:05	ES2219074-005
					Result		Result		Result		Result			
EA055: Moisture Content					1.0	%		11.0		12.5		6.6		9.1
Moisture Content					---									
EG005(ED093)†: Total Metals by ICP-AES														
Arsenic	7440-38-2	5	mg/kg		128		<5		7		97		<5	
Cadmium	7440-43-9	1	mg/kg		<1		<1		<1		<1		<1	
Chromium	7440-47-3	2	mg/kg		5		7		8		10		11	
Copper	7440-50-8	5	mg/kg		<5		9		12		6		<5	
Lead	7439-92-1	5	mg/kg		8		9		14		6		<5	
Nickel	7440-02-0	2	mg/kg		14		8		13		8		49	
Zinc	7440-66-6	5	mg/kg		15		30		49		16		153	
EG035†: Total Recoverable Mercury by FIMS														
Mercury	7439-97-6	0.1	mg/kg		<0.1		<0.1		<0.1		<0.1		<0.1	
EP030071: Total Petroleum Hydrocarbons														
C6 - C9 Fraction	---	10	mg/kg		<10		<10		<10		<10		<10	
C10 - C14 Fraction	---	50	mg/kg		130		<50		<50		<50		<50	
C15 - C28 Fraction	---	100	mg/kg		910		<100		<100		<100		<100	
C29 - C36 Fraction	---	100	mg/kg		100		<100		<100		<100		<100	
^ C10 - C36 Fraction (sum)	---	50	mg/kg		1040		<50		<50		<50		<50	
EP030071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions														
C6 - C10 Fraction	C6_C10	10	mg/kg		<10		<10		<10		<10		<10	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10		<10		<10		<10		<10	
>C10 - C16 Fraction	---	50	mg/kg		360		<50		<50		<50		<50	
>C16 - C34 Fraction	---	100	mg/kg		700		<100		<100		<100		<100	
>C34 - C40 Fraction	---	100	mg/kg		<100		<100		<100		<100		<100	
^ >C10 - C40 Fraction (sum)	---	50	mg/kg		1060		<50		<50		<50		<50	
^ >C10 - C16 Fraction minus Naphthalene (F2)	---	50	mg/kg		360		<50		<50		<50		<50	
EP030: BTEXN														
Benzene	71-43-2	0.2	mg/kg		<0.2		<0.2		<0.2		<0.2		<0.2	
Toluene	108-88-3	0.5	mg/kg		<0.5		<0.5		<0.5		<0.5		<0.5	
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5		<0.5		<0.5		<0.5		<0.5	
meta- & para-Xylene	108-38-3	0.5	mg/kg		<0.5		<0.5		<0.5		<0.5		<0.5	
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5		<0.5		<0.5		<0.5		<0.5	
^ Sum of BTEX	---	0.2	mg/kg		<0.2		<0.2		<0.2		<0.2		<0.2	

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Work Order

Client

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: ES2219074

: LOW ECOLOGICAL SERVICES

: Glen Helen Drilling Soil Samples



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID							
Compound	CAS Number	LOR	Sampling date / time	Unit	MW1-6m	MW1-10m	MW1-13m	MW2-6m	MW2-13m
EP080: BTEXN - Continued									
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	<1
EP080S: TPH(V)BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%		96.2	97.1	96.2	100	98.3
Toluene-D8	2037-26-5	0.2	%		103	98.8	98.8	100	100
4-Bromofluorobenzene	460-00-4	0.2	%		93.8	93.8	90.9	96.2	94.6

Glen Helen Fuel Contamination: Progress Report LOW ECOLOGICAL SERVICES (LES)



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Work Order : ES2219074
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen Drilling Soil Samples

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		MW3-5m		MW3-15m		MW4-5m		MW4-6m		MW4-10m	
Compound	CAS Number	LOR	Sampling date / time	Unit	Result	Result	Result	Result	Result	Result	Result	Result	Result
EA055: Moisture Content													
Moisture Content	----	1.0	%		5.2	16.0		3.9		----		7.0	
EA055: Moisture Content (Dried @ 105-110°C)													
Moisture Content	----	1.0	%		----	----		----		5.4		----	
EG005(ED093)T: Total Metals by ICP-AES													
Arsenic	7440-38-2	5	mg/kg		94	<5		57		31		<5	
Cadmium	7440-43-9	1	mg/kg		<1	<1		<1		<1		<1	
Chromium	7440-47-3	2	mg/kg		4	2		6		12		12	
Copper	7440-50-8	5	mg/kg		<5	<5		5		<5		<5	
Lead	7439-92-1	5	mg/kg		5	7		<5		5		<5	
Nickel	7440-02-0	2	mg/kg		10	4		10		10		35	
Zinc	7440-66-6	5	mg/kg		10	15		10		14		87	
EG035T: Total Recoverable Mercury by FIMS													
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1		<0.1		<0.1		<0.1	
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons													
Naphthalene	91-20-3	0.5	mg/kg		----	----		----		<0.5		----	
Acenaphthylene	208-96-8	0.5	mg/kg		----	----		----		<0.5		----	
Acenaphthene	83-32-9	0.5	mg/kg		----	----		----		<0.5		----	
Fluorene	86-73-7	0.5	mg/kg		----	----		----		<0.5		----	
Phenanthrene	85-01-8	0.5	mg/kg		----	----		----		<0.5		----	
Anthracene	120-12-7	0.5	mg/kg		----	----		----		<0.5		----	
Fluoranthene	206-44-0	0.5	mg/kg		----	----		----		<0.5		----	
Pyrene	129-00-0	0.5	mg/kg		----	----		----		<0.5		----	
Benz(a)anthracene	56-55-3	0.5	mg/kg		----	----		----		<0.5		----	
Chrysene	218-01-9	0.5	mg/kg		----	----		----		<0.5		----	
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg		----	----		----		<0.5		----	
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		----	----		----		<0.5		----	
Benzo(a)pyrene	50-32-8	0.5	mg/kg		----	----		----		<0.5		----	
Indeno(1,2,3-cd)pyrene	193-39-5	0.5	mg/kg		----	----		----		<0.5		----	
Dibenz(a,h)anthracene	53-70-3	0.5	mg/kg		----	----		----		<0.5		----	
Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg		----	----		----		<0.5		----	
^ Sum of polycyclic aromatic hydrocarbons													
^ Benzo(a)pyrene TEQ (zero)													
^ Benzo(a)pyrene TEQ (half LOR)													
^ Benzo(a)pyrene TEQ (LOR)													
	----	0.5	mg/kg		----	----		----		0.6		----	
	----	0.5	mg/kg		----	----		----		1.2		----	

Glen Helen Fuel Contamination: Progress Report LOW ECOLOGICAL SERVICES (LES)

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Work Order : ES2219074
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen Drilling Soil Samples



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID							
Compound	CAS Number	LOR	Sampling date / time	Unit	MW3-5m	MW3-15m	MW4-5m	MW4-6m	MW4-10m
					ES2219074-006	ES2219074-007	ES2219074-008	ES2219074-009	ES2219074-010
					Result	Result	Result	Result	Result
EP0800/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	<50
EP0800/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	<50	<50	<50
EP0800: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	<1
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		----	----	----	64.6	----
2-Chlorophenol-D4	93951-73-6	0.5	%		----	----	----	66.7	----
2,4,6-Tribromophenol	118-79-6	0.5	%		----	----	----	41.9	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		----	----	----	110	----
Anthracene-d10	1719-06-8	0.5	%		----	----	----	110	----
4-Terphenyl-d14	1718-51-0	0.5	%		----	----	----	104	----
EP0800S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%		108	97.4	101	86.3	92.8

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID							
Compound	CAS Number	LOR	Sampling date / time	Unit	MW3-5m	MW3-15m	MW4-5m	MW4-6m	MW4-10m
					27-May-2022 16:25 ES2219074-006	27-May-2022 16:15 ES2219074-007	27-May-2022 17:55 ES2219074-008	27-May-2022 18:00 ES2219074-009	27-May-2022 18:05 ES2219074-010
EP080S: TPH(V)BTEX Surrogates - Continued									
Toluene-D8	2037-26-5	0.2	%		110	102	109	104	107
4-Bromofluorobenzene	460-00-4	0.2	%		103	92.4	101	87.7	93.2



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Work Order : ES2219074
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Project : Glen Helen Drilling Soil Samples

Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2,4,6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130

APPENDIX E: QUALITY CONTROL REPORT (SECTION A)



Work Order

: ES2219074

Client

: LOW ECOLOGICAL SERVICES

Contact

: MR BILL LOW

Address

: PO BOX 3130
ALICE SPRINGS NT, AUSTRALIA 0871

Telephone

: +61 08 89 555 222

Project

: Glen Helen Drilling Soil Samples

Order number

: BL20220530

C-O-C number

: —

Sampler

: Katelyn Douglass

Site

: —

Quote number

: EN/333

No. of samples received

: 10

No. of samples analysed

: 10

Page

: 1 of 7

Laboratory

: Environmental Division Sydney

Contact

: Customer Services ES

Address

: 277-289 Woodpark Road Smithfield NSW Australia 2164

Telephone

: +61-2-8784 8555

Date Samples Received

: 01-Jun-2022

Date Analysis Commenced

: 05-Jun-2022

Issue Date

: 10-Jun-2022



Accreditation No. 815
Authorised for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories		Accreditation Category
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW

ALS

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: LOW ECOLOGICAL SERVICES

: Glen Helen Drilling Soil Samples

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: SOIL										
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)	
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 4386035)	MW1-6m	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit	
		EG005T: Chromium	7440-47-3	2	mg/kg	5	4	0.0	No Limit	
		EG005T: Nickel	7440-02-0	2	mg/kg	14	12	13.9	No Limit	
		EG005T: Arsenic	7440-38-2	5	mg/kg	128	140	9.0	0% - 20%	
		EG005T: Copper	7440-50-8	5	mg/kg	<5	6	0.0	No Limit	
		EG005T: Lead	7439-92-1	5	mg/kg	8	7	0.0	No Limit	
ES2219076-001	Anonymous	EG005T: Zinc	7440-66-6	5	mg/kg	15	13	9.1	No Limit	
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit	
		EG005T: Chromium	7440-47-3	2	mg/kg	31	28	9.7	0% - 50%	
		EG005T: Nickel	7440-02-0	2	mg/kg	16	15	10.1	No Limit	
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit	
		EG005T: Copper	7440-50-8	5	mg/kg	22	20	9.2	No Limit	
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 4386038)	Anonymous	EG005T: Lead	7439-92-1	5	mg/kg	10	9	0.0	No Limit	
		EG005T: Zinc	7440-66-6	5	mg/kg	58	53	9.0	0% - 50%	
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 4386038)										
ENZ05276-003	Anonymous	EA055: Moisture Content	----	0.1	%	21.8	21.3	2.3	0% - 20%	
ES2219074-004	MW2-6m	EA055: Moisture Content	----	0.1	%	6.6	6.9	4.4	No Limit	
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 4386034)										
ES2219074-001	MW1-6m	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit	
ES2219076-001	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit	
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 4379926)										
ES2212941-001	Anonymous	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	

Glen Helen Fuel Contamination: Progress Report LOW ECOLOGICAL SERVICES (LES)



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Work Order : ES2219074
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen Drilling Soil Samples

Sub-Matrix: SOIL		Laboratory Duplicate (DUP) Report								
Laboratory sample ID	Sample ID	Method/Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)	
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 4379926) - continued										
ES2212941-001	Anonymous	EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
			205-82-3							
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
		EP075(SIM): Indeno(1,2,3,cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
		EP075(SIM): Dibenzo(a,h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
EP075(SIM): Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit			
EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit			
EP075(SIM): Benzo(a)pyrene TEQ (zero)										
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4379925)										
ES2219074-009	MW4-6m	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit	
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit	
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit	
		EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit	
ES2212941-001	Anonymous	EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit	
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit	
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4380711)										
ES2219130-021	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit	
ES2219130-026	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4379925)										
ES2219074-009	MW4-6m	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit	
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit	
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit	
		EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit	
ES2212941-001	Anonymous	EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit	
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4380711)										
ES2219130-021	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit	
ES2219130-026	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit	
EP080: BTEXN (QC Lot: 4380711)										



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Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen Drilling Soil Samples

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method/Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP080: BTEXN (QC Lot: 4380711) - continued ES2219130-021	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
			106-42-3						
ES2219130-026	Anonymous	EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
		EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
			106-42-3						
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit



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Work Order : ES2219074
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen Drilling Soil Samples

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: SOIL

Sub-Matrix: SOIL	Method/Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report			
						Spike Concentration	Spike Recovery (%)	Acceptable Limits (%)	
	EG0005(ED093)T: Total Metals by ICP-AES (QCLot: 4386035)								
	EG0005T: Arsenic	7440-38-2	5	mg/kg	<5	121.1 mg/kg	92.2	88.0	113
	EG0005T: Cadmium	7440-43-9	1	mg/kg	<1	0.74 mg/kg	82.1	70.0	130
	EG0005T: Chromium	7440-47-3	2	mg/kg	<2	19.6 mg/kg	106	68.0	132
	EG0005T: Copper	7440-50-8	5	mg/kg	<5	52.9 mg/kg	104	89.0	111
	EG0005T: Lead	7439-92-1	5	mg/kg	<5	60.8 mg/kg	99.7	82.0	119
	EG0005T: Nickel	7440-02-0	2	mg/kg	<2	15.3 mg/kg	97.5	80.0	120
	EG0005T: Zinc	7440-66-6	5	mg/kg	<5	139.3 mg/kg	89.5	66.0	133
	EG035T: Total Recoverable Mercury by FIMS (QCLot: 4386034)								
	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	0.087 mg/kg	79.9	70.0	125
	EP0705(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 4379925)								
	EP0705(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	6 mg/kg	105	77.0	125
	EP0705(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	6 mg/kg	104	72.0	124
	EP0705(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	6 mg/kg	106	73.0	127
	EP0705(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	6 mg/kg	107	72.0	126
	EP0705(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	6 mg/kg	113	75.0	127
	EP0705(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	6 mg/kg	101	77.0	127
	EP0705(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	6 mg/kg	114	73.0	127
	EP0705(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	6 mg/kg	116	74.0	128
	EP0705(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	6 mg/kg	98.9	69.0	123
	EP0705(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	6 mg/kg	105	75.0	127
	EP0705(SIM): Benzo(b+1)fluoranthene	205-99-2	0.5	mg/kg	<0.5	6 mg/kg	93.7	68.0	116
	EP0705(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	6 mg/kg	109	74.0	126
	EP0705(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	6 mg/kg	109	70.0	126
	EP0705(SIM): Indeno(1,2,3-cd)pyrene	193-39-5	0.5	mg/kg	<0.5	6 mg/kg	108	61.0	121
	EP0705(SIM): Dibenzo(a,h)anthracene	53-70-3	0.5	mg/kg	<0.5	6 mg/kg	105	62.0	118
	EP0705(SIM): Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg	<0.5	6 mg/kg	108	63.0	121
	EP0800/071: Total Petroleum Hydrocarbons (QCLot: 4379925)								
	EP071: C10 - C14 Fraction	----	50	mg/kg	<50	300 mg/kg	93.9	75.0	129
	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	450 mg/kg	102	77.0	131
	EP071: C29 - C36 Fraction	----	100	mg/kg	<100	300 mg/kg	103	71.0	129
	EP0800/071: Total Petroleum Hydrocarbons (QCLot: 4380711)								
	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	123	68.4	128
	EP0800/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4379925)								



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Work Order : ES2219074
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen Drilling Soil Samples

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report Result	Spike Concentration	Laboratory Control Spike (LCS) Report	
Method: Compound	CAS Number	LOR	Unit			Spike Recovery (%)	Acceptable Limits (%)
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4379925) - continued							
EP071: >C10 - C16 Fraction	---	50	mg/kg	<50	375 mg/kg	100.0	77.0 125
EP071: >C16 - C34 Fraction	---	100	mg/kg	<100	525 mg/kg	102	74.0 138
EP071: >C34 - C40 Fraction	---	100	mg/kg	<100	225 mg/kg	106	63.0 131
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4380711)							
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	123	68.4 128
EP080: BTEXN (QCLot: 4380711)							
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	112	62.0 116
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	117	67.0 121
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	100	65.0 117
EP080: meta- & para-Xylene	108-38-3	0.5	mg/kg	<0.5	2 mg/kg	105	66.0 118
	106-42-3						
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	101	68.0 120
EP080: Naphthalene	91-20-3	1	mg/kg	<1	1 mg/kg	106	63.0 119

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs), Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL					Matrix Spike (MS) Report		
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Spike Concentration	Spike Recovery(%)	MS	Acceptable Limits (%)
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 4386035)							
ES2219074-001	MW1-6m	EG005T: Arsenic	7440-38-2	50 mg/kg		108	70.0
		EG005T: Cadmium	7440-43-9	50 mg/kg		103	70.0
		EG005T: Chromium	7440-47-3	50 mg/kg		100	68.0
		EG005T: Copper	7440-50-8	250 mg/kg		113	70.0
		EG005T: Lead	7439-92-1	250 mg/kg		105	70.0
		EG005T: Nickel	7440-02-0	50 mg/kg		102	70.0
		EG005T: Zinc	7440-66-6	250 mg/kg		101	66.0
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4386034)							
ES2219074-001	MW1-6m	EG035T: Mercury	7439-97-6	5 mg/kg		110	70.0
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 4379926)							
ES2212941-001	Anonymous	EP075(SIM): Acenaphthene	83-32-9	10 mg/kg		103	70.0
		EP075(SIM): Pyrene	129-00-0	10 mg/kg		117	70.0
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4379925)							
ES2212941-001	Anonymous	EP071: C10 - C14 Fraction	----	480 mg/kg		110	73.0
		EP071: C15 - C28 Fraction	----	3100 mg/kg		111	53.0



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Work Order : ESZ219074
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen Drilling Soil Samples

Sub-Matrix: SOIL

Sub-Matrix: SOIL			Matrix Spike (MS) Report				
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Spike Concentration	Spike Recovery(%) MS	Acceptable Limits (%) Low	Acceptable Limits (%) High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4379925) - continued							
ES2212941-001	Anonymous	EP071: C29 - C36 Fraction	----	2060 mg/kg	124	52.0	132
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4380711)							
ES2219074-001	MW1-6m	EP080: C6 - C9 Fraction	----	32.5 mg/kg	88.7	70.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4379925)							
ES2212941-001	Anonymous	EP071: >C10 - C16 Fraction	----	860 mg/kg	104	73.0	137
		EP071: >C16 - C34 Fraction	----	4320 mg/kg	119	53.0	131
		EP071: >C34 - C40 Fraction	----	890 mg/kg	132	52.0	132
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4380711)							
ES2219074-001	MW1-6m	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	82.6	70.0	130
EP080: BTXN (QCLot: 4380711)							
ES2219074-001	MW1-6m	EP080: Benzene	71-43-2	2.5 mg/kg	88.4	70.0	130
		EP080: Toluene	108-88-3	2.5 mg/kg	93.2	70.0	130
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	87.6	70.0	130
		EP080: meta- & para-Xylene	108-38-3	2.5 mg/kg	86.6	70.0	130
		EP080: ortho-Xylene	106-42-3	2.5 mg/kg			
		EP080: Naphthalene	91-20-3	2.5 mg/kg	86.9	70.0	130
				2.5 mg/kg	90.3	70.0	130

APPENDIX F: QA/QC COMPLIANCE ASSESSMENT (SECTION A)



QA/QC Compliance Assessment to assist with Quality Review

Work Order : ES2219074

Client : LOW ECOLOGICAL SERVICES

Contact : MR BILL LOW

Project : Glen Helen Drilling Soil Samples

Site : ----

Sampler : Katelyn Douglass

Order number : BL20220530

Page : 1 of 5

Laboratory : Environmental Division Sydney

Telephone : +61-2-8784 8555

Date Samples Received : 01-Jun-2022

Issue Date : 10-Jun-2022

No. of samples received : 10

No. of samples analysed : 10

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- NO Method Blank value outliers occur.
- NO Duplicate outliers occur.
- NO Laboratory Control outliers occur.
- NO Matrix Spike outliers occur.
- For all regular sample matrices, NO surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- NO Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- NO Quality Control Sample Frequency Outliers exist.



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 Work Order : ES2219074
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen Drilling Soil Samples

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results. This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein. Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days; mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters. Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive of Vinyl Chloride and Styrene are not key analytes of interest/concern.

Method		Sample Date		Extraction / Preparation		Analysis	
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content							
Soil Glass Jar - Unpreserved (EA055)	MW1-6m,	27-May-2022	---	---	08-Jun-2022	10-Jun-2022	✓
	MW1-13m,						
	MW2-13m,						
	MW3-5m,						
	MW3-15m,						
	MW4-10m						
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055)	MW4-6m	27-May-2022	---	---	08-Jun-2022	10-Jun-2022	✓
EG005(ED03)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T)	MW1-6m,	27-May-2022	08-Jun-2022	23-Nov-2022	09-Jun-2022	23-Nov-2022	✓
	MW1-13m,						
	MW2-13m,						
	MW3-15m,						
	MW4-6m,						
	MW4-10m						
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T)	MW1-6m,	27-May-2022	08-Jun-2022	24-Jun-2022	09-Jun-2022	24-Jun-2022	✓
	MW1-13m,						
	MW2-13m,						
	MW3-15m,						
	MW4-6m,						
	MW4-10m						
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM))	MW4-6m	27-May-2022	06-Jun-2022	10-Jun-2022	08-Jun-2022	16-Jul-2022	✓

Glen Helen Fuel Contamination: Progress Report LOW ECOLOGICAL SERVICES (LES)



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 Work Order : ES2219074
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen Drilling Soil Samples

Matrix: SOIL		Evaluation: * = Holding time breach ; ✓ = Within holding time.			
Method	Container / Client Sample ID(s)	Extraction / Preparation		Analysis	
		Date extracted	Due for extraction	Date analysed	Due for analysis
EP080/071: Total Petroleum Hydrocarbons					
Soil Glass Jar - Unpreserved (EP080)					
MW1-6m, MW1-13m, MW2-13m, MW3-15m, MW4-6m.	MW1-10m, MW2-6m, MW3-5m, MW4-5m, MW4-10m	05-Jun-2022	10-Jun-2022	07-Jun-2022	10-Jun-2022
				✓	✓
Soil Glass Jar - Unpreserved (EP071)					
MW1-6m, MW1-13m, MW2-13m, MW3-15m, MW4-6m.	MW1-10m, MW2-6m, MW3-5m, MW4-5m, MW4-10m	06-Jun-2022	10-Jun-2022	08-Jun-2022	16-Jul-2022
				✓	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions					
Soil Glass Jar - Unpreserved (EP080)					
MW1-6m, MW1-13m, MW2-13m, MW3-15m, MW4-6m.	MW1-10m, MW2-6m, MW3-5m, MW4-5m, MW4-10m	05-Jun-2022	10-Jun-2022	07-Jun-2022	10-Jun-2022
				✓	✓
Soil Glass Jar - Unpreserved (EP071)					
MW1-6m, MW1-13m, MW2-13m, MW3-15m, MW4-6m.	MW1-10m, MW2-6m, MW3-5m, MW4-5m, MW4-10m	06-Jun-2022	10-Jun-2022	08-Jun-2022	16-Jul-2022
				✓	✓
EP080: BTEXN					
Soil Glass Jar - Unpreserved (EP080)					
MW1-6m, MW1-13m, MW2-13m, MW3-15m, MW4-6m.	MW1-10m, MW2-6m, MW3-5m, MW4-5m, MW4-10m	05-Jun-2022	10-Jun-2022	07-Jun-2022	10-Jun-2022
				✓	✓



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 Work Order : ES2219074
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen Drilling Soil Samples

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: SOIL									
Quality Control Sample Type		Method		Count		Rate (%)		Evaluation	
Analytical Methods				QC	Regular	Actual	Expected		
Laboratory Duplicates (DUP)									
Moisture Content		EA055		2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)		EP075(SIM)		1	9	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS		EG035T		2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES		EG005T		2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction		EP071		2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX		EP080		2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)									
PAH/Phenols (SIM)		EP075(SIM)		1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS		EG035T		1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES		EG005T		1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction		EP071		1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX		EP080		1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)									
PAH/Phenols (SIM)		EP075(SIM)		1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS		EG035T		1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES		EG005T		1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction		EP071		1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX		EP080		1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)									
PAH/Phenols (SIM)		EP075(SIM)		1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS		EG035T		1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES		EG005T		1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction		EP071		1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX		EP080		1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard



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 Work Order : ES2219074
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen Drilling Soil Samples

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Total Metals by ICP-AES	EG05T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3)
Total Mercury by FIMS	EG05T	SOIL	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl ₂) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
TRH - Semivolatile Fraction	EP071	SOIL	In house: Referenced to USEPA SW 846 - 8015 Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM Schedule B(3)
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270. Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM Schedule B(3) amended.
Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na ₂ SO ₄ and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.

APPENDIX G: ALS TAX INVOICE (SECTION A)



Australian Laboratory Services Pty Ltd ABN 84 009 936 029. An ALS Limited Company

TAX INVOICE: 1151511173

LOW ECOLOGICAL SERVICES

MR BILL LOW

PO BOX 3130

ALICE SPRINGS

NT, AUSTRALIA 0871

Work Order	Project / Overall Description	Site	Order number	C-O-C number	Contact
ES2219074	Glen Helen Drilling Soil Samples / ----	----	BL20220530	----	MR BILL LOW

Issue Date	: 10-Jun-2022	Taxable value	: AUD\$	755.00
		Tax Incurred (GST)	: AUD\$	75.50
Due Date	: 10-Jul-2022	Amount Payable	: AUD\$	830.50

Work Order Breakdown

Method	Sale Item Descriptions	Quantity	Unit Value (AUD\$)	Value (AUD\$)	GST (AUD\$)	Line Total (AUD\$)
Work Order: ES2219074		Quote number: EN/333		Submatrix summary: 10 SOILS		
*Misc	Workorder Admin Fee	1.00	40.00	40.00	4.00	44.00
S-05	TRH/BTEXN/8 Metals	9.00	68.20	613.80	61.38	675.18
S-26	8 metals/TRH/BTEXN/PAH	1.00	101.20	101.20	10.12	111.32

* denotes non-discountable item

• Please direct all queries to Environmental Division Sydney on +61-2-8784 8555.

REMITTANCE ADVICE

POST TO: Australian Laboratory Services Pty Ltd
P.O. Box 66 Everton Park
QLD 4053 Australia

EMAIL TO: remittances@alsglobal.com

Vendor bank details

Bank: Commonwealth Bank

BSB: 064 000

Account: 12672843

Swift Code: CTBAAU2S

or Cheque

Payable to Australian Laboratory Services Pty Ltd

or Credit Card

Visa

Mastercard

American Express

Amount Payable

AUD\$ 830.50

ALS Client Reference

LOWECO

TAX INVOICE

1151511173

APPENDIX H: DRILLING INVOICE (SECTION A)



TAX INVOICE

Low Ecological Services P/L
PO Box 3130
ALICE SPRINGS NT 0871
AUSTRALIA

Invoice Date
2 Jun 2022

Invoice Number
INV-1042

Reference
Glen Helen
Monitoring Bores

ABN
91 641 332 238

AS Technical Drilling
Services Pty Ltd
66 Smith St
CICCON NT 0870
AUSTRALIA

Description	Quantity	Unit Price	GST	Amount AUD
1. Shramm 685 (Rig 8) Mobilisation / Demobilisation	264.00	12.50	10%	3,300.00
2. Drilling Day Rate	1.00	9,480.00	10%	9,480.00
2.1 Bore Completion Hourly Rate	6.00	500.00	10%	3,000.00
Consumables:	0.00	0.00		0.00
3.1 PVC casing	60.00	15.00	10%	900.00
3.2 Grout & Cement	26.00	22.00	10%	572.00
3.3 Bentonite	4.00	18.00	10%	72.00
3.4 Gravel Pack	20.00	40.00	10%	800.00
			Subtotal	18,124.00
			TOTAL GST 10%	1,812.40
			TOTAL AUD	19,936.40

Due Date: 1 Jul 2022

Direct Deposit Details
Bank: NAB BSB: 085-995 Acc: 25 292 6360
Account Name: AS Technical Drilling Services Pty Ltd

Payment Terms: Net 14

APPENDIX I: MUDEX SAFETY DATA SHEET (SECTION A)



SAFETY DATA SHEET

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

1.1 Product identifier

Product name FOAM X (ALL GRADES)

Synonyms FOAM X • FOAM X PLUS • FOAM X ULTRA • MUDEX FOAM X (ALL GRADES)

1.2 Uses and uses advised against

Uses DRILLING FLUID ADDITIVE • FOAMING AGENT

1.3 Details of the supplier of the product

Supplier name MUDEX (PTY) LTD

Address 5 Coulson Way, Canning Vale, WA, 6155, AUSTRALIA

Telephone + 61 (08) 9390 4620

Email info@mudex.com.auWebsite <http://www.mudex.com.au>

1.4 Emergency telephone numbers

Emergency +61 427 558 155

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

NOT CLASSIFIED AS HAZARDOUS ACCORDING TO SAFE WORK AUSTRALIA CRITERIA

2.2 GHS Label elements

No signal word, pictograms, hazard or precautionary statements have been allocated.

2.3 Other hazards

No information provided.

3. COMPOSITION/ INFORMATION ON INGREDIENTS

3.1 Substances / Mixtures

Ingredient	CAS Number	EC Number	Content
SODIUM LAURYL ETHOXY SULPHATE	68585-34-2	500-223-8	30 to 60%
DIETHYLENE GLYCOL BUTYL ETHER	112-34-5	203-961-6	<10%
WATER	7732-18-5	231-791-2	Remainder

4. FIRST AID MEASURES

4.1 Description of first aid measures

Eye If in eyes, hold eyelids apart and flush continuously with running water. Continue flushing until advised to stop by a Poisons Information Centre, a doctor, or for at least 15 minutes.

Inhalation If inhaled, remove from contaminated area. Apply artificial respiration if not breathing.

Skin If skin or hair contact occurs, remove contaminated clothing and flush skin and hair with running water. Continue flushing with water until advised to stop by a Poisons Information Centre or a doctor.

Ingestion For advice, contact a Poisons Information Centre on 13 11 26 (Australia Wide) or a doctor (at once). If swallowed, do not induce vomiting. Rinse mouth with water.

First aid facilities None allocated.



PRODUCT NAME FOAM X (ALL GRADES)

4.2 Most important symptoms and effects, both acute and delayed

See Section 11 for more detailed information on health effects and symptoms.

4.3 Immediate medical attention and special treatment needed

Treat symptomatically.

5. FIRE FIGHTING MEASURES

5.1 Extinguishing media

Use an extinguishing agent suitable for the surrounding fire.

5.2 Special hazards arising from the substance or mixture

Non flammable. May evolve toxic gases (carbon/ sulphur oxides, hydrocarbons) when heated to decomposition.

5.3 Advice for firefighters

Evacuate area and contact emergency services. Toxic gases may be evolved in a fire situation. Remain upwind and notify those downwind of hazard. Wear full protective equipment including Self Contained Breathing Apparatus (SCBA) when combating fire. Use waterfog to cool intact containers and nearby storage areas.

5.4 Hazchem code

None allocated.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Wear Personal Protective Equipment (PPE) as detailed in section 8 of the SDS. Clear area of all unprotected personnel. Ventilate area where possible. Contact emergency services where appropriate.

6.2 Environmental precautions

Prevent product from entering drains and waterways.

6.3 Methods of cleaning up

Contain spillage, then cover / absorb spill with non-combustible absorbent material (vermiculite, sand, or similar), collect and place in suitable containers for disposal.

6.4 Reference to other sections

See Sections 8 and 13 for exposure controls and disposal.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Before use carefully read the product label. Use of safe work practices are recommended to avoid eye or skin contact and inhalation. Observe good personal hygiene, including washing hands before eating. Prohibit eating, drinking and smoking in contaminated areas.

7.2 Conditions for safe storage, including any incompatibilities

Store in a cool, dry, well ventilated area, removed from incompatible substances, heat or ignition sources and foodstuffs. Ensure containers are adequately labelled, protected from physical damage and sealed when not in use. Check regularly for leaks or spills. Large storage areas should have appropriate fire protection systems.

7.3 Specific end uses

No information provided.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Control parameters

Exposure standards

Ingredient	Reference	TWA		STEL	
		ppm	mg/m ³	ppm	mg/m ³
Diethylene glycol butyl ether	SWA [Proposed]	10	67.5	--	--



PRODUCT NAME FOAM X (ALL GRADES)

Biological limits

No biological limit values have been entered for this product.

8.2 Exposure controls

Engineering controls Avoid inhalation. Use in well ventilated areas. Where an inhalation risk exists, mechanical explosion proof extraction ventilation is recommended. Maintain vapour levels below the recommended exposure standard.

PPE

Eye / Face	Wear splash-proof goggles.
Hands	Wear PVC or rubber gloves.
Body	Wear coveralls.
Respiratory	Where an inhalation risk exists, wear a Type A (Organic vapour) respirator.



9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

Appearance	COLOURED LIQUID
Odour	SLIGHT ODOUR
Flammability	NON FLAMMABLE
Flash point	NOT RELEVANT
Boiling point	NOT AVAILABLE
Melting point	NOT AVAILABLE
Evaporation rate	NOT AVAILABLE
pH	7 to 9
Vapour density	NOT AVAILABLE
Relative density	1.05
Solubility (water)	SOLUBLE
Vapour pressure	NOT AVAILABLE
Upper explosion limit	NOT RELEVANT
Lower explosion limit	NOT RELEVANT
Partition coefficient	NOT AVAILABLE
Autoignition temperature	NOT AVAILABLE
Decomposition temperature	NOT AVAILABLE
Viscosity	NOT AVAILABLE
Explosive properties	NOT AVAILABLE
Oxidising properties	NOT AVAILABLE
Odour threshold	NOT AVAILABLE

9.2 Other information

Freezing point	-10°C
Pour point	-8°C

10. STABILITY AND REACTIVITY

10.1 Reactivity

Carefully review all information provided in sections 10.2 to 10.6.

10.2 Chemical stability

Stable under recommended conditions of storage.

10.3 Possibility of hazardous reactions

Polymerization is not expected to occur.

10.4 Conditions to avoid

Avoid contact with incompatible substances.

ChemAlert.

PRODUCT NAME FOAM X (ALL GRADES)

10.5 Incompatible materials

Incompatible with oxidising agents (e.g. hypochlorites), acids (e.g. nitric acid), alkalis (e.g. sodium hydroxide), heat and ignition sources.

10.6 Hazardous decomposition products

May evolve toxic gases (carbon/ sulphur oxides, hydrocarbons) when heated to decomposition.

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity Based on available data, the classification criteria are not met. Ingestion of large quantities may result in nausea, vomiting, abdominal pain and diarrhoea.

Information available for the ingredients:

Ingredient	Oral LD50	Dermal LD50	Inhalation LC50
SODIUM LAURYL ETHOXY SULPHATE	1700 - 5000 mg/kg (rat)	--	--

Skin	Contact may result in irritation, redness, pain and rash.
Eye	Contact may result in irritation, lacrimation, pain and redness.
Sensitisation	Not classified as causing skin or respiratory sensitisation.
Mutagenicity	Not classified as a mutagen.
Carcinogenicity	Not classified as a carcinogen.
Reproductive	Not classified as a reproductive toxin.
STOT - single exposure	Over exposure to vapours may result in irritation of the nose and throat, with coughing. High level exposure may result in drowsiness, dizziness, nausea and headache.
STOT - repeated exposure	Repeated exposure to some glycols may result in kidney damage.
Aspiration	Not classified as causing aspiration.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Harmful to aquatic life.

12.2 Persistence and degradability

This product is readily biodegradable.

12.3 Bioaccumulative potential

No information provided.

12.4 Mobility in soil

No information provided.

12.5 Other adverse effects

No information provided.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Waste disposal For small amounts, absorb with sand, vermiculite or similar and dispose of to an approved landfill site. Contact the manufacturer/supplier for additional information if disposing of large quantities (if required). Prevent contamination of drains and waterways as aquatic life may be threatened and environmental damage may result.

Legislation Dispose of in accordance with relevant local legislation.

14. TRANSPORT INFORMATION

NOT CLASSIFIED AS A DANGEROUS GOOD BY THE CRITERIA OF THE ADG CODE, IMDG OR IATA



PRODUCT NAME FOAM X (ALL GRADES)

	LAND TRANSPORT (ADG)	SEA TRANSPORT (IMDG / IMO)	AIR TRANSPORT (IATA / ICAO)
14.1 UN Number	None allocated.	None allocated.	None allocated.
14.2 Proper Shipping Name	None allocated.	None allocated.	None allocated.
14.3 Transport hazard class	None allocated.	None allocated.	None allocated.
14.4 Packing Group	None allocated.	None allocated.	None allocated.

14.5 Environmental hazards

No information provided.

14.6 Special precautions for user

Hazchem code	None allocated.

15. REGULATORY INFORMATION**15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture**

Poison schedule A poison schedule number has not been allocated to this product using the criteria in the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP).

Classifications Safework Australia criteria is based on the Globally Harmonised System (GHS) of Classification and Labelling of Chemicals.

Inventory listings **AUSTRALIA: AIIC (Australian Inventory of Industrial Chemicals)**
All components are listed on AIIC, or are exempt.

16. OTHER INFORMATION**Additional information****PERSONAL PROTECTIVE EQUIPMENT GUIDELINES:**

The recommendation for protective equipment contained within this report is provided as a guide only. Factors such as form of product, method of application, working environment, quantity used, product concentration and the availability of engineering controls should be considered before final selection of personal protective equipment is made.

HEALTH EFFECTS FROM EXPOSURE:

It should be noted that the effects from exposure to this product will depend on several factors including: form of product; frequency and duration of use; quantity used; effectiveness of control measures; protective equipment used and method of application. Given that it is impractical to prepare a report which would encompass all possible scenarios, it is anticipated that users will assess the risks and apply control methods where appropriate.

PRODUCT NAME FOAM X (ALL GRADES)

Abbreviations	ACGIH	American Conference of Governmental Industrial Hygienists
	CAS #	Chemical Abstract Service number - used to uniquely identify chemical compounds
	CNS	Central Nervous System
	EC No.	EC No - European Community Number
	EMS	Emergency Schedules (Emergency Procedures for Ships Carrying Dangerous Goods)
	GHS	Globally Harmonized System
	GTEPG	Group Text Emergency Procedure Guide
	IARC	International Agency for Research on Cancer
	LC50	Lethal Concentration, 50% / Median Lethal Concentration
	LD50	Lethal Dose, 50% / Median Lethal Dose
	mg/m ³	Milligrams per Cubic Metre
	OEL	Occupational Exposure Limit
	pH	relates to hydrogen ion concentration using a scale of 0 (high acidic) to 14 (highly alkaline).
	ppm	Parts Per Million
	STEL	Short-Term Exposure Limit
	STOT-RE	Specific target organ toxicity (repeated exposure)
	STOT-SE	Specific target organ toxicity (single exposure)
	SUSMP	Standard for the Uniform Scheduling of Medicines and Poisons
	SWA	Safe Work Australia
	TLV	Threshold Limit Value
	TWA	Time Weighted Average

Report status This document has been compiled by RMT on behalf of the manufacturer, importer or supplier of the product and serves as their Safety Data Sheet ('SDS').

It is based on information concerning the product which has been provided to RMT by the manufacturer, importer or supplier or obtained from third party sources and is believed to represent the current state of knowledge as to the appropriate safety and handling precautions for the product at the time of issue. Further clarification regarding any aspect of the product should be obtained directly from the manufacturer, importer or supplier.

While RMT has taken all due care to include accurate and up-to-date information in this SDS, it does not provide any warranty as to accuracy or completeness. As far as lawfully possible, RMT accepts no liability for any loss, injury or damage (including consequential loss) which may be suffered or incurred by any person as a consequence of their reliance on the information contained in this SDS.

Prepared by Risk Management Technologies
5 Ventnor Ave, West Perth
Western Australia 6005
Phone: +61 8 9322 1711
Fax: +61 8 9322 1794
Email: info@rmt.com.au
Web: www.rmtglobal.com

[End of SDS]

APPENDIX J: PID BUMP TEST (SECTION A)

FIELD EQUIPMENT CALIBRATION RECORD					
Job/Site Details:					
SITE NAME: <u>Glen Helen</u>			SITE CODE: _____		
DATE WORK STARTS: <u>27/05/2022</u>			FIELD STAFF: <u>EL / KD</u>		
TYPE OF WORK: <u>Soil Sampling</u>					
Photoionisation Detector (PID):					
Equipment Make/Model: <u>METRAE 3000</u>					
Equipment ID: <u>598-702448</u>					
Concentration of Calibration Gas - Span Value (ppm): <u>100ppm</u>					
Date of Last Calibration: _____					
	DATE	TIME	BACKGROUND AIR READING	PID READING (Range limit)	
1)	<u>27/05/2022</u>	<u>11:15 AM</u>	<u>0.2 PPM</u>	<u>97.2 VPM</u>	
2)					
3)					
4)					
5)					
6)					
7)					
Field Challenge Details: <u>TRAINING - 1810-2939 / CYCLOPENTANE CALIBRATION GAS / 100 ppm / ISO BUTYLENE</u> <u>BUMP TESTED PRIOR TO SAMPLING - SOIL BOD - SAMPLING</u>					



Low Ecological Services

PO Box 8120, Alice Springs, NT 0871

Ph (08) 89 555 222

Email: sw@lowecol.com.au

Web: www.lowecol.com.au



APPENDIX K: CHAIN OF CUSTODY (SECTION B)

[illegible]

APPENDIX L: CERTIFICATE OF ANALYSIS (SECTION B)



Environmental

CERTIFICATE OF ANALYSIS

Work Order	: ES2241769	Page	: 1 of 6
Client	: LOW ECOLOGICAL SERVICES	Laboratory	: Environmental Division Sydney
Contact	: LOW ECOL	Contact	: Customer Services ES
Address	: PO BOX 31130	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ALICE SPRINGS NT, AUSTRALIA 0871	Telephone	: +61-2-8784 8555
Project	: +61 08 89 555 222	Date Samples Received	: 18-Nov-2022 07:30
Order number	: Glen Helen - Monitoring Wells	Date Analysis Commenced	: 21-Nov-2022
C-O-C number	: ---	Issue Date	: 25-Nov-2022 16:27
Sampler	: BLR/FDA		
Site	: ---		
Quote number	: EN/333		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

- Analytical Results
- Surrogate Control Limits

Additional information pertinent

Additional information pertinent to this report

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadiar	Organic Coordinator	Sydney Organics, Smithfield, NSW

Page
Work Order
Client
Project

: 2 of 6
: ES2241769
: LOW ECOLOGICAL SERVICES
: Glen Helen - Monitoring Wells



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

Λ = This result is computed from individual analyte detections at or above the level of reporting

⊖ = ALS is not NATA accredited for these tests.

- = Indicates an estimated value.

- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EG005T: Poor precision was obtained for Copper and Lead on sample ES2241464 # 026. Confirmed by re-digestion and reanalysis.
- EP080: Positive results for ES2241769#1, #2, #3 and #4 have been confirmed by re-analysis.

Page : 3 of 6
Work Order : ES2241769
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Monitoring Wells



Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		GH Down Stream		Method	Method	Method	Method
		Sampling date / time		11-Nov-2022 00:00		Method	Method	Method	Method
Compound	CAS Number	LOR	Unit	ES2241769-005		Method	Method	Method	Method
				Result		Method	Method	Method	Method
EA055: Moisture Content									
Moisture Content		1.0	%	21.8		Method	Method	Method	Method
EG005(ED093)T: Total Metals by ICP-AES									
Arsenic	7440-38-2	5	mg/kg	<5		Method	Method	Method	Method
Cadmium	7440-43-9	1	mg/kg	<1		Method	Method	Method	Method
Chromium	7440-47-3	2	mg/kg	<2		Method	Method	Method	Method
Copper	7440-50-8	5	mg/kg	<5		Method	Method	Method	Method
Lead	7439-92-1	5	mg/kg	<5		Method	Method	Method	Method
Nickel	7440-02-0	2	mg/kg	<2		Method	Method	Method	Method
Zinc	7440-66-6	5	mg/kg	5		Method	Method	Method	Method
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg	<0.1		Method	Method	Method	Method
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction		10	mg/kg	<10		Method	Method	Method	Method
C10 - C14 Fraction		50	mg/kg	<50		Method	Method	Method	Method
C15 - C28 Fraction		100	mg/kg	<100		Method	Method	Method	Method
C29 - C36 Fraction		100	mg/kg	<100		Method	Method	Method	Method
^ C10 - C36 Fraction (sum)		50	mg/kg	<50		Method	Method	Method	Method
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg	<10		Method	Method	Method	Method
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10		Method	Method	Method	Method
>C10 - C16 Fraction		50	mg/kg	<50		Method	Method	Method	Method
>C16 - C34 Fraction		100	mg/kg	<100		Method	Method	Method	Method
>C34 - C40 Fraction		100	mg/kg	<100		Method	Method	Method	Method
^ >C10 - C40 Fraction (sum)		50	mg/kg	<50		Method	Method	Method	Method
^ >C10 - C16 Fraction minus Napthalene (F2)		50	mg/kg	<50		Method	Method	Method	Method
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg	<0.2		Method	Method	Method	Method
Toluene	108-88-3	0.5	mg/kg	<0.5		Method	Method	Method	Method
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5		Method	Method	Method	Method
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5		Method	Method	Method	Method
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5		Method	Method	Method	Method
^ Sum of BTEX		0.2	mg/kg	<0.2		Method	Method	Method	Method

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Work Order : ES2241769
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Monitoring Wells



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		GH Down Stream																	
Compound	CAS Number	Sampling date / time		Result	Unit	LOR	Sample ID	GH Down Stream													
		EP080: BTEXN - Continued																			
		^ Total Xylenes																			
Naphthalene	91-20-3	0.5	mg/kg	<0.5	mg/kg	1	11-Nov-2022 00:00														
EP080S: TPH(V)BTEX Surrogates																					
1,2-Dichloroethane-D4	17060-07-0	0.2	%	84.5	%																
Toluene-D8	2037-26-5	0.2	%	92.4	%																
4-Bromofluorobenzene	460-00-4	0.2	%	86.8	%																

Glen Helen Fuel Contamination: Progress Report LOW ECOLOGICAL SERVICES (LES)

Page : 5 of 6
Work Order : ES2241769
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Monitoring Wells



Analytical Results

Sub-Matrix: WATER
(Matrix: WATER)

Sub-Matrix: WATER (Matrix: WATER)		Sample ID		Sampling date / time	Unit	MW1	MW2	MW3	MW4	****
Compound	CAS Number	LOR	Result			Result	Result	Result	Result	Result
EP080/071: Total Petroleum Hydrocarbons										
C6 - C9 Fraction	----	20	µg/L	40	110	30	740	----		
C10 - C14 Fraction	----	50	µg/L	<50	140	<50	60	----		
C15 - C28 Fraction	----	100	µg/L	<100	110	<100	<100	----		
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	----		
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	250	<50	60	----		
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions										
C6 - C10 Fraction	C6_C10	20	µg/L	40	100	30	730	----		
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	40	90	30	730	----		
>C10 - C16 Fraction	----	100	µg/L	<100	150	<100	<100	----		
>C16 - C34 Fraction	----	100	µg/L	<100	110	<100	<100	----		
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	----		
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	260	<100	<100	----		
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	140	<100	<100	----		
EP080: BTEXN										
Benzene	71-43-2	1	µg/L	<1	4	<1	<1	----		
Toluene	108-88-3	2	µg/L	<2	<2	<2	3	----		
Ethylbenzene	100-41-4	2	µg/L	<2	2	<2	<2	----		
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	----		
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	----		
^ Total Xylenes	----	2	µg/L	<2	<2	<2	<2	----		
^ Sum of BTEX	----	1	µg/L	<1	6	<1	3	----		
Naphthalene	91-20-3	5	µg/L	<5	6	<5	<5	----		
EP080S: TPH(V)BTEX Surrogates										
1,2-Dichloroethane-D4	17060-07-0	2	%	108	104	109	89.4	----		
Toluene-D8	2037-26-5	2	%	106	109	111	92.0	----		
4-Bromofluorobenzene	460-00-4	2	%	108	108	106	91.2	----		



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Work Order : ES2241769
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Monitoring Wells

Surrogate Control Limits

Sub-Matrix: SOIL			
Compound	CAS Number	Recovery Limits (%)	
		Low	High
EP080S: TPH(V)/BTX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130
Sub-Matrix: WATER			
Compound	CAS Number	Recovery Limits (%)	
		Low	High
EP080S: TPH(V)/BTX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

APPENDIX M: QUALITY CONTROL REPORT (SECTION B)



QUALITY CONTROL REPORT

Work Order	: ES2241769	Page	: 1 of 8
Client	: LOW ECOLOGICAL SERVICES	Laboratory	: Environmental Division Sydney
Contact	: LOW ECOL	Contact	: Customer Services ES
Address	: PO BOX 3130 ALICE SPRINGS NT, AUSTRALIA 0871	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 08 89 555 222	Telephone	: +61-2-8784 8555
Project	: Glen Helen - Monitoring Wells	Date Samples Received	: 18-Nov-2022
Order number	: —	Date Analysis Commenced	: 21-Nov-2022
C-O-C number	: —	Issue Date	: 25-Nov-2022
Sampler	: BL/RF/DA		
Site	: —		
Quote number	: EN/333		
No. of samples received	: 5		
No. of samples analysed	: 5		



Accreditation No. 823
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories
This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW

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Client : LOW ECOLOGICAL SERVICES

Project : Glen Helen - Monitoring Wells

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: SOIL											
Laboratory sample ID	Sample ID	Method/Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)		
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 4720516)											
ES2241460-032	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit		
		EG005T: Chromium	7440-47-3	2	mg/kg	7	7	0.0	No Limit		
		EG005T: Nickel	7440-02-0	2	mg/kg	18	18	0.0	No Limit		
		EG005T: Arsenic	7440-38-2	5	mg/kg	7	8	0.0	No Limit		
		EG005T: Copper	7440-50-8	5	mg/kg	36	38	5.6	No Limit		
		EG005T: Lead	7439-92-1	5	mg/kg	26	25	0.0	No Limit		
		EG005T: Zinc	7440-66-6	5	mg/kg	88	89	1.3	0% - 50%		
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit		
ES2241464-026	Anonymous	EG005T: Chromium	7440-47-3	2	mg/kg	<2	<2	0.0	No Limit		
		EG005T: Nickel	7440-02-0	2	mg/kg	2	2	0.0	No Limit		
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit		
		EG005T: Copper	7440-50-8	5	mg/kg	31	# 62	66.9	0% - 50%		
		EG005T: Lead	7439-92-1	5	mg/kg	70	# 820	169	0% - 20%		
		EG005T: Zinc	7440-66-6	5	mg/kg	447	416	7.1	0% - 20%		
		EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 4720524)									
		ES2241464-003	Anonymous	EA055: Moisture Content	----	0.1	%	11.7	12.9	9.7	0% - 50%
ES2241464-040	Anonymous	EA055: Moisture Content	----	0.1	%	17.9	17.5	2.3	0% - 50%		
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 4720517)											
ES2241464-003	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	0.1	<0.1	0.0	No Limit		
ES2241464-032	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit		
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4714640)											
ES2241460-001	Anonymous	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit		
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit		

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Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)	
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4714640) - continued										
ES2241460-001	Anonymous	EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit	
ES2241460-011	Anonymous	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit	
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit	
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit	
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4715778)										
ES2241957-001	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit	
ES2241880-001	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4714640)										
ES2241460-001	Anonymous	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit	
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit	
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit	
		EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit	
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4715778)										
ES2241957-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit	
ES2241880-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit	
EP080: BTEXN (QC Lot: 4715778)										
ES2241957-001	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit	
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
		EP080: meta- & para-Xylene	108-38-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
		EP080: ortho-Xylene	106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit	
		EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit	
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
		EP080: meta- & para-Xylene	108-38-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
ES2241880-001	Anonymous	EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit	
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit	
Sub-Matrix: WATER										
Laboratory sample ID		Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4714625)										
ES2241643-008	Anonymous	EP071: C15 - C28 Fraction	----	100	µg/L	<100	<100	0.0	No Limit	
		EP071: C10 - C14 Fraction	----	50	µg/L	<50	<50	0.0	No Limit	
		EP071: C29 - C36 Fraction	----	50	µg/L	<50	<50	0.0	No Limit	
ES2241643-001	Anonymous	EP071: C15 - C28 Fraction	----	100	µg/L	<100	<100	0.0	No Limit	

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Sub-Matrix: WATER		Laboratory sample ID		Sample ID	Method: Compound	CAS Number	LOR	Unit	Laboratory Duplicate (DUP) Report		RPD (%)	Acceptable RPD (%)
									Original Result	Duplicate Result		
				EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4714625) - continued								
ES2241643-001		Anonymous			EP071: C10 - C14 Fraction	----	50	µg/L	<50	<50	0.0	No Limit
					EP071: C29 - C36 Fraction	----	50	µg/L	<50	<50	0.0	No Limit
				EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4721535)								
ES2241613-001		Anonymous			EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
ES2241613-011		Anonymous			EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
				EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4714625)								
ES2241643-008		Anonymous			EP071: >C10 - C16 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
					EP071: >C16 - C34 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
					EP071: >C34 - C40 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
ES2241643-001		Anonymous			EP071: >C10 - C16 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
					EP071: >C16 - C34 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
					EP071: >C34 - C40 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
				EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4721535)								
ES2241613-001		Anonymous			EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
ES2241613-011		Anonymous			EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
				EP080: BTEXN (QC Lot: 4721535)								
ES2241613-001		Anonymous			EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
					EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
					EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
					EP080: meta- & para-Xylene	108-38-3	2	µg/L	<2	<2	0.0	No Limit
						106-42-3						
					EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
					EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
					EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
					EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
					EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
					EP080: meta- & para-Xylene	108-38-3	2	µg/L	<2	<2	0.0	No Limit
						106-42-3						
					EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
					EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit



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Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: SOIL

Sub-Matrix: SOIL								
Method/Compound	CAS Number		LOR	Unit	Method Blank (MB) Report	Spike Concentration	Laboratory Control Spike (LCS) Report	
							Spike Recovery (%)	Acceptable Limits (%)
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 4720516)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	121.1 mg/kg	101	88.0	113
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	0.74 mg/kg	128	70.0	130
EG005T: Chromium	7440-47-3	2	mg/kg	<2	19.6 mg/kg	118	68.0	132
EG005T: Copper	7440-50-8	5	mg/kg	<5	52.9 mg/kg	110	89.0	111
EG005T: Lead	7439-92-1	5	mg/kg	<5	60.8 mg/kg	110	82.0	119
EG005T: Nickel	7440-02-0	2	mg/kg	<2	15.3 mg/kg	105	80.0	120
EG005T: Zinc	7440-66-6	5	mg/kg	<5	139.3 mg/kg	96.8	66.0	133
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4720517)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	0.087 mg/kg	97.7	70.0	125
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4714640)								
EP071: C10 - C14 Fraction	---	50	mg/kg	<50	300 mg/kg	110	75.0	129
EP071: C15 - C28 Fraction	---	100	mg/kg	<100	450 mg/kg	109	77.0	131
EP071: C29 - C36 Fraction	---	100	mg/kg	<100	300 mg/kg	111	71.0	129
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4715778)								
EP080: C6 - C9 Fraction	---	10	mg/kg	<10	26 mg/kg	91.5	68.4	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4714640)								
EP071: >C10 - C16 Fraction	---	50	mg/kg	<50	375 mg/kg	111	77.0	125
EP071: >C16 - C34 Fraction	---	100	mg/kg	<100	525 mg/kg	108	74.0	138
EP071: >C34 - C40 Fraction	---	100	mg/kg	<100	225 mg/kg	117	63.0	131
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4715778)								
EP080: C6 - C10 Fraction	C6, C10	10	mg/kg	<10	31 mg/kg	94.2	68.4	128
EP080: BTEXN (QCLot: 4715778)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	104	62.0	116
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	98.4	67.0	121
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	98.6	65.0	117
EP080: meta- & para-Xylene	108-38-3	0.5	mg/kg	<0.5	2 mg/kg	94.2	66.0	118
	106-42-3							
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	96.8	68.0	120
EP080: Naphthalene	91-20-3	1	mg/kg	<1	1 mg/kg	98.0	63.0	119
Sub-Matrix: WATER								
Method/Compound	CAS Number		LOR	Unit	Method Blank (MB) Report	Spike Concentration	Laboratory Control Spike (LCS) Report	
							Spike Recovery (%)	Acceptable Limits (%)
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4714625)								

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Sub-Matrix: WATER

Sub-Matrix: WATER	Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report		Laboratory Control Spike (LCS) Report		
					Result	Spike Concentration	Spike Recovery (%)	LCS	Low
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4714625) - continued									
	EP071: C10 - C14 Fraction	----	50	µg/L	<50	400 µg/L	68.0	53.7	97.0
	EP071: C15 - C28 Fraction	----	100	µg/L	<100	600 µg/L	90.7	63.3	107
	EP071: C29 - C36 Fraction	----	50	µg/L	<50	400 µg/L	103	58.3	120
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4721535)									
	EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L	92.5	75.0	127
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4714625)									
	EP071: >C10 - C16 Fraction	----	100	µg/L	<100	500 µg/L	71.6	53.9	95.5
	EP071: >C16 - C34 Fraction	----	100	µg/L	<100	700 µg/L	97.4	57.8	110
	EP071: >C34 - C40 Fraction	----	100	µg/L	<100	300 µg/L	91.8	50.5	115
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4721535)									
	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L	93.5	75.0	127
EP080: BTEXN (QCLot: 4721535)									
	EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	89.8	70.0	122
	EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	95.3	69.0	123
	EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	96.0	70.0	120
	EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	10 µg/L	96.6	69.0	121
	EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	99.2	72.0	122
	EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	86.0	70.0	120

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: SOIL

Laboratory sample ID		Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report		
					Spike Concentration	SpikeRecovery(%)	Acceptable Limits (%)
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 4720516)							
ES2241460-032	Anonymous		EG005T: Arsenic	7440-38-2	50 mg/kg	93.2	70.0
			EG005T: Cadmium	7440-43-9	50 mg/kg	90.7	70.0
			EG005T: Chromium	7440-47-3	50 mg/kg	99.1	68.0
			EG005T: Copper	7440-50-8	250 mg/kg	100	70.0
			EG005T: Lead	7439-92-1	250 mg/kg	100	70.0
			EG005T: Nickel	7440-02-0	50 mg/kg	102	70.0
		EG005T: Zinc	7440-66-6	250 mg/kg	99.4	66.0	
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4720517)							
ES2241464-003	Anonymous		EG035T: Mercury	7439-97-6	5 mg/kg	98.9	70.0



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Sub-Matrix: SOIL

Sub-Matrix: SOIL									
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report					
				Spike Concentration	SpikeRecovery(%)	MS	Acceptable Limits (%)	Low	High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4714640)									
ES2241460-001	Anonymous	EP071: C10 - C14 Fraction	----	480 mg/kg	109		73.0		137
		EP071: C15 - C28 Fraction	----	3100 mg/kg	107		53.0		131
		EP071: C29 - C36 Fraction	----	2060 mg/kg	103		52.0		132
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4715778)									
ES2241957-001	Anonymous	EP080: C6 - C9 Fraction	----	32.5 mg/kg	86.0		70.0		130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4714640)									
ES2241460-001	Anonymous	EP071: >C10 - C16 Fraction	----	860 mg/kg	111		73.0		137
		EP071: >C16 - C34 Fraction	----	4320 mg/kg	104		53.0		131
		EP071: >C34 - C40 Fraction	----	890 mg/kg	103		52.0		132
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4715778)									
ES2241957-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	87.2		70.0		130
EP080: BTEXN (QCLot: 4715778)									
ES2241957-001	Anonymous	EP080: Benzene	71-43-2	2.5 mg/kg	90.8		70.0		130
		EP080: Toluene	108-88-3	2.5 mg/kg	86.6		70.0		130
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	87.6		70.0		130
		EP080: meta- & para-Xylene	108-38-3	2.5 mg/kg	87.8		70.0		130
EP080: ortho-Xylene	EP080: Naphtalene	106-42-3							
		95-47-6	2.5 mg/kg	89.3		70.0		130	
EP080: Naphtalene		91-20-3	2.5 mg/kg	88.6		70.0		130	

Sub-Matrix: WATER

Sub-Matrix: WATER								
Laboratory sample ID		Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report			
					Spike Concentration	Spike Recovery(%) MS	Acceptable Limits (%) Low	High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4714625)								
ES2241643-002	Anonymous		EP071: C10 - C14 Fraction	----	200 µg/L	92.2	70.0	130
			EP071: C15 - C28 Fraction	----	250 µg/L	116	71.0	130
			EP071: C29 - C36 Fraction	----	200 µg/L	111	67.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4721535)								
ES2241613-001	Anonymous		EP080: C6 - C9 Fraction	----	325 µg/L	91.2	70.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4714625)								
ES2241643-002	Anonymous		EP071: >C10 - C16 Fraction	----	250 µg/L	91.2	70.0	130
			EP071: >C16 - C34 Fraction	----	350 µg/L	97.8	75.0	130
			EP071: >C34 - C40 Fraction	----	150 µg/L	115	67.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4721535)								
ES2241613-001	Anonymous		EP080: C6 - C10 Fraction	C6_C10	375 µg/L	90.9	70.0	130
EP080: BTEXN (QCLot: 4721535)								
ES2241613-001	Anonymous		EP080: Benzene	71-43-2	25 µg/L	85.1	70.0	130

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Project : Glen Helen - Monitoring Wells



Sub-Matrix: WATER

Laboratory sample ID		Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report				
					Spike Concentration	Spike Recovery(%)	MS	Acceptable Limits (%)	
EP080: BTEXN (QCLot: 4721535) - continued									
ES2241613-001	Anonymous		EP080: Toluene	108-88-3	25 µg/L		90.8	70.0	130
			EP080: Ethylbenzene	100-41-4	25 µg/L		96.4	70.0	130
			EP080: meta- & para-Xylene	108-38-3	25 µg/L		93.7	70.0	130
				106-42-3					
			EP080: ortho-Xylene	95-47-6	25 µg/L		93.6	70.0	130
			EP080: Naphthalene	91-20-3	25 µg/L		74.7	70.0	130

APPENDIX N: QA/QC COMPLIANCE ASSESSMENT (SECTION B)



QA/QC Compliance Assessment to assist with Quality Review

Work Order	: ES2241769	Page	: 1 of 6
Client	: LOW ECOLOGICAL SERVICES	Laboratory	: Environmental Division Sydney
Contact	: LOW ECOL	Telephone	: +61-2-8784 8555
Project	: Glen Helen - Monitoring Wells	Date Samples Received	: 18-Nov-2022
Site	: ---	Issue Date	: 25-Nov-2022
Sampler	: BLURFIDA	No. of samples received	: 5
Order number	: ---	No. of samples analysed	: 5

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- NO Method Blank value outliers occur.
- NO Laboratory Control outliers occur.
- NO Matrix Spike outliers occur.
- Duplicate outliers exist - please see following pages for full details.
- For all regular sample matrices, NO surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- NO Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- NO Quality Control Sample Frequency Outliers exist.

Page : 2 of 6
Work Order : ES2241769
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Monitoring Wells



Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: SOIL

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
EG005(ED093)T: Total Metals by ICP-AES	ES2241464-026	Anonymous	Copper	7440-50-8	66.9 %	0% - 50%	RPD exceeds LOR based limits
EG005(ED093)T: Total Metals by ICP-AES	ES2241464-026	Anonymous	Lead	7439-92-1	169 %	0% - 20%	RPD exceeds LOR based limits

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results. This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for *VOC in soils* vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: SOIL

Method		Sample Date	Extraction / Preparation		Analysis	
Container / Client Sample ID(s)	Date extracted		Due for extraction	Evaluation	Date analysed	Due for analysis
Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.						
Matrix: SOIL						
EA055: Moisture Content						
Soil Glass Jar - Unpreserved (EA055) GH Down Stream	11-Nov-2022	----	----	23-Nov-2022	25-Nov-2022	✔
EG005(ED093)T: Total Metals by ICP-AES						
Soil Glass Jar - Unpreserved (EG005T) GH Down Stream	11-Nov-2022	23-Nov-2022	10-May-2023	✔	23-Nov-2022	10-May-2023
EG035T: Total Recoverable Mercury by FIMS						
Soil Glass Jar - Unpreserved (EG035T) GH Down Stream	11-Nov-2022	23-Nov-2022	09-Dec-2022	✔	23-Nov-2022	09-Dec-2022
EP080/071: Total Petroleum Hydrocarbons						
Soil Glass Jar - Unpreserved (EP071) GH Down Stream	11-Nov-2022	21-Nov-2022	25-Nov-2022	✔	22-Nov-2022	31-Dec-2022
Soil Glass Jar - Unpreserved (EP080) GH Down Stream	11-Nov-2022	21-Nov-2022	25-Nov-2022	✔	23-Nov-2022	25-Nov-2022
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions						
Soil Glass Jar - Unpreserved (EP071) GH Down Stream	11-Nov-2022	21-Nov-2022	25-Nov-2022	✔	22-Nov-2022	31-Dec-2022
Soil Glass Jar - Unpreserved (EP080) GH Down Stream	11-Nov-2022	21-Nov-2022	25-Nov-2022	✔	23-Nov-2022	25-Nov-2022
EP080: BTEXN						
Soil Glass Jar - Unpreserved (EP080) GH Down Stream	11-Nov-2022	21-Nov-2022	25-Nov-2022	✔	23-Nov-2022	25-Nov-2022
Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.						
Matrix: WATER						

Glen Helen Fuel Contamination: Progress Report LOW ECOLOGICAL SERVICES (LES)

Page : 3 of 6
 Work Order : ES2241769
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen - Monitoring Wells



Matrix: WATER

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method	Sample Date	Extraction / Preparation		Analysis	
Container / Client Sample ID(s)		Date extracted	Due for extraction	Date analysed	Evaluation
EP080/071: Total Petroleum Hydrocarbons					
Amber Glass Bottle - Unpreserved (EP071) MW1, MW3,	15-Nov-2022	21-Nov-2022	22-Nov-2022	22-Nov-2022	31-Dec-2022
				✓	✓
Amber VOC Vial - Sulfuric Acid (EP080) MW1, MW3,	15-Nov-2022	24-Nov-2022	29-Nov-2022	24-Nov-2022	29-Nov-2022
				✓	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions					
Amber Glass Bottle - Unpreserved (EP071) MW1, MW3,	15-Nov-2022	21-Nov-2022	22-Nov-2022	22-Nov-2022	31-Dec-2022
				✓	✓
Amber VOC Vial - Sulfuric Acid (EP080) MW1, MW3,	15-Nov-2022	24-Nov-2022	29-Nov-2022	24-Nov-2022	29-Nov-2022
				✓	✓
EP080: BTEXN					
Amber VOC Vial - Sulfuric Acid (EP080) MW1, MW3,	15-Nov-2022	24-Nov-2022	29-Nov-2022	24-Nov-2022	29-Nov-2022
				✓	✓

Page : 4 of 6
 Work Order : ES2241769
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen - Monitoring Wells



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL** Evaluation: * = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)		Quality Control Specification	
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Total Mercury by FIMS	EG035T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Total Mercury by FIMS	EG035T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Total Mercury by FIMS	EG035T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER** Evaluation: * = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)		Quality Control Specification	
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
TRH - Semivolatile Fraction	EP071	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
TRH - Semivolatile Fraction	EP071	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
TRH - Semivolatile Fraction	EP071	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
TRH - Semivolatile Fraction	EP071	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard

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 Work Order : ES2241769
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen - Monitoring Wells



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
TRH - Semivolatile Fraction	EP071	SOIL	In house: Referenced to USEPA SW 846 - 8015 Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM Schedule B(3).
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM Schedule B(3) amended.
TRH - Semivolatile Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015 The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GC/MS analysis. This method is compliant with the QC requirements of NEPM Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.

Page
Work Order
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Project

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: ES2241769
: LOW ECOLOGICAL SERVICES
: Glen Helen - Monitoring Wells



Preparation Methods	Method	Matrix	Method Descriptions
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot of 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.

APPENDIX O: ALS TAX INVOICE (SECTION B)



Australian Laboratory Services Pty Ltd ABN 84 009 936 029. An ALS Limited Company

TAX INVOICE: 1151614088

LOW ECOLOGICAL SERVICES
 LOW ECOL
 PO BOX 3130
 ALICE SPRINGS
 NT, AUSTRALIA 0871

Work Order	Project / Overall Description	Site	Order number	C-O-C number	Contact
ES2241769	Glen Helen - Monitoring Wells / ----	----	----	----	LOW ECOL

Issue Date	: 25-Nov-2022	Taxable value	: AUD\$	298.00
		Tax Incurred (GST)	: AUD\$	29.80
Due Date	: 26-Dec-2022	Amount Payable	: AUD\$	327.80

Work Order Breakdown

Method	Sale Item Descriptions	Quantity	Unit Value (AUD\$)	Value (AUD\$)	GST (AUD\$)	Line Total (AUD\$)
Work Order: ES2241769		Quote number: EN/333		Submatrix summary: 4 WATERS, 1 SOIL		
*Misc	Workorder Admin Fee	1.00	45.00	45.00	4.50	49.50
S-05	TRH/BTEXN/8 Metals	1.00	68.20	68.20	6.82	75.02
W-04	TRH/BTEXN	4.00	46.20	184.80	18.48	203.28

* denotes non-discountable item

- Please direct all queries to Environmental Division Sydney on +61-2-8784 8555.

REMITTANCE ADVICE

POST TO: Australian Laboratory Services Pty Ltd
 P.O. Box 66 Everton Park
 QLD 4053 Australia

EMAIL TO: remittances@alsglobal.com

Vendor bank details

Bank: Westpac Banking Corporation or Credit Card
 BSB: 034 008 Visa
 Account: 464673 Mastercard
 Swift Code: WPACAU2S American Express
 or Cheque

Payable to Australian Laboratory Services Pty Ltd

Amount Payable

AUD\$ 327.80

ALS Client Reference

LOWECO

TAX INVOICE

1151614088

APPENDIX P: CHAIN OF CUSTODY (COC) (SECTION C)

[illegible]

APPENDIX Q: SAMPLE RECEIPT NOTIFICATION (SRN) (SECTION C)



Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order	: ES2245882		
Client	: LOW ECOLOGICAL SERVICES	Laboratory	: Environmental Division Sydney
Contact	: MR BILL LOW	Contact	: Customer Services ES
Address	: PO BOX 3130 ALICE SPRINGS NT, AUSTRALIA 0871	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: lowecol@lowecol.com.au	E-mail	: ALSEnviro.Sydney@ALSGlobal.com
Telephone	: +61 08 89 555 222	Telephone	: +61-2-8784 8555
Facsimile	: +61 08 89 555 722	Facsimile	: +61-2-8784 8500
Project	: Glen Helen - Monitoring Wells	Page	: 1 of 2
Order number	: LES221214	Quote number	: EB2017LOWECO0001 (EN/333)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: BL/RF/MK		

Dates

Date Samples Received	: 20-Dec-2022 08:30	Issue Date	: 20-Dec-2022
Client Requested Due Date	: 04-Jan-2023	Scheduled Reporting Date	: 04-Jan-2023

Delivery Details

Mode of Delivery	: Client Drop Off	Security Seal	: Not Available
No. of coolers/boxes	: 1	Temperature	: 16.8°C - Ice present
Receipt Detail	:	No. of samples received / analysed	: 7 / 7

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Proactive Holding Time Report
 - Requested Deliverables
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Issue Date : 20-Dec-2022
 Page : 2 of 2
 Work Order : ES2245882 Amendment 0
 Client : LOW ECOLOGICAL SERVICES



Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- No sample container / preservation non-compliance exists.

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - W-04 TRIHEXN
ES2245882-001	13-Dec-2022 13:36	MW1	✓
ES2245882-002	13-Dec-2022 13:48	MW2	✓
ES2245882-003	13-Dec-2022 13:30	MW3	✓
ES2245882-004	13-Dec-2022 13:20	MW4	✓
ES2245882-005	13-Dec-2022 16:00	EQUIPMENT BLANK	✓
ES2245882-006	13-Dec-2022 13:20	SAMPLE BLANK	✓
ES2245882-007	13-Dec-2022 16:06	TRIP BLANK	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

BILL LOW

- *AU Certificate of Analysis - NATA (COA)	Email	lowecol@lowecol.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	lowecol@lowecol.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	lowecol@lowecol.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	lowecol@lowecol.com.au
- A4 - AU Tax Invoice (INV)	Email	lowecol@lowecol.com.au
- Chain of Custody (CoC) (COC)	Email	lowecol@lowecol.com.au
- EDI Format - XTab (XTAB)	Email	lowecol@lowecol.com.au

MIRIAM KUNDE

- *AU Certificate of Analysis - NATA (COA)	Email	miriam.kunde@gmail.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	miriam.kunde@gmail.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	miriam.kunde@gmail.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	miriam.kunde@gmail.com
- Chain of Custody (CoC) (COC)	Email	miriam.kunde@gmail.com
- EDI Format - XTab (XTAB)	Email	miriam.kunde@gmail.com

APPENDIX R: CERTIFICATE OF ANALYSIS (SECTION C)



Work Order

: ES2245882

Client

: LOW ECOLOGICAL SERVICES

Contact

: MR BILL LOW

Address

: PO BOX 3130
ALICE SPRINGS NT, AUSTRALIA 0871

Telephone

: +61 08 89 555 222

Project

: Glen Helen - Monitoring Wells

Order number

: LES221214

C-O-C number

: --

Sampler

: BL/RF/MK

Site

: --

Quote number

: EN/333

No. of samples received

: 7

No. of samples analysed

: 7

Page

: 1 of 5

Laboratory

: Environmental Division Sydney

Contact

: Customer Services ES

Address

: 277-289 Woodpark Road Smithfield NSW Australia 2164

Telephone

: +61-2-8784 8555

Date Samples Received

: 20-Dec-2022 08:30

Date Analysis Commenced

: 20-Dec-2022

Issue Date

: 03-Jan-2023 06:28



Accreditation No. 825

Accredited for compliance with

ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories
This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW

APPENDIX R

RIGHT SOLUTIONS | RIGHT PARTNER

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Work Order : ES2245882
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Monitoring Wells



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

Λ = This result is computed from individual analyte detections at or above the level of reporting

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.

Glen Helen Fuel Contamination: Progress Report LOW ECOLOGICAL SERVICES (LES)



Page : 3 of 5
 Work Order : ES2245882
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen - Monitoring Wells

Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Sub-Matrix: WATER (Matrix: WATER)	Sample ID													
	Sampling date / time		Unit		MW1		MW2		MW3		MW4		EQUIPMENT BLANK	
	LOR	CAS Number	Result	ES2245882-001	Result	ES2245882-002	Result	ES2245882-003	Result	ES2245882-004	Result	ES2245882-005		
Compound														
EP080/071: Total Petroleum Hydrocarbons														
C6 - C9 Fraction	----	20	µg/L		<20	60	<20	30	<20					
C10 - C14 Fraction	----	50	µg/L		<50	<50	<50	<50	<50					
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	<100	<100					
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	<50	<50					
^ C10 - C36 Fraction (sum)	----	50	µg/L		<50	<50	<50	<50	<50					
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions														
C6 - C10 Fraction	C6_C10	20	µg/L		<20	60	<20	30	<20					
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L		<20	60	<20	30	<20					
>C10 - C16 Fraction	----	100	µg/L		<100	<100	<100	<100	<100					
>C16 - C34 Fraction	----	100	µg/L		<100	<100	<100	<100	<100					
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	<100					
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	<100	<100	<100	<100					
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		<100	<100	<100	<100	<100					
EP080: BTEXN														
Benzene	71-43-2	1	µg/L		<1	4	<1	<1	<1					
Toluene	108-88-3	2	µg/L		<2	<2	<2	<2	<2					
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	<2					
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	<2	<2					
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	<2	<2					
^ Total Xylenes	----	2	µg/L		<2	<2	<2	<2	<2					
^ Sum of BTEX	----	1	µg/L		<1	4	<1	<1	<1					
Naphthalene	91-20-3	5	µg/L		<5	6	<5	<5	<5					
EP080S: TPH(V)BTEX Surrogates														
1,2-Dichloroethane-D4	17060-07-0	2	%		106	107	106	108	105					
Toluene-D8	2037-26-5	2	%		98.6	99.5	95.0	96.3	92.2					
4-Bromofluorobenzene	460-00-4	2	%		106	106	94.4	94.4	99.5					

Glen Helen Fuel Contamination: Progress Report LOW ECOLOGICAL SERVICES (LES)

Page : 4 of 5
 Work Order : ES2245882
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen - Monitoring Wells



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Sub-Matrix: WATER (Matrix: WATER)	Sample ID				CAS Number	Sampling date / time		Unit	SAMPLE BLANK	TRIP BLANK	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result

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Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Monitoring Wells



Surrogate Control Limits

Sub-Matrix: WATER			
Compound	CAS Number	Recovery Limits (%)	
		Low	High
EP080S: TPH(V)BTX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

APPENDIX S: QUALITY CONTROL REPORT (SECTION C)



Work Order

: ES2245882

Client

: LOW ECOLOGICAL SERVICES

Contact

: MR BILL LOW

Address

: PO BOX 3130
ALICE SPRINGS NT, AUSTRALIA 0871

Telephone

: +61 08 89 555 222

Project

: Glen Helen - Monitoring Wells

Order number

: LES221214

C-O-C number

: ---

Sampler

: BL/RF/MK

Site

: ---

Quote number

: EN/333

No. of samples received

: 7

No. of samples analysed

: 7

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: 1 of 5

Laboratory

: Environmental Division Sydney

Contact

: Customer Services ES

Address

: 277-289 Woodpark Road Smithfield NSW Australia 2164

Telephone

: +61-2-8784 8555

Date Samples Received

: 20-Dec-2022

Date Analysis Commenced

: 20-Dec-2022

Issue Date

: 03-Jan-2023



Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW

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 Work Order : ES2245882
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen - Monitoring Wells



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot

CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

RPD = Relative Percentage Difference

= Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

Sub-Matrix: WATER		Sample ID	Laboratory sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
						LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4788633)											
	ES2245398-068	Anonymous		EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
	ES2245882-004	MW4		EP080: C6 - C9 Fraction	----	20	µg/L	30	30	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4791578)											
	ES2245882-001	MW1		EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4788633)											
	ES2245398-068	Anonymous		EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
	ES2245882-004	MW4		EP080: C6 - C10 Fraction	C6_C10	20	µg/L	30	30	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4791578)											
	ES2245882-001	MW1		EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
EP080: BTEXN (QC Lot: 4788633)											
	ES2245398-068	Anonymous		EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
				EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
				EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
				EP080: meta- & para-Xylene	108-38-3	2	µg/L	<2	<2	0.0	No Limit
					106-42-3						
				EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
				EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
				EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
				EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
				EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
				EP080: meta- & para-Xylene	108-38-3	2	µg/L	<2	<2	0.0	No Limit
					106-42-3						
	ES2245882-004	MW4									
				EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit

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: LOW ECOLOGICAL SERVICES
: Glen Helen - Monitoring Wells



Sub-Matrix: WATER									
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP080: BTEXN (QC Lot: 4788633) - continued									
ES2245882-004	MW4	EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
EP080: BTEXN (QC Lot: 4791578)									
ES2245882-001	MW1	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3	2	µg/L	<2	<2	0.0	No Limit
			106-42-3						
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit



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 Work Order : ES2245882
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen - Monitoring Wells

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: WATER

Sub-Matrix: WATER				Method Blank (MB) Report		Laboratory Control Spike (LCS) Report			
Method: Compound	CAS Number	LOR	Unit	Result	Spike Concentration	Spike Recovery (%)	LCS	Acceptable Limits (%)	
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4781330)									
EP071: C10 - C14 Fraction	----	50	µg/L	<50	400 µg/L		69.1	53.7	
EP071: C15 - C28 Fraction	----	100	µg/L	<100	600 µg/L		105	63.3	
EP071: C29 - C36 Fraction	----	50	µg/L	<50	400 µg/L		94.4	58.3	
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4788633)									
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L		87.4	75.0	
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4791578)									
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L		97.2	75.0	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4781330)									
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	500 µg/L		80.4	53.9	
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	700 µg/L		106	57.8	
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	300 µg/L		72.2	50.5	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4788633)									
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L		89.7	75.0	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4791578)									
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L		98.8	75.0	
EP080: BTEXN (QCLot: 4788633)									
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L		88.9	70.0	
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L		87.9	69.0	
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L		87.2	70.0	
EP080: meta- & para-Xylene	108-38-3	2	µg/L	<2	10 µg/L		87.2	69.0	
	106-42-3								
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L		91.3	72.0	
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L		97.4	70.0	
EP080: BTEXN (QCLot: 4791578)									
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L		98.3	70.0	
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L		96.2	69.0	
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L		100	70.0	
EP080: meta- & para-Xylene	108-38-3	2	µg/L	<2	10 µg/L		99.6	69.0	
	106-42-3								
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L		107	72.0	
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L		99.0	70.0	

Matrix Spike (MS) Report

Glen Helen Fuel Contamination: Progress Report LOW ECOLOGICAL SERVICES (LES)

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Work Order : ES2245882
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Monitoring Wells



The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report				
				Spike Concentration	SpikeRecovery(%) MS	Acceptable Limits (%)	Low	High
Laboratory sample ID	Sample ID	Method: Compound	CAS Number					
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4788633)								
ES2245398-068	Anonymous	EP080: C6 - C9 Fraction	----	325 µg/L	95.1	70.0	130	
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4791578)								
ES2245882-001	MW1	EP080: C6 - C9 Fraction	----	325 µg/L	106	70.0	130	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4788633)								
ES2245398-068	Anonymous	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	100.0	70.0	130	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4791578)								
ES2245882-001	MW1	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	103	70.0	130	
EP080: BTEXN (QCLot: 4788633)								
ES2245398-068	Anonymous	EP080: Benzene	71-43-2	25 µg/L	92.1	70.0	130	
		EP080: Toluene	108-88-3	25 µg/L	88.1	70.0	130	
		EP080: Ethylbenzene	100-41-4	25 µg/L	90.6	70.0	130	
		EP080: meta- & para-Xylene	108-38-3	25 µg/L	88.8	70.0	130	
			106-42-3					
		EP080: ortho-Xylene	95-47-6	25 µg/L	89.9	70.0	130	
		EP080: Naphthalene	91-20-3	25 µg/L	85.0	70.0	130	
EP080: BTEXN (QCLot: 4791578)								
ES2245882-001	MW1	EP080: Benzene	71-43-2	25 µg/L	106	70.0	130	
		EP080: Toluene	108-88-3	25 µg/L	98.8	70.0	130	
		EP080: Ethylbenzene	100-41-4	25 µg/L	104	70.0	130	
		EP080: meta- & para-Xylene	108-38-3	25 µg/L	100	70.0	130	
			106-42-3					
		EP080: ortho-Xylene	95-47-6	25 µg/L	103	70.0	130	
		EP080: Naphthalene	91-20-3	25 µg/L	102	70.0	130	

APPENDIX T: QA/QC COMPLIANCE ASSESSMENT (SECTION C)



QA/QC Compliance Assessment to assist with Quality Review			
Work Order	: ES2245882	Page	: 1 of 5
Client	: LOW ECOLOGICAL SERVICES	Laboratory	: Environmental Division Sydney
Contact	: MR BILL LOW	Telephone	: +61-2-8784 8555
Project	: Glen Helen - Monitoring Wells	Date Samples Received	: 20-Dec-2022
Site	: ----	Issue Date	: 03-Jan-2023
Sampler	: BL/RF/MK	No. of samples received	: 7
Order number	: LES221214	No. of samples analysed	: 7

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- NO Method Blank value outliers occur.
- NO Duplicate outliers occur.
- NO Laboratory Control outliers occur.
- NO Matrix Spike outliers occur.
- For all regular sample matrices, NO surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- NO Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers exist - please see following pages for full details.



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 Work Order : ES22-45882
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen - Monitoring Wells

Outliers : Frequency of Quality Control Samples

Matrix: WATER						
Quality Control Sample Type	Method	Count		Rate (%)		Quality Control Specification
		QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)						
TRH - Semivolatile Fraction		0	7	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)						
TRH - Semivolatile Fraction		0	7	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results. This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (eg. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: WATER		Sample Date		Extraction / Preparation		Analysis	
Method	Container / Client Sample ID(s)	Date extracted	Due for extraction	Date analysed	Due for analysis	Evaluation	
EP080071: Total Petroleum Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP071)	MW2, MW4, EQUIPMENT BLANK, TRIP BLANK	20-Dec-2022	20-Dec-2022	28-Dec-2022	29-Jan-2023	✓	✓
Amber VOC Vial - Sulfuric Acid (EP080)	MW2, MW4, EQUIPMENT BLANK, TRIP BLANK	13-Dec-2022	24-Dec-2022	24-Dec-2022	27-Dec-2022	✓	✓
EP080071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Amber Glass Bottle - Unpreserved (EP071)	MW2, MW4, EQUIPMENT BLANK, TRIP BLANK	13-Dec-2022	20-Dec-2022	28-Dec-2022	29-Jan-2023	✓	✓
Amber VOC Vial - Sulfuric Acid (EP080)	MW2, MW4, EQUIPMENT BLANK, TRIP BLANK	13-Dec-2022	24-Dec-2022	24-Dec-2022	27-Dec-2022	✓	✓

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Work Order
: ES22-45882

Client
: LOW ECOLOGICAL SERVICES

Project
: Glen Helen - Monitoring Wells



Matrix: WATER									
Evaluation: * = Holding time breach ; ✓ = Within holding time.									
Method		Sample Date		Extraction / Preparation		Analysis			
Container / Client Sample ID(s)		Date extracted		Due for extraction		Date analysed		Due for analysis	
EP080: BTEXIN		13-Dec-2022		24-Dec-2022		27-Dec-2022		27-Dec-2022	
Amber VOC Vial - Sulfuric Acid (EP080)		MW2, MW3, EQUIPMENT BLANK, TRIP BLANK		MW2, MW4, SAMPLE BLANK,		✓		✓	



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Work Order : ES22-45882
Client : LOW ECOLOGICAL SERVICES
Project : Glen Helen - Monitoring Wells

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification

Quality Control Sample Type		Method	Count		Rate (%)		Quality Control Specification	
Analytical Methods			QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)								
TRH - Semivolatile Fraction		EP071	0	7	0.00	10.00	✖	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX		EP080	3	30	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)								
TRH - Semivolatile Fraction		EP071	1	7	14.29	5.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX		EP080	2	30	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)								
TRH - Semivolatile Fraction		EP071	1	7	14.29	5.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX		EP080	2	30	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)								
TRH - Semivolatile Fraction		EP071	0	7	0.00	5.00	✖	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX		EP080	2	30	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard



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 Work Order : ES2245882
 Client : LOW ECOLOGICAL SERVICES
 Project : Glen Helen - Monitoring Wells

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods		Method	Matrix	Method Descriptions
TRH - Semivolatile Fraction		EP071	WATER	In house: Referenced to USEPA SW 846 - 8015 The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM Schedule B(3)
TRH Volatiles/BTEX		EP080	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GC/MS analysis. This method is compliant with the QC requirements of NEPM Schedule B(3)
Preparation Methods		Method	Matrix	Method Descriptions
Separatory Funnel Extraction of Liquids		ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3). ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation		ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.

APPENDIX U: GROUNDWATER ANALYTICAL RESULTS (SECTION C)

Lab Report Number	Well	Laboratory	Date	BTEX					TRH									
				Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Xylene (m & p) µg/L	Xylene (o) µg/L	Xylene Total µg/L	Sum of BTEX µg/L	Naphthalene µg/L	CG-C10 Fraction (F1) µg/L	CG-C10 (F1 minus BTEX) µg/L	CG-C10-C16 Fraction (F2) µg/L	CG-C10-C16 Fraction (F2 minus Naphthalene) µg/L	CG-C16-C34 Fraction (F3) µg/L	CG-C34-C40 Fraction (F4) µg/L	>C10-C40 Fraction (Sum) µg/L
LOR Freshwater Ecosystems - ANZG 2018 99% level of species protection Australian Drinking Water Guidelines (as updated September 2022) Agriculture and Irrigation (Irrigation) Agriculture and Irrigation (Stock Watering) Water-based recreation - aesthetic criteria 2021 Water-based recreation - health criteria 2021 Human Health - Vapour Intrusion		ES2241769	15/11/2022	1	1	1	2	1	3									
		ES2245882	13/12/2022	600	110	50	140 (m) 50 (p)	200	600									600
		ES2241769	15/11/2022	1	800	300												
		ES2245882	13/12/2022	1	800	300			600									600
		ES2241769	15/11/2022							20**								600
		ES2245882	13/12/2022	10	25**	3**												600
		ES2241769	15/11/2022	900/5000							1,000/7,000							
		ES2245882	13/12/2022												1,000/NL			
ES2241769	MW1	ES2241769001	15/11/2022	<1	<2	<1	<2	<2	<3	<1	<5	40	<100	<100	<100	<100	<100	
ES2245882	MW2	ES2245882001	13/12/2022	<1	<1	<1	<2	<1	<3	<1	<5	<20	<100	<100	<100	<100	<100	
ES2241769		ES2241769002	15/11/2022	<1	<2	<1	2	<2	<2	6	6	100	90	150	140	110	260	
ES2245882		ES2245882002	13/12/2022	4	<1	<1	<1	<2	<1	<3	4	6	60	<100	<100	<100	<100	
ES2241769	MW3	ES2241769003	15/11/2022	<1	<2	<1	<2	<2	<2	<1	<5	30	<100	<100	<100	<100	<100	
ES2245882		ES2245882003	13/12/2022	<1	<1	<1	<2	<1	<3	<1	<5	<20	<20	<100	<100	<100	<100	
ES2241769	MW4	ES2241769004	15/11/2022	<1	3	<1	<2	<2	<2	3	<5	730	<100	<100	<100	<100	<100	
ES2245882		ES2245882004	13/12/2022	<1	<1	<1	<2	<1	<3	<1	<5	30	<100	<100	<100	<100	<100	
767539	EQUIPMENT BLANK	ES2245882005	13/12/2022	<1	<1	<1	<2	<1	<3	<1	<5	<20	<100	<100	<100	<100	<100	
785551	SAMPLE BLANK	ES2245882006	13/12/2022	<1	<1	<1	<2	<1	<3	<1	<5	<20	<100	<100	<100	<100	<100	
811267	TRIP BLANK	ES2245882007	13/12/2022	<1	<1	<1	<2	<1	<3	<1	<5	<20	<100	<100	<100	<100	<100	

ES2245882007: Trip blank. No detectable BTEX or TRH compounds. (Detection limit: 0.5 µg/L for BTEX, 1.0 µg/L for TRH)

ES2245882007: Trip blank. No detectable BTEX or TRH compounds. (Detection limit: 0.5 µg/L for BTEX, 1.0 µg/L for TRH)

APPENDIX K

Audit Communications / Reviews



22 July 2021

Katelyn Douglass
Environmental Consultant
Low Ecological Services P/L

**RE:- REVIEW OF BACKGROUND INFORMATION / REPORTING
GLEN HELEN LODGE (NT)**

This letter documents my initial review of background reporting, with the intention this will form the initial stage of an environmental audit program (should this ultimately be required) under the relevant provisions of the *Waste Management and Pollution Control Act 1998*. The following reports have been reviewed at this stage:-

- o *Glen Helen Lodge, Investigation for Fuel Leakage from UPSS* (Low Ecological Services PL, July 2021);

The table attached provides my initial review and comments on various aspects of the assessment and monitoring works to date, and the conceptual site model (CSM) as it is currently portrayed. The primary reference for this review has been the National Environment Protection (Assessment of Site Contamination) Measure (referred to from here on as "the ASC NEPM"). Other national and state guidance is referenced where applicable.

The intention is for Low Ecological Services to use this review and comments in planning what (if any) additional assessment and monitoring works might be required to progress (and eventually allow completion of) an environmental audit, should one ultimately be required.

As always, I am happy to meet and discuss once you have had a chance to consider the comments.

Yours sincerely,

A handwritten signature in black ink that reads "Steven Kirsanovs".

Steven Kirsanovs

Environmental Auditor appointed under the Environment Protection Act 2017 (Victoria)

PO Box 1243 Unley SA 5061
PO Box 1291 Carlton VIC 3053
T: 08 8271 9025
M: 0412944411
E: stevek@kirsaenv.com.au

ABN: 46 450 893 799

Review of Aspects of the CSM, and the Assessment and Remediation Works

Aspect	Requirements	Comments / Data Gaps
Basic Site Information	Legal site identification (lot / plan ref) and copies of current property titles. Plan of audit site boundary (survey plan referenced to the title boundary is required if audit site is a portion of a property covered by a larger title).	Included in various parts of the reporting. Future reporting should include references to any changes in ownership. No further comments or queries.
Desktop review of site history and other relevant background information	A historical review is a fundamental component of any site assessment and forms the basis / justification for all subsequent investigation and management. The PSI should include the following components:- - o A desktop study to review the site history, physical setting including geology and hydrogeology, and site conditions; - o A site inspection and interviews with current and past owners, operators and occupiers; and - o Development of an initial conceptual site model (CSM). The PSI may also include limited sampling and analysis. (Refer Section 2 in schedule B(2) of the ASC NEPM)	The reporting provides basic historical information on the underground fuel storage and dispensing infrastructure and there is an initial CSM presented. Overall, there should be sufficient information in the background reporting to plan subsequent assessments and develop a strategy to address the historical fuel impacts. Comments / queries:- o The location of the third UST should be shown on relevant plans in the report. It is acknowledged it is shown on Fig 6 later in the report but it is suggested it should also be shown on Figure 3 as well.
Physical & environmental setting, and proximity to sensitive receptors	Basic information on the dominant topographical, geological and hydrological features should be provided including:- - o Local hydrology and drainage patterns on site and in the surrounding area; - o Surrounding land uses, and proximity to parks, local watercourses, and any areas of environmental significance;	The general info provided on the geology and hydrogeology is reasonable and adequate for planning further investigations and monitoring. Comments / queries:- o Surface water and flow systems. The direction of flow of the Finke River should be noted in report section 4. This is important in considering potential contaminant migration pathways and receptors.

Aspect	Requirements	Comments / Data Gaps
	- o regional geology and hydrogeology; - o any available site specific geology or hydrogeology information; - o current groundwater usage and resource potential both on site and off site in areas (via records of registered wells in locality).	o Groundwater occurrence / resource usage. There should be more detail provided on the occurrence of groundwater including depths, aquifer types, and flow systems. As part of this, the details of the bores identified on the NT government systems should be provided. Ideally this would include depth, lithology, water quality, and use/s. This should include the two bores listed in the report section 4, plus the Glen Helen Lodge groundwater bore shown on Figure 2.
Environmental values of waters (surface water and groundwater)	This determines the environmental values of groundwater to be protected – essentially defining the level of protection to be afforded to the impacted aquifer. It is linked to the environmental values of groundwater. In the absence of a specific Beneficial Use Declaration for a particular waterway, environmental values should be defined via the process outlined in the National Water Quality Management Strategy. In the case of groundwater, this process should also be consistent with schedule B6 of the ASC NEPM, by considering the groundwater on the basis of its suitability for current or realistic future use.	The assessment report has discussed results in terms of ecological and human health impacts and this is presented reasonably clearly. However, there is no specific consideration of environmental values or beneficial uses which are important in assessing the significance of contamination and potential impacts. Comments / queries:- o The report should include consideration of environmental values / beneficial uses of surface water and groundwater, including not just environmental and extractive uses, but also indigenous cultural and spiritual values.
Identification of potential contaminants of concern.	The potential contaminants of concern should be identified based on the understanding of the history of activities and specific chemical storage and usage.	The assessment report identifies the main chemicals of concern are associated with historical fuel storage and dispensing. The assessment has comprised sampling and analyses of soil samples from the former tank pit areas and surrounds, and stockpiled materials from the excavated pits. Analyses have been completed for total petroleum hydrocarbons (TPH), benzene, toluene, ethyl benzene xylenes, naphthalene (BTEXN) and a suite of heavy metals. It is agreed the analysis suites were applicable. This type of contamination includes a wide range of aliphatic and aromatic

Aspect	Requirements	Comments / Data Gaps
		hydrocarbon compounds along with other minor additives potentially used in the fuels. But it is agreed these analysis suites were applicable for assessing the overall extent of impacts and degree of contamination. No further comments or queries.
Assessment – Extent of Impacts On-site	The nature and extent of contamination should be defined with sufficient detail to allow for the assessment of risks, and to allow for development of a response strategy. The level of detail will be specific to the circumstances at the particular site.	The assessment report has documented various stages of assessment via hand auger bores, conventional drilling and soil coring and sampling from excavator bucket to provide a reasonable snapshot of the nature and extent of fuel related contamination in soils under and in the vicinity of the former fuel tank and bowser locations. Comments / queries:- - o Further discussion should be provided to justify the rationale around why groundwater and surface water are not likely to have been impacted. This appears to be the main issue of concern related to this release and should therefore be closed out more thoroughly in the reporting and possibly justified with further lines of evidence (see comment below).. - o Consideration should be given to collection of some limited additional data to improve the confidence in the assessment and in particular to support the conclusions that the historical fuel release has not impacted on the environmental values of the Finke River and adjacent National Park. For a relatively small additional amount of effort and cost some additional sampling should be considered including opportunistic water sampling from the Finke River adjacent, upstream and downstream of the site.

Aspect	Requirements	Comments / Data Gaps
Assessment – Extent of Impacts Off-site	There should be sufficient assessment completed to define the nature and extent of off-site impacts attributed to historical operations at the audit site.	Refer to comments above.
Conceptual Model – Sources, Pathways, Receptors	There should be a progressive development and refinement of a CSM outlining the potential source-pathway-receptor linkages. Justification should be provided for removal or addition of any linkages.	The discussion in the report covers most aspects of what would be expected to be included in a CSM but it would benefit from updating. Comments / queries:- o Suggest updating the discussion at the end of the report to reflect the current understanding of the CSM and presented in terms of sources, pathways and receptors. The cross section and other figures are useful but they could be improved by annotations with more information to note potential migration pathways and receptors relevant for this site.
Assessment of Risks Posed by Contamination	There should be sufficient assessment of risks posed by the off-site impacts to receptors. In the case of groundwater impacts, this should include an assessment of the evidence for a stable or decreasing dissolved plume, and the capacity of the aquifer to continue to limit any further expansion of the plume. Risks associated with groundwater extraction, vapour intrusion, and any other plausible exposure pathways also need to be evaluated.	Risk assessment documented in the report concludes there is no significant risk posed by the petroleum impacts found under the former fuel tank and bowser locations. It is agreed it is unlikely there are any significant risks but given the sensitivity of this location some additional lines of evidence and updates to the report are suggested in the comments below. Comments / queries:- o There should be a more systematic evaluation of results against applicable screening criteria including the ecological and health based screening levels, and TPH management limits. Some reported results for soils remaining in the excavations exceed some of these screening levels listed in the report appendices. As noted in the report discussion some exposure pathways may not be relevant and could be discounted, but this needs further justification. Suggest also

Aspect	Requirements	Comments / Data Gaps
		comparing the results against the health screening levels based on direct contact exposures, as listed in CRC CARE Technical Report 10 as these are also applicable for the site circumstances, particularly the values for intrusive maintenance workers. - o The use of the petroleum hydrocarbon HSLs and ESLs from the ASC NEPM and CRC CARE Technical Report 10 should be justified by inclusion with the report of a completed HSL Application Checklist which is available from the CRC CARE website with the technical reports. - o The assessment of vapour intrusion risks to the current buildings should include discussion of guidance around lateral and vertical screening distances to buildings, which can be found in CRC CARE Tech Reports and 13 and 23.
Remediation Options Assessment	A review of remediation options should be completed with regard to the prevailing national and state guidance. Note that "remediate" and "remediation" are defined under Section 3(1) of the Environment Protection Act 1993 (the Act) as meaning to treat, contain, remove or manage chemical substances on or below the surface of a site to eliminate or prevent actual or potential harm (to human health, water, or other environmental harm) that is not trivial. The South Australian EPA's framework for assessment and remediation of site contamination of groundwater recognises that the remediation of groundwater back to the original beneficial use is not always possible. The EPA has established a risk based system of remediation	The report provides a narrative around the actions taken to date which have involved excavation and removal of fuel impacted soils from under the former fuel tanks. The actions taken thus far are considered reasonable and appropriate. The proposed strategy to complete the remediation includes backfilling the tank pits with uncontaminated materials, and off-site disposal of the other soils. Additional local and / or imported soils will be used to make up for any shortfall to reinstate the excavations. It is also proposed to rely on natural source zone depletion for the degradation of the remaining impacted soils left under the former tanks, with testing into the future to monitor and verify the degradation. We agree in principle with the proposed strategy noting the site's relatively remote location poses potentially significant constraints in

Aspect	Requirements	Comments / Data Gaps
	based on the protection of human health and the environment, having regard for current and potential future uses of the groundwater, and the environmental values of the groundwater. Where groundwater contamination exists, and it is apparent that remediation of groundwater back to the original beneficial use is not possible, a determination can be made (by an auditor or EPA) on remediation to the point of necessity, with the point of necessity being the protection of human health and the environment associated with that site. The auditor understands that this is also on the proviso that reasonable and practicable efforts have been made to restore beneficial use of groundwater, and that further remediation is not feasible or justifiable. Each site needs to be considered on its merits in terms of assessment and remediation efforts completed to that point in time, the constraints posed by the geological and hydrogeological setting, the risks posed by residual impacts and how these can be managed into the future.	terms of technical, logistical and cost aspects of remediation. A careful balance will need to be struck between these factors, and the need to protect the sensitive surrounding environment. The solution also needs to be satisfactory to the various stakeholders who have an interest in protecting the environmental values of this location. It is acknowledged with the site's remote location there is a need to move quickly and use resources whilst they are mobilised on site to get the most cost effective outcome while still meeting the legislative requirements. Comments/ queries:- - o There needs to be a more transparent argument provided as to why further excavation should not be completed to remove all residual impacted soils down to bedrock for offsite disposal. This needs to be framed in terms of the likely costs and benefits, and whether these are justified in terms of the relative risks and environmental gains. - o If impacted soils are going to be left in place, suggest considering incorporating other low cost measures to possibly assist biodegradation processes whilst the excavations are open and there is ready access prior to backfilling the pits.
Implementation of Remediation	The various remediation measures will need to be implemented, with plans put in place outlining the various measures, how they will be implemented, by who, the timeframes that will apply, and mechanisms for future reporting and reviews. This should include appropriate consultation with relevant stakeholders.	Not applicable at this stage – to be addressed as part of future reporting.

Report / document ref:	Auditor Review comments	Responses	Issue resolved (Y/N)	Additional auditor comments
Low Ecological Services P/L, Fuel Contamination from Underground Petroleum Storage System: Investigation and Remediation Report March 2022 (Version 8)		Follow up comments (Auditor, 25 Feb 2022)		Status of issue (21 Mar 2022) following check of 28/02/2022 (Version 7) / also identified as March 2022 Contamination Investigation and Remediation Report (former title was DSI).
DSI (Ver 6, Dec 2021)	Report Layout / Structure. Exec Summary. For these types of reports the Executive Summary is normally put up the front of the document and not as a dedicated section within the body of the report. So section 1 of the report would be the introduction. Suggest pulling the Exec Summary out and putting it at the front of the report.	Exec summary has been added. This provides a reasonably clear and accurate overview of the sequence of works completed and the findings.	Yes	Resolved (per prior columns)
DSI (Ver 6, Dec 2021)	Auditor involvement. There is mention in the Exec Summary and Section 1 that the NT EPA commissioned an auditor. This is not strictly correct. The text should indicate that due to the sensitivity of the area, the NT EPA issued a s48 Notice requiring the investigations, remediation and validation works to be completed under an environmental audit program under the relevant provisions of the Waste Management and Pollution Control Act 1998. Ngurratjuta has commissioned Steven Kirsanovs of Kirs Environmental who is accredited under the Victorian EPA auditor scheme to complete the environmental audit program. All investigations and reporting have been completed under the oversight of Mr Kirsanovs who will eventually produce an environmental audit report as required under the s48 Notice.	The explanation in the DSI of the auditor's involvement has been amended and is now considered more appropriate.	Yes	Resolved (per prior columns)
DSI (Ver 6, Dec 2021)	Legal Identification of Site. It would normally be expected that the land title or any equivalent documentation showing the legal identification of the land is included in the report and appendices. Can any documents be provided and included in an appendix? Also, I was under the impression the land had been sold by Ngurratjuta/Para Nijarra Aboriginal Corporation to another entity. Can this be clarified? Could the report also please clarify if the land is within or outside the national park?	This has been clarified in sections 1.1 and 2 (background and site identification). The report has clarified that the site is in a freehold lot that is surrounded by the National Park.	Yes	Resolved (per prior columns)
DSI (Ver 6, Dec 2021)	Physical and Environmental Setting. Is there a plan available showing the contours of the land in the area? If so, that should be included. Also, some discussion of the general lie of the land at the site and in the surrounding area should be included in section 5.	Further detail has been provided in section 4.	Yes	Resolved (per prior columns)
DSI (Ver 6, Dec 2021)	Surface water / Finkle River. Section 5 Suggest moving the sentences discussing the Finkle River in the section "Surrounding Land Use" be moved into the first part of this section ("Stormwater and Surface Water").	Report layout and sections have been relocated to improve the flow / order in the report.	Yes	Resolved (per prior columns)
DSI (Ver 6, Dec 2021)	Geology / Hydrogeology. Suggest for the flow of the report that in section 5, the sections discussing the soil and geology be moved to before the section discussing the groundwater conditions.	Report layout and sections have been relocated to improve the flow / order in the report.	Yes	Resolved (per prior columns)
DSI (Ver 6, Dec 2021)	Supporting info / documents. The field sampling records, chain of custody documents and lab sample receipt documents should be included in the report appendices so there is a complete audit trail.	Can't be confirmed as there is no listing of appendices in the current version of the DSI and no appendices have been provided for review.	No	All ALS sample receipt notification (standard reports) are still missing.
DSI (Ver 6, Dec 2021)	There needs to be a review of the field and lab data quality completed to demonstrate the data is sufficiently reliable etc with regard to the 5 data quality indicators (accuracy, precision, representativeness, completeness, comparability). Refer to schedule B2 in the ASC NEPM for further guidance on this aspect.	The review of the field and lab data quality looks like it is limited to some soil data. It needs to be upgraded to cover the water and vapour assessments as well. Ditto comment above re need to include supporting info in the report appendices.	No	Overall, the reviewer considers that the report QA/QC aspects are lacking. Note that some more text was added to Section 10 but it was mainly to list protocols used in the soil, groundwater and vapour sampling. This information is relevant to QA but is normally provided as methodology. It remains that the only field QA sample was one soil stockpile duplicate (intra- and inter-lab) sample. There were zero field QA samples analysed for soils relating to the site's final condition, zero for groundwater and zero for soil vapour. The report notes that "the completed sampling was appropriate to the setting on account of the remote location, the variety of samples taken and the large scale of the data" and implies that the auditor (see AIR 15) has agreed that the "lack of quality control samples does not diminish the assessment or limit the overall results".
DSI (Ver 6, Dec 2021)	Assessment criteria. There should be a section included that list the rationale and justification for the adopted screening criteria for the various media. The relevance of the TPH management limits should be covered in this section.	There needs to be more detail and justification provided for the specific screening criteria adopted for soil, groundwater and vapour. It would help to include a set of tables perhaps either in the report text or in the report attachments. There also needs to be a HSL application checklist completed for this report, as for any site where the petroleum hydrocarbon HSLs are being used.	No	Section 7 "Screening Assessment Criteria" was added. This section is very limited. It should have provided a clear rationale for including and excluding the range of possible soil, groundwater and vapour assessment levels (e.g. there should have been reasoning presented as to why commercial and residential assessment levels were not applied, if there will be any risks to intrusive maintenance workers, why drinking water guidelines are not relevant). This section should also have referenced all applicable guideline documents.

Report / document ref:	Auditor Review comments	Responses	Issue resolved (Y/N)	Additional auditor comments
DSI (Vsn 6, Dec 2021)	Results interpretation. I think there is scope to update the interpretation to provide a clearer picture of the situation and justify why no further remediation is warranted. This includes but is not limited to the discussion around the exceedances of TPH management limits. I think there needs to be more discussion around the relevance of these for this site and the significance of the results remaining above these values. Plus I think the report could be improved by updating the discussion of the overall risk profile. Let's discuss.	The additional discussion re the river red gums is noted and considered reasonable and defensible. The report still needs to clarify the relevance of the TPH management limits and other screening criteria to link these more clearly to the overall assessment of risk. I would like to discuss this further with Low Enviro before the DSI is finalised.	No	Section 11.3 'Hydrocarbon Management Considerations' has been added and this section notes that "a management plan is being recommended to manage the impacted zone into the future ...". The reviewer notes that Section 13 'Future Monitoring and Recommendations' refers to a management plan and what it will likely include. Overall the audit report will determine what the management objectives should be in relation to the area / extent of impact (which may or may not include the area once occupied by the river red gums).
DSI (Vsn 6, Dec 2021)	Full copies of the lab reports including any QAQC reporting should be provided for a complete audit trail.	To be checked once all appendices are provided.	No	Following are still missing: - ALS Sample Receipt Notifications (SRN) for all ALS reports.
DSI (Vsn 6, Dec 2021)	Electronic format. All reporting including supporting info needs to be in PDF format and able to be word searchable. This includes the appendices. The lab reports at the moment are embedded in the file as images so they can't be searched. This is a requirement for reports in further actions / management / monitoring. I would like to discuss these further before they are locked in.	To be checked once all appendices are provided.	No	Spot checked some of the attached laboratory documents and found these are word searchable.
DSI (Vsn 6, Dec 2021)		In order to progress things from assessment to ongoing management, the audit report will acknowledge the findings and conclusions off the DSI but given the sensitivity of the area there is likely to be a recommendation that a management / monitoring plan be developed and that the plan is to be reviewed and endorsed by an auditor under the NT regulatory framework.	Yes	Resolved (per prior columns)
DSI (Vsn 7, Feb 2022)	The dates on the front page, the report headers, have not been updated to Vsn 7 / Feb 2022, and the document revisions table has not been updated to include Vsn 7 / Feb 2022.	New issue to be resolved	No	Dates and version history are inconsistent / irregular and therefore confusing to cross-reference. The report title is now changed. The prior report / version title was 'DSI', now the title is 'Contamination investigation and remediation report (CIRR)'. Last version of the report (DSI) was assigned V6 but it was saved as V7.01 and was dated 08/12/2021. Current version of the report (CIRR) is assigned V7 and is dated 28/02/2022 as well as March 2022 (see cover page and footers).
DSI / Contamination Investigation and Remediation Report	Various mentions of the auditor implying the auditor's role and involvement in the project. Examples: - Document revision table attributes V4 and V6 to the auditor. The auditor did not write these versions. - "All investigations and reporting have been completed under the oversight of Mr. Kisanovs who will eventually produce an environmental audit report as required under the s44 Notice." suggest clarifying that the investigation design was the consultant's decision with the auditor's involvement being limited to suggestions and examples of what to do. "Therefore, the lack of quality control samples does not diminish the assessment or limit the overall results, as agreed upon by Mr Kisanovs (Auditor)". This text communicates that the lack of QA was considered OK (because it is a remote site) prior to / without consideration of the integrity of the data being reviewed. This text should rather communicate that the auditor acknowledged that the investigation does not have the standard level of QA and - regardless of the remoteness of the site - that will render it difficult to verify some aspects (i.e. repeatability, accuracy, precision, representativeness) of the data. The audit will therefore aim to identify limitations to the overall data set and will make recommendations where necessary to address these limitations, say during future verification / monitoring works. "A perforated vent pipe system, designed by LES and agreed upon by Mr. Kisanovs (Auditor), was installed in both pits to increase aeration and natural remediation of the soil at the bottom of the pits." This implies that the auditor was involved in the final design. The review has not identified any plans / schematics / drawings / cross-sections to show what has been installed and if the installation is in fact what was agreed with the auditor.	New issue to be resolved	No	New issue to be resolved.

Report / document ref:	Auditor Review comments	Responses	Issue resolved (Y/N)	Additional auditor comments
Report / document ref:	Auditor Review comments		Issue resolved (Y/N)	
Low Ecological Services P/L Fuel Contamination from Underground Petroleum Storage System: A Progress Update Report, January 2023 (date of issue to Auditor 15 March 2023)		Auditor follow up comment.		Status of issue - follow up review of issue as per issued final version of reporting November 2023.
	It is unclear when the front cover photograph was taken and whether this pre or post development of the groundwater monitoring bores. The fact that the baller water is turbid may be an indication of insufficient development of the wells post construction. This will impact the validity of the results obtained. i.e. groundwater impact concentrations may not accurately be reflected if groundwater cannot move freely through the well screen interval. In accordance with Schedule B2, section 8.2.3.5, of the ASC NEPM, appropriate and effective well development is vital to ensure that fine sands, silt, clay and any drilling mud residues are removed to ensure hydraulic functioning of the well that is representative of natural conditions. Development should continue until the abstracted water is reasonably clear and free of suspended solids. After development, bores should be left for a period until bore water chemistry can be demonstrated to have stabilised (generally between 24 hours and seven days) before samples are collected, dependant on the aquifer properties. The information provided does not adequately demonstrate if this has been achieved.	Issues as stated throughout this review have not been addressed by LES.	Yes	Well development was undertaken by Terra Environments prior to the May 2023 GME (see comments throughout).
Document revision	Dates need to be updated to reflect current version.		No	Dates have not been updated through the issued version of the reporting. Kirsas Environmental have referred to the final version as November 2023 (the document was provided to the Auditor along with appendices on 24 November 2023).
Competencies of environmental professionals	Schedule B9 of the ASC NEPM outlines the minimum level of knowledge, experience and technical competencies expected for environmental professionals carrying out contaminated site assessment within Australia. Section 10.2 of the NT Contaminated Land Guideline outlines who can conduct a contaminated site assessment. The ASC NEPM defines that the relevant qualifications, experience and competencies of environmental consultants involved in the assessment and/or remediation of contaminated sites include (but not be limited to):- - Demonstrated relevant experience in contaminated site assessment, - a comprehensive knowledge of the relevant legislation and guidelines, - competencies relevant to assessment and remediation. The processes and methodologies adopted during the assessment indicate minimal consideration of the relevant National Measures or NT related guidance. Schedule B10 of the ASC NEPM outlines that consultants need to be able to recognise when supporting professional advice beyond their expertise in assessing contamination and its effects on human health and/or the environment is required.		No	Accordingly incumbent assessor was changed for most recent groundwater monitoring event.
Executive summary	The report concludes that water sampling from these MW at Glen Helen Lodge should resume twice a year (1 sampling event during wet, and one during dry season) for the next three years (until 2026). A review after these three years will determine any future monitoring requirements (p.4). This conclusion for the need for ongoing management needs to be reflected in a GQMP (as per example document provided to LES). The GQMP will detail the trigger for cessation of monitoring (i.e. review of applicability of ongoing monitoring in 3 years subject to review of data set collected over the monitoring period and meeting of triggers. -A brief letter report will need to be provided to the auditor for review annually, to communicate the results and data set obtained over the year. 5.2.1.2 Sampling methods and procedures Point 8. – I have not before encountered the process of returning to collect another PID field reading at the well after 2 hours? Do you have any further information of the rationale for this aspect of the methodology?		Yes	GMP prepared by Terra Environments and reviewed by Kirsas Environmental. No further comments or queries.

Report / document ref:	Auditor Review comments	Responses	Issue resolved (Y/N)	Additional auditor comments
Data Quality Objectives	Strictly speaking, DQOs are a systematic planning approach (and is the process adopted in the ASC NEPM) to plan the assessment and the quality and quantity of data required for the purposes of appropriately assessing contamination at a site. Section 10.1.2 of the NT Contaminated Land Guideline also defines that a DSI should involve development of DQOs. DQOs have not been considered in either the DSI report (March 2022) or the Progress Update Report to date. The development of the DQOs should be guided by identification of critical data gaps in the preliminary CSM formulated at the beginning of the site assessment process (further comments related to CSM are presented in later comments). - determining the nature and extent of contamination - delineating the lateral and vertical extent of contamination - developing an understanding of the geology and hydrogeology - the identification of potential and actual contaminant migration routes - determining whether relevant investigation and/or screening levels are exceeded - determining whether further investigation or management is required. Discussion of DQOs will be required to demonstrate the planning undertaken for the assessment process (see Schedule B2 of the ASC NEPM for further information and process examples).	No adequate DQOs formulated	Partially	DQOs established by Tierra Environment for the subsequent groundwater sampling.
Groundwater analysis summary table	The May 2022 groundwater sampling results need to be inserted into the table.	-	-	-
Section A drilling and sampling of Monitoring wells, 1.1.1 Monitoring Well (MW) Summary	Please update the second sentence to read "Rachael Haman, a representative for auditor Steven Kirsanovs of Kirsas Environmental (accredited under the Victorian EPA auditor scheme) was present during the drilling of MW01 and discussed groundwater monitoring well installation methodology with LES representatives". Figure 2. name plate – well nomenclature needs to be updated to reflect naming requirements.	update to report wording was not undertaken.	No	
Section A drilling and sampling of Monitoring well, 1.1.1 Monitoring Well (MW) Summary	It is important that this summary information is presented in a borelog pictorial format. This is a vital form of field reporting the LES should be preparing at any Site where a groundwater monitoring well is advanced. The log will include the information you have provided, as well as at what depth the geology became moist and then wet during the drilling process. It will also need to include the PID readings collected at each depth interval. An example of the format of borelog preparation is presented in Schedule B2 of the ASC NEPM. The bore construction will need to be pictorially described including length of screen, endcaps, surface construction information (i.e. flush gatic), include the depth of bentonite, and information on the filter pack backfilled around the screen. Examples of borehole log where bores have been constructed are provided in Figures 8 and 9 of schedule B2 of the ASC NEPM.		No	
Section A drilling and sampling of Monitoring well, 2.2 laboratory Results	With regard to the ALS Certificates of Analysis it is best to provide these in the annexure, the complete, unedited document suite will need to be provided (COC, Laboratory Quality Assurance Report, Sample Receipt Certification and the Analytical Results). In the report text it will be best to summarise the results for discussion. The Soil laboratory results need to be compared to the NEPM investigation levels / screening levels areas of ecological sensitivity. Soil laboratory reports have not been provided for the soil sample collected from the area of surface water displaying a sheen (further discussion of this issue is provided later in the comments).		Yes	Tierra Environment subsequently undertook groundwater sampling, due to the questionable reliability of earlier groundwater monitoring. No further comments or queries.
Section A drilling and sampling of Monitoring well, Section 2.1 Monitoring well sampling protocol, Section B Monitoring Well Sampling	The primary aim of groundwater sampling is to collect samples that are representative of aquifer conditions. Representative samples allow for confidence in the concentrations of analytes within discrete portions of the aquifer and also inform the type and extent of remediation or management required for any specific site. Section 8.2.4 of the ASC NEPM provides that an appropriate method for groundwater sampling needs to be employed. Sampling via bailers (as adopted for this site) or high speed pumps is not recommended, as the samples obtained are unlikely to be representative. Prior to the last round of sampling, the Auditor and LES discussed that collecting bailer samples in this instance was not an appropriate method for sample collection. A number of other potential methods were discussed including low-flow pumping and Hydrasleeve no-purge sampling (too long as a sufficient water column is present to submerge the sleeve). The use of bailers raises uncertainty with the validity of the results obtained. This is supported by information relating to factors such and the sample blank showing no petroleum impact, while the primary sample indicating detections. This can occur when decanting groundwater from the bailer into sampling containers, as oily contaminants do not always accumulate uniformly within the bailer.		Yes	Tierra Environment subsequently undertook groundwater sampling, due to the questionable reliability of earlier groundwater monitoring. No further comments or queries.

Report / document ref:	Auditor Review comments	Responses	Issue resolved (Y/N)	Additional auditor comments
Conceptual Site Model	LES have provided a preliminary CSM in version 8 of the LES DSI, March 2022 (section 4). Figure 4 does not adequately represent a CSM figure as would be anticipated for an assessment of this nature. Figure 4 is more correctly defined as a site location plan. A representative flow diagram example is provided in Schedule B4 (Figure 2) of the ASC NEPM. Typically, the CSM should be presented in written format and illustrated with suitable graphics and flow diagrams. A scaled cross section is the most common way to produce a CSM diagram and needs to be provided in the reporting. The CSM will indicate information such as:- - as groundwater depth feature location, - geology (as per the observation recorded in bore logging), - the relative location of buildings, - surface feature and sensitive receptors (i.e. the Finkle River and human and ecological receptors). - Exposure pathways between contamination sources and receptors. An example of a CSM incorporated into publicly available reporting has been provided to LES previously.		Yes	Tierra Environment subsequently produced a site CSM. No further comments or queries.
Section Monitoring Well Sampling 8.1.0 Introduction	Section 3.3 of the NT Contaminated Land Guidelines that the presence of chemicals on or in surface water or groundwater – visible through abnormal colouration, or a sheen (i.e. free phase petroleum) is an indicator of contamination. Information and discussion provided by LES is insufficient to understand the sheen identified in Figures 7 and 8 (sic) on the areas near the Finkle River. The exact locations of the sample collection need to be defined (i.e. location up or down gradient of the location of the groundwater bores and operational areas of the site). The information and sampling locations need to be presented on a plan. No information is presented as to where the runoff originated from as to why there would be a sheen present (i.e. was the runoff emanating from an area of vehicle or plant storage. What is the nomenclature of the sample collected? Also, the analysis suite is not fully defined and the results of this sampling has not been provided. It is also unclear if the sample was analysis for petroleum, diesel and/or BTEX contaminants. It is unclear why a surface water sample was not collected when the sheen was a separated phase on the pooled water. The discussion in section 2.2 / section 3 still does not define the analytes tested, only that the soil results were below LOR. Please confirm if LES has any further information as to whether the discolouration or sheen is a known to result from algae growth. Without this further data and discussion we are unable to assess the significance of this potential contamination and whether it is relevant to works undertaken by the current Site owner or related to historical site activities.		Yes	The auditor reviewed the locations of the documented sheens. Based on the location of the sheen (approximately 150m down-gradient of the site), and that no connection was established that the river was receiving groundwater at this location, the sheen was related to algal bloom (HABs can look like scums in the water and may have small flecks, foams, or sometimes globs and mats floating in it. The water can also look like it has spilled paint or a green sheen on the surface). No further comments or queries and this section of the LES report has not been considered further for the purposes of the audit.
Figure 9	The location of the groundwater monitoring wells (along with each nomenclature) need to be defined on a plan.		Yes	Tierra Environment subsequently undertook groundwater sampling, due to the questionable reliability of earlier groundwater monitoring. No further comments or queries.
Section B Monitoring Well Sampling, 3.0 Discussion	The lines of evidence to explain the elevated results at MW04 seem are not complete. - is it possible the samples were mixed up (allocated the incorrect nomenclature) given that there were no other indicators of contamination reported in this area in this area? - see comment on the use of bailers. - can corroborative data in relating to elevated rainfall in June, September and October 2022 be provided to assist as evidence (i.e. BOM data).		Yes	Tierra Environment subsequently undertook groundwater sampling, due to the questionable reliability of earlier groundwater monitoring. No further comments or queries.
Section B Monitoring Well Sampling, 3.0 Discussion	Please provide the reporting and data generated for the underground sonar (GPR) to demonstrate the rocky ridge that was identified in the vicinity of MW03. Further, information on the capabilities of the particular GPR employed will need to be provided.		No	No further information provided.
SECTION C WELL DEVELOPMENT AND MW SAMPLING DECEMBER 2022, Section 2.0 Method	As discussed in previous comments, sampling 40 minutes to 2 hours after well development does not provide sufficient time for the well to recover and reach a chemical equilibrium.		Yes	Tierra Environment subsequently undertook groundwater sampling, due to the questionable reliability of earlier groundwater monitoring. No further comments or queries.
SECTION C WELL DEVELOPMENT AND MW SAMPLING DECEMBER 2022, Section 3.0 Results	Units need to be updated to µg/L. Sample blanks need to be collected at the same time as the primary sample. This is achieved by having each sampling container open and moving between the bottles to decant the sample as evenly as possible through the bottles. This would be particularly important when sampling via bailer. LES comment that... 'It is likely that any residue of C6-C9 Fraction floating on the water surface has been scooped up when taking the sample MW4 and was therefore clear of C6-C9 residue in the sample taken immediately after for the sample blank'. The Auditor agrees that it is plausible that impacted water was dispersed in the primary sample and not in the second bail-load of water, therefore skewing reliability of the repeatability sample data.		Yes	Tierra Environment subsequently undertook groundwater sampling, due to the questionable reliability of earlier groundwater monitoring. No further comments or queries.

Report / document ref:	Auditor Review comments	Responses	Issue resolved (Y/N)	Additional auditor comments
Assessment of Data Quality.	No overall assessment of the quality of the sampling data obtained has been undertaken by LES. Most of this information can be included in the appendices and the significance discussed as per the guidance. Section B2 of the ASC NEPM, along with section 10.6 of the NT Contaminated Land Guideline require a review of the quality of the data obtained. Schedule B2 Section 19.10 of the ASC NEPM provides a checklist for field quality control information required including (but not limited to):- Field QA/QC needs to include details of: - the sampling team - evidence of appropriate decontamination procedures carried out between sampling events - completed logs for each sample collected, showing time, location, initials of sampler, duplicate locations, duplicate type, chemical analyses to be performed, site observations and weather conditions - completed chain-of-custody documentation, identifying for each sample the name of the sampler, the nature of the sample, collection date, analyses to be performed, sample preservation method, departure time from the site and dispatch courier(s) and condition of samples at dispatch - a statement of duplicate frequency for intra-laboratory and inter-laboratory duplicate samples and duplicate sample results - field blank results. - rinseate sample results - laboratory-prepared trip spike results for volatile analytes - trip blank results - field instrument calibration for instruments used on site. QA/QC documentation needs to include: - Evaluation of all QA/QC information listed above against the stated DQOs including a discussion of documentation completeness, data completeness, data comparability, data representativeness - Results of data comparability checks to assess bias that may arise from various sources, including: - collection and analysis of samples by different personnel - use of different methodologies - collection and analysis by the same personnel using the same methods but at different times - spatial and temporal changes (because of environmental dynamics) - Relative percent differences for intra- and inter-laboratory duplicates.		No	As far as practicable, Kirsia Environmental undertook an independent data review based on the information provided
Annexure information that will be required to be annexed to the report:	All annexures need to be provided for review purposes. The annexures will need to include:- - Calibration certificates for the YSI Professional Plus Water Quality Meter and the PID; - Copy of the field sheets collected during sampling; - Field notations in relation to the development of the wells that was undertaken following installation. This is a really important aspect of the sampling process, in particular when the wells are being sampled via baller. - Field sheets in relation to groundwater sampling for each GME. - Pre sampling water level gauging sheets. - Interpreted groundwater flow contours. - Scaled plans illustrating the location and concentrations of impacts in each well location during each round. Laboratory Documentation needs to include: - a copy of signed chain-of-custody forms acknowledging receipt date and time, conditions of samples on receipt and identity of samples included in shipments - record of holding times and a comparison with method specifications - analytical methods used - laboratory accreditation for analytical methods used - laboratory performance in inter-laboratory trials for the analytical methods used, where available - the results for blind duplicate samples collected from the field.		Partially	Some of the additional information was subsequently provided along with the final report. Information provided included the required laboratory documentation.
Additional dis out issues relating to samples D3 - 0.1 and P2 - 01 (Collected April 2021) Questions sent via email 12 October 2023.	D3 - 0.1 and P2 - 01 that were collected during the soil verification sampling from within the opal and diesel pits (April 2021). The concentrations measured in these samples were high as indicated by both the PID field measurements (389 and 1,863ppm respectively) and the subsequent laboratory results. Questions relating to this sample are as follows:- 1. Based on the results, were the soils represented by these samples moved from this area to the stockpiles for offsite disposal? 2. It is questionable that the PID field results correlate with the laboratory analysed samples (i.e. is there a possibility that the PID results/lab samples may have been switched?). Please check your field sheets / records / sampling data to confirm.	Correspondence received via email from LES on 23 November 2023:- These soils were removed to the skips for off site transfer by the lead contractors.	yes	Based on the information provided, Kirsia Environmental interpreted the samples as representative of concentrations remaining onsite at depths below 1.5m. Further information present throughout the audit report.
		Correspondence received via email from LES on 23 November 2023:- Interpreting PID readings and lab analysis involves a degree of interpretation. At the time of writing up the results it is unlikely the results were switched and may relate to old diesel (the tanks had not been in use for several years) with fewer volatiles vs petrol (not quite so old, but containing more volatiles than diesel), but in both cases the soil was removed to the skip for transport off site, so this information was used in helping to determine how much soil to remove...	Yes	Based on the information provided, Kirsia Environmental interpreted the samples as representative of concentrations remaining onsite at depths below 1.5m. Further information present throughout the audit report.

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	3. Can you please confirm the depth of collection of the retained D3-0.1 sample? The name suggests it was collected at 0.1m, however photographs suggest that this sample may have been collected at a deeper location within the tank pit. Further, the March 22 (version 8) Fuel Contamination from Underground Petroleum Storage System: Investigation and Remediation Report, section 9.3 (Hydrocarbon Management Considerations) states as follows:- Residual soil samples analysed from D11, D3 and D17 in the diesel pit recorded hydrocarbon (TRH) levels above the NEPM hydrocarbon management limits for commercial sites. They were taken at depth from 1.5 m to 3.5 m bgl, which is deeper than the 1 m generally used for potential impact to existing services, future installation of services or trenching.... Appendix A also contains this photograph [reproduced in the email]. This information and the depth of samples has ramifications for the assessment of risks for the site. Any information you can provide will be greatly appreciated.	Correspondence received via email from LES on 23 November 2023:- Sorry, I haven't had time to try to find this information and, while I was responsible, I didn't have a lot of involvement in the writing. At this stage, I interpret the coding as the 1st sample for that sample location and the following information you have kindly copied confirms the sample would relate to the depth of 1.5 m. My clear memory of drill and auger hole sampling was that there were no locations where high PID and soil sample analyses were present in the top 10 cm of soil except when the diesel bowser was removed and soil immediately under the bowser had high levels of diesel. The remaining risks for the site are minimal due to the small amount of contaminated soil remaining at depth greater than 2 m, possibly in the lower regolith rocky layer at 2.7m and the distance underground (possibly in the geological rock layer which dips steeply to the south under the Finkle River and waterhole) the site is from sensitive habitat (it is unlikely the habitat in the water in Glen Helen Gap would be sensitive to very low levels of hydrocarbon presence since it likely generates it's own methane from the reed beds). If there is room to mention these reasons for lower risk, it could be useful.	Yes	Based on the information provided, Kirsia Environmental interpreted the samples as representative of concentrations remaining onsite at depths below 1.5 m. Further information present throughout the audit report.



HSL APPLICATION CHECKLIST

INTRODUCTION

This checklist is designed to allow assessors to conceptualise potential issues with contaminated land, and how to apply the HSLs. The checklist is designed to trigger responses from the assessor in determining whether the HSLs are applicable or whether consideration should be given to a more site-specific determination of risk. It highlights the key limitations and considerations that are common to contamination assessments and risk assessment.

The checklist summarises the key items from this Application Document.
 It is recommended that the Application Document be read in conjunction with the use of this Checklist.

Summary of Steps	
Step 1	Identification of key limitations to the application of health screening levels
Step 2	Identification of key receptors and scenarios
Step 3	Identification of relevant soil type
Step 4	Identification of impacted media and depths
Step 5	Identification of source concentrations to be compared with health screening levels
Step 6	Selecting appropriate HSL and consideration of combining vapour intrusion and direct contact exposure
Step 7	Applying adjustments to the HSLs based on vapour biodegradation, soil organic carbon content, air exchange rate, and soil moisture content Consideration given to soil saturation and water solubility limits
Step 8	Adjustments for cancer risk assessment - modification of acceptable cancer risk level, assessment of cumulative cancer risk



Step 1 – Limitations to HSLs

Assessing contamination in soil and groundwater should only be carried out by a qualified professional.

Are guidelines relevant for site? Check the following limitations:

Have chemicals other than petroleum hydrocarbons been identified at the site?	_____	Y May consider site-specific risk assessment (refer to Section 5.2 of the Application Document)
Is the groundwater to be used for irrigation purposes?	_____	N May consider site-specific risk assessment (refer to Section 2.4.5 of the Application Document)
Is the site conservation land?	_____	N May be required to also assess ecological values (refer to Section 2.4.6 of the Application Document)
Is the depth to groundwater impact less than 2m bgs ?	_____	N May consider site-specific risk assessment for direct contact May consider soil vapour sampling for vapour intrusion (refer to Section 2.4.2 of the Application Document)
Has significant odour been observed at the site?	_____	N May be required to also assess odour for sensitive land uses (refer to Section 5.4 of the Application Document)
Is the identified chemical a result of a solvent spill rather than petroleum spill/leak?	_____	N HSLs may be used where saturation point is not considered (refer to Section 5.3 of the Application Document)
Is the identified contamination an atypical petroleum mixture?	_____	N May consider site-specific risk assessment to consider cumulative effects between chemicals (refer to Section 3.6 of the Application Document)
Is the soil source thickness significantly different than 2 m?	_____	N For small source thicknesses, HSLs may be overly conservative if source fully depletes. For larger thicknesses HSLs may not adequately characterise risk, however lateral extent of contamination should also be considered. A site-specific HRA may be considered. (refer to Section 2.4.7 of the Application Document)
Does the building have a crawl space rather than slab-on-ground construction?	_____	NA HSLs may be used as likely to be conservative. However, for situations where inhabitants may be exposed in crawl space area such as spaces under dwellings which incorporate garages/workshop then consideration may be given to ambient air sampling. (refer to Section 2.3.4 of the Application Document)
Does the building have or is likely to have a habitable basement?	_____	NA May consider site-specific risk assessment (refer to Section 2.3.3 of the Application Document)

Note that the HSLs may be used for assessing health risk. In addition to this assessment, legislation requirements still need to be fulfilled which may include other considerations and assessments. Such considerations may include:

- Assessment of environmental values and ecological impacts
- Consideration of sustainability issues
- Risks for extraction and use of groundwater
- Soil source ongoing source to groundwater contamination
- Local planning requirements, such as sensitive uses under commercial zones, or future land use zones
- Social impacts and consultation with stakeholders

Step 2 – Identify receptors and scenarios to be considered

Check the receptors and scenarios to be assessed. Note that receptors and scenarios may require consideration of future land use planning and local regulations pertaining to site redevelopment.

HSL-A	☐ Residential use (refer to Sections 2.1.1 and 2.3.1 of the Application Document) ☐ Low-Density Residential – assumes access to soils with no management controls on site. Assessment may consider surface soils with direct contact, intrusive maintenance worker protection, and consider using surface soil HSL for all soils down to 3 m depth to protect uncontrolled excavation of contamination.
HSL-B	☐ High-Density Residential – assumes limited access to surface soils with management controls on site. Assessment may consider surface soils/dust with limited direct contact. Intrusive maintenance workers may be protected under suitable site management plan.
HSL-A	☐ Medium-Density Residential with grassed open space – assumes access to soils with management controls on site. Assessment may consider surface soils with direct contact and subsurface soils through vapour intrusion. Intrusive maintenance workers may be protected under suitable site management plan.
HSL-B	☐ Medium-Density Residential with permanent paving open space – assumes limited access to soils with management controls on site. Assessment may consider surface soils/dust with limited direct contact. Intrusive maintenance workers may be protected under suitable site management plan.
HSL-A (for VI) HSL-A or HSL-B (for DC)	☐ Low- or Medium-Density Residential with single basement garage – for vapour intrusion, low-density residential (HSL-A) may apply due to low air exchange rate for basement garage. HSL depth is displaced by depth of basement. For soil direct contact HSLs, select from above medium density scenarios based on access to soils. Intrusive maintenance workers may be protected under suitable site management plan (refer to Section 2.3.3 of the Application Document).
HSL-D (for VI) HSL-B (for DC outside footprint)	☐ Medium- or High-Density Residential with communal basement car park – assumes no access to soils with management controls on site. HSL depth is displaced by depth of basement. Intrusive maintenance workers may be protected under suitable site management plan. Note that areas outside of the basement footprint may be required to be assessed as a building without basement and with limited direct contact with soil. Also, limited exposure time for basement users and therefore HSL for Commercial Worker may be used for vapour intrusion (refer to Section 2.3.3 of the Application Document).
HSL-C	☐ Recreational / Public Open Space (refer to Section 2.1.2 of the Application Document) ☐ Parks, ovals, pedestrian areas ☐ National parks, conservation areas – may be required to also assess ecological values (refer to Section 2.4.6 of the Application Document)
HSL-D	☐ Commercial / Industrial Workers (refer to Section 2.1.3 of the Application Document) – considers only healthy adults under normal working conditions. Does not consider sensitive commercial uses such as schools, day care centres and medical practices. ☐ Commercial sensitive users – may consider using residential HSLs or a site-specific HRA (refer to Section 2.4.1 of the Application Document) ☐ Agricultural land – may consider a site specific HRA (refer to Section 2.4.5 of the Application Document)
	☐ Shallow intrusive workers down to 1 m deep. May require assessment of direct contact for soils surface to <2 m (refer to Sections 2.1.4 and 2.4.3 of the Application document)
	☐ Deep intrusive workers down to >1 m deep, such as sewer. Should be managed with appropriate procedures and work practices for confined spaces (refer to Section 2.4.4 of the Application Document)
Is a site management plan (that includes specific occupational hazard management for works on the site) to be implemented on the site (controlled site)?	
	☒ May not need to consider health risks to intrusive workers



Step 3 – Identify soil type relevant to site (soils above impacts in soil and/or groundwater)

Note the following before selecting soil type for use in assessment:

1. The prime parameter that influences the value of the HSL is the air filled porosity and volatility of the specific chemical. The higher the air filled porosity the greater the potential for volatile chemicals to migrate vertically through the soil profile.
2. The selection of a generic soil type requires knowledge of the soil profile across the site.
3. The selection of generic soil types should take into account the predominant characteristics of the soil profile and depth of contamination. The generic soil types assume a uniform profile, which at many, if not all, sites will not be the case. Where the overlying profile is predominantly fine materials (clays) (i.e. > 50% for soil column), these may be considered as the generic soil type. If the profile has a significant proportion of loose/coarse materials (including backfill) (i.e. > 50%), these materials may be considered as the generic soil type.
4. Air filled porosity is affected by moisture content. The wetter the soil, the lower the air filled porosity. Generic soil types have assumed a typical moisture content for the profile typical of average soil conditions occurring at depth. Moisture content will vary greatly by location and season. Moisture content will also vary between sub-categories of soil, e.g. between sand and clayey sand. HSLs may be adjusted based on moisture content. This is done in Step 7.
5. The selection of appropriate soil type is discussed in Section 3.2 of the Application Document.

Is there one dominant soil type on the site (> 50% of soil column)?

Or can a geological setting be conservatively identified (i.e. allowing greater vapour transport)?

☒ Y - Proceed
☐ N - Consideration may be given to assuming the more conservative soil type, or may be given to a site-specific HRA (refer to Section 4.6 of the Application Document)

Has excavated area(s) been backfilled with more porous materials ?

☒ Y - Consideration should be given to adopting a more porous soil type (refer to Section 3.2 of the Application Document)
☐ N - Proceed

Does the site lithology contain rock formations or soil with large cracks that can form preferential pathways?

☒ Y - The derived HSLs do not include lithologies with rock formations. Consideration may be given to using soil-vapour sampling or carrying out a site-specific HRA (refer to Section 4.6 of the Application Document)
☐ N - Proceed

Identify HSL soil type relevant to site and assessment (above impacts)

The soil profile properties have been based on a predominant soil texture grouping developed by the US Department of Agriculture. The 12 texture classes have been grouped into 3 groups: sand, silt and clay. The groupings of the classes are based on mean particle size and saturation porosities. Refer to Section 3.2 for further discussion on the soil properties.

HSL soil type selected:

☒ **Sand** – Properties selected to be representative of a coarse textured undisturbed soil profile. Consists of texture classes sand, sandy clay.

☐ **Silt** – Properties selected to be representative of a coarse textured undisturbed soil profile. Consists of texture classes silt, silty clay.

☐ **Clay** – Properties selected to be representative of a fine textured undisturbed soil profile. Consists of texture classes clay.

☒ **Other** – Including soil with large cracks (preferential pathways) and fractured rock (basalt, sandstone, siltstone, limestone) - refer to Section 4.6 of the Application Document. Soil vapour measurement is preferred to soil or groundwater. Due to fractures and preferential vapour pathways in rock, consideration should be given to overlying weathered soil, or to using HSLs for surface soil in sand.

For soil assessment (texture classification) undertaken in accord with AS 1726 the classifications of sand, silt and clay may be applied as coarse, fine with liquid limit less than 50%, and fine with liquid limit greater than 50% respectively.

Where there is uncertainty, laboratory analysis should be carried out. This may include parameters for detailed particle analysis and exact soil texture sub-class, and saturation porosity.



Step 4 – Impact media

Are there impacts to media other than soil and groundwater? (e.g surface water, biota, odours etc) Note: aesthetic issues (odours/staining/ecological impacts etc.) to be addressed separately	☐ N As well as human health assessment, consideration of other issues such as ecological, aesthetics, etc. may be required. ☐ N
Soils Are there soil impacts remaining on the site? Depth to soil impacts. Note if considering basements, depths need to be displaced e.g. a 3 m deep basement means surface to <1 m represents 3 m to <4 m. (refer to Section 2.3.3 of the Application Document) ☐ Y surface to <1 m ☐ Y 1 m to <2 m ☐ Y 2 m to <4 m ☐ 4 m and deeper ☐ Displacement due to basement Distance of displacement (m) _____ Is the site of interest an uncontrolled site where excavation activities such as construction may result in subsurface soil contamination brought to surface in the future?	☐ Y - Proceed ☐ N - Go to groundwater section ☐ N Consideration may be given to use of HSLs for direct contact and surface HSLs for vapour intrusion, for deeper soils. A site management plan may be used to address uncontrolled excavation at a site. (refer to Sections 2.3.1, 3.4.1, and 4.7 of the Application Document)
Groundwater Are there groundwater impacts beneath the site? Is the depth to groundwater less than 2 m? Depth to groundwater impacts. Note if considering basements, depths should be displaced e.g. a 3 m deep basement means surface to 2 m represents 5 m (refer to Sections 2.3.3 of the Application Document). With basements, groundwater HSLs may not adequately characterise risks where the groundwater level is within 2 m of basement foundation. ☐ Y 2 m to <4 m ☐ 4 m to <8 m ☐ 8 m and deeper ☐ Displacement due to basement Distance of displacement (m) _____	☐ Y - Proceed ☐ N - Go to soil vapour section ☐ N The HSL values may not adequately address this scenario. A site-specific HRA may be considered. Soil vapour sampling may be used to assess vapour intrusion. (refer to Section 2.3.3 of the Application Document)



Step 4 – Impact media (cont.)

Soil vapour

Has soil vapour sampling been used to characterise vapour intrusion at the site?

Depth to soil impacts. Note if considering basements, depths need to be displaced e.g. a 3 m deep basement means surface to <1 m represents 3 m to <4 m.
(Refer to Section 2.3.3 of the Application Document.)

☒	Y	surface to <1 m
☒	Y	1 m to <2 m
☒	Y	2 m to <4 m
☐		4 m to <8 m
☐		8 m and deeper

☐ Displacement due to basement
Distance of displacement (m) _____

☐	Y - Proceed
☒	NA - Proceed to Step 5

In using soil vapour sampling, please note the following:

- 1) It is recommended that soil vapour samples be taken as laterally close to a vapour source as possible (within or above).
- 2) Any sample taken within 1 m of the open air is subject to high levels of uncertainty due to atmospheric and meteorological effects. This includes the base and wall of excavation pits.
- 3) For sites subject to redevelopment with residential or commercial buildings, the soil vapour profiles are subject to change due to presence of concrete slabs. Caution is required on the use of soil vapour samples that are not within a soil source and in locations where buildings currently do not exist (refer to Section 1.6 of the Application Document).



Step 5 – Selection of relevant source concentrations

Soil concentrations

1. Is the investigation site likely to be subdivided into smaller lots? ☐ Y - Statistical analysis using entire data set may not be applicable. Consideration may be given to using the maximums or using a sub-set for statistical analysis (refer to Section 3.4.1 of the Application Document)
☐ N - Statistical analysis using entire data set may be applicable
2. Is the site public open space / recreational land where users are unlikely to be in the same location for extended period? ☐ Y - Statistical analysis using entire data set may not be applicable. Consideration may be given to using the maximums or using a sub-set for statistical analysis (refer to Section 3.4.1 of the Application Document)
☐ N - Statistical analysis using entire data set may be applicable

If statistical analysis is appropriate consideration should be given to the following methodology (refer to Section 3.4.1 of the Application Document):

1. Samples should be sub-divided into appropriate depth ranges as defined by HSLs (i.e. surface to <1 m, 1 m to <2 m, 2 m to <4 m, 4 m+). Note if considering basement, the appropriate displacement distance should be accounted for.
2. For each depth range, the statistical mean (e.g. 95% UCL arithmetic mean) soil concentration should be calculated for each chemical. One approach is described in the NSW EPA *Contaminated sites: Sampling design guidelines* (1995). The coefficient of variance test described in the document may be used to determine if the distribution is normal or lognormal. Consideration of other statistical methods may be adopted if justified (e.g. distribution does not fit a normal or lognormal distribution).
3. For samples with no detection, it is recommended to use half the detection limit during statistical analysis.
4. If the standard deviation is very large (due to outliers or low number of samples) the statistical mean may be higher than the maximum concentrations. In this case it is recommended to use the maximum.
5. It is recommended to keep note of maximum concentrations as well as statistical mean concentrations. Maximum concentrations may be required to address potential acute exposure issues.

Groundwater concentrations

Has floating product been identified in any well? ☐ Y - Refer to point (a)

(a) If PSH is identified, dissolved phase is likely to contain chemicals at solubility limits. Proceed with HSL comparison, noting that if there is at least one chemical for which HSLs in groundwater is limiting (i.e. not all chemical HSLs are NL) then presence of PSH may be a potential vapour risk to site users (refer to Section 3.4.2 of the Application Document). Also note that the presence of PSH may trigger other legislative requirements for remediation/monitoring.

Is the area of interest represented by a single groundwater location or multiple? ☐ Single - small area of interest such as residential dwelling may be represented by the maximum groundwater concentration if the dwelling location is unknown, otherwise if the building footprint is known, the groundwater well nearest to the point of interest may be used.
☐ Y Multiple - where exposure may occur over larger areas such as recreational parkland, consideration may be given to averaging the concentrations across the area of interest.

In deciding which set of monitoring data is most useful for analysis consideration may also be given to:

- Historical results to determine trends in groundwater concentrations (i.e. the likelihood that concentrations may increase)
- Upgradient wells and background concentrations
- Groundwater flow direction

(Refer to Section 3.4.2 of the Application Document.)



Step 5 – Selection of relevant source concentrations (cont)

Soil vapour concentrations

Is the area of interest represented by a single or multiple vapour location? → **NA** Single - small area of interest such as residential dwelling may be represented by the maximum soil vapour concentration if the dwelling location is unknown, otherwise if the building footprint is known, the groundwater well nearest to the point of interest may be used.

NA Multiple - where exposure may occur over larger areas such as recreational parkland, consideration may be given to averaging the concentrations across the area of interest.

Are soil vapour samples measured in shallow soil less than 1 m from the surface where there is no existing slab or concrete paving? → **NA** Y - Measurements are subject to influence from weather and atmospheric conditions and may not be considered reliable.

Are soil vapour samples measured in areas where there is no existing slab or concrete paving, and the site is planned to be redeveloped where a building will exist (residential/commercial/industrial use)? → **NA** Y - Soil vapour samples not measured within a soil or groundwater source, may not be representative of the soil vapour in the future when a building is located on site. The placement of an impermeable barrier such as a concrete slab can cause build-up of soil vapour within the soil and sub-slab, above levels measured where there is no slab present. Note soil vapour measurements from within soil and groundwater sources are not subject to vapour build-up as the soil vapour is likely to be at its maximum concentration when located within the source.

Soil vapour measurements may be taken at multiple depths, including within the source zone, above the source zone, and directly under a building foundation. Each of the measurement depths should be considered individually.

Refer to Sections 3.4.3 and 1.6 of the Application Document.

Step 6 – HSL determination and combined vapour intrusion and direct contact

HSL determination

HSLs and saturation/solubility limits are presented in the Appendix B HSL tables. Select the appropriate HSLs for vapour intrusion from tables for:

- 1) Each selected receptor listed in Step 2
- 2) Dominant soil texture classification listed in Step 3
- 3) Source depth listed in Step 4

HSLs may be compared to soil/groundwater/soil vapour source concentrations determined in Step 5.

Note for TPH C6 to C10, BTEX should be subtracted from analytical result prior to comparing with HSL

1. Is the HSL value Not Limiting 'NL'? ☒ Y - Indicates that vapour reaches saturation point and cannot increase to a point which would result in an unacceptable health risk
☐ N - Continue with Question 2 for groundwater, or proceed to Question 3
2. Is groundwater HSL not 'NL' and PSH identified in water? ☒ Y - May indicate potential vapour risk (refer to Section 3.4.2 of Application Document)
☐ N - Proceed to Question 3
3. Are comparisons being made against soil HSLs? ☒ Y - Proceed to Question 4
☐ N - Proceed to Question 5
4. Does direct contact need to be considered as well as vapour intrusion?

$$\text{Cumulative Fraction} = \frac{C_{\text{Under Building}}}{\text{HSL}_{\text{vapour intrusion}}} + \frac{C_{\text{Outside Building}}}{\text{HSL}_{\text{direct contact}}}$$

$$\text{Cumulative Fraction} = \frac{C_{\text{Land use 1}}}{\text{HSL}_{\text{land use 1}}} + \frac{C_{\text{Land use 2}}}{\text{HSL}_{\text{land use 2}}}$$
☐ N HSL-A Low-Density Residential - surface soils, and possibly subsurface soils if determined to be relevant (refer to Section 4.7 of Application Document). Proceed to 'Combined pathways exposure'
☒ N HSL-B High-Density Residential - surface soils. Proceed to 'Combined pathways exposure'
☐ N HSL-C Open Space Recreational - surface soils. Proceed to 'Combined pathways exposure'
☒ Y HSL-D Commercial / Industrial - surface soils. Proceed to 'Combined pathways exposure'
☒ Y Intrusive Maintenance Worker - down to 2 m. Proceed to 'Combined pathways exposure'
☐ N - Proceed to Question 5
5. Do cross-scenario exposure need to be considered? (eg. adjacent residential and open space) ☐ Y - Proceed to 'Combined pathways exposure'
☒ N - Proceed to Step 7

Combined pathways exposure

Refer to Section 3.3 of the Application Document.

Combined exposures may occur on the same property where indoor vapour intrusion occurs concurrently with outdoor direct contact.

Combined exposure may also occur on adjacent properties, e.g. vapour intrusion on residential property and direct contact on adjacent open space (park).

For the given scenarios/chemicals, list the HSLs.

Where a vapour intrusion HSL is Not Limiting (NL) the chemical / scenario does not need to be considered in the combined pathway exposure.

The combined exposure is assessed as follows:

Multiple exposure pathways:

where vapour intrusion can refer to soil, groundwater or soil vapour source

Multiple exposure scenarios:

where the HSLs may refer to HSLs for vapour intrusion or direct contact

If a given C/HSL fraction is less than 0.1, the contribution of risk may be considered insignificant and the cumulative exposure need not be assessed for this scenario.

Where a cumulative fraction is less than 1 risk is normally acceptable. Where the value exceeds 1 a site-specific assessment should be undertaken, or proceed to Step 7.



Step 7 – HSLs and adjustments (vapour intrusion)

HSL adjustments (vapour intrusion only)

For each adjustment, careful consideration and justification is required.

1. Vapour biodegradation (refer to Section 4.2 of Application Document)

Prior to applying attenuation factor for vapour degradation it is recommended to read the source documentation (Davis et al. 2009).

The minimum requirements for allowing attenuation factors for vapour degradation are as follows:

1. Is there evidence of oxygen penetration? →

NA
Y

 - Requires measurement of oxygen in soil gas with at least 5% at 1 m depth (refer to Section 4.2.1 of Application Document)

NA
N

 - Attenuation factor may not be applicable
2. Is the source depth 2 m or deeper? →

NA
Y

 - Continue to Question 3 (refer to Section 4.2.2 of Application Document)

NA
N

 - Attenuation factor may not be applicable
3. Does the slab have one side less than 15m length? →

NA
Y

 - Degradation factor may apply. Less than 4 m depth, a factor of 10 may apply. 4 m and deeper, a factor of 100 may apply. (refer to Section 4.2.3 of Application Document)

NA
N

 - Attenuation factor may not be applicable

2. Soil organic carbon content (refer to Section 4.3 of Application Document)

May be used to adjust soil HSLs only. Soil HSLs were based on fraction organic carbon content of 0.003.

HSL may be adjusted if background levels of organic carbon content at the same depth as source is different from baseline. Background sample must not be contaminated with hydrocarbons. If surface soil, background sample in open space may not be appropriate to use if comparing for soil under slab.

Adjustment is linear, i.e. doubling the organic carbon will double the HSL. Applies only to soil HSL for vapour intrusion.

3. Air exchange rate (refer to Section 4.4 of Application Document)

HSLs are based on air exchange rate (AER) of 0.6 h^{-1} for residential and 0.83 h^{-1} for commercial.

Careful justification may be required prior to changing AER. Consideration should be given to weather conditions, practice of leaving doors/windows open, or closed in climate controlled building. New buildings tend to be more air tight to comply with energy saving regulations.

For soil and groundwater, adjustment is linear with respect to AER.

For soil vapour, adjustment is variable depending on soil type and depth.

Refer to the charts in Appendix D to determine the adjustment factor.

4. Moisture content (refer to Section 4.5 of Application Document)

HSLs may be adjusted if moisture content in soil is significantly different from baseline HSLs. The baseline moisture contents used were (dry wt) for sand 8%, silt 22% and clay 20%.

Moisture content should be representative of long-term moisture content and not short-term result from recent rain event. Also note that for a development

with future building where no building currently exists, moisture contents on site may not be representative for the future state of the site.

HSL scaling factors for different land use/chemicals/soils are presented in Appendix C of the Application Document and may be applied as described in Section 4.5.



Step 7 – HSLs and adjustments (vapour intrusion) (cont.)	
Saturation/solubility limits (soil and groundwater HSLs only)	
Apply the adjustments to the HSLs for vapour intrusion by multiplying by the determined factors.	
After applying the adjustments to the HSLs, is the revised HSL greater than the solubility / saturation limit?	NA → Y - Indicates that the predicted source concentration to produce an unacceptable vapour risk is higher than the saturation point. The revised HSL is not limiting to vapour (NL). Note this does not apply to soils with direct contact. NA N - Revised HSL may be compared with measured source concentrations.
Multi-Pathway Exposure	
1. Is inclusion of direct contact with soils required?	NA → Y - Repeat Step 6 with Adjusted Vapour Intrusion HSLs and Direct Contact HSLs NA N - Proceed to Question 2
2. Is cross-scenario exposure required to be assessed?	NA → Y - Repeat Step 6 with Adjusted Vapour Intrusion HSLs and Direct Contact HSLs NA N - Proceed to 'Screening assessment'
Screening assessment	
Is the adjusted HSL less than source concentration?	→ Y - Indicates potential health risk N - Considered within acceptable health risks. If cancer endpoint (benzene) may also need to assess cancer risk level and cumulative cancer risk in Step 8
Is the maximum soil, groundwater or soil-vapour concentration greater than the HSL by more than one or two orders of magnitude?	→ Y - Indicates potential acute risk around hotspot N - Considered within acceptable health risks
If the screening assessment indicates the potential for unacceptable health risk, consideration may be given to further investigations such as further contamination delineation, site-specific health risk assessment or site management. Before deciding the appropriate form of action considerations should include:	
- The magnitude of HSL exceedence - The nature of the source - The time frame required for managing health risks - Other statutory requirements	



Step 8 – Cancer risk assessment

Acceptable cancer risk

(Refer to Section 5.1 of Application Document)

HSLs for benzene have been based on 1×10^{-5} cancer risk. In some jurisdictions it may be required to assess carcinogenic risks based on 1×10^{-6} cancer risk.

- 1) The HSLs are linearly related to acceptable risk. HSLs based on a cancer risk of 1×10^{-6} may be calculated by dividing the HSLs in Appendix B by a factor of 10.
- 2) If the HSL is NL (vapour only HSL), it is possible that it may become limiting if the HSL is within a factor of 10 of the soil saturation concentration (or solubility limit for groundwater).
- 3) If soil or groundwater source concentration is less than an order of magnitude of the saturation concentration / solubility limit (in Appendix B), then even dividing the non-limiting HSL by 10 would result in an acceptable risk. Hence there is no need to proceed further.
- 4) If soil or groundwater source concentration is within an order of magnitude of the saturation concentration / solubility limit it is recommended to calculate the revised HSL from the non-limiting HSL. This process is outlined as follows:

Calculating revised HSL for 10^{-6} cancer risk from non-limiting HSL

- 1) The non-limiting HSLs are presented in Friebe & Nadebaum 2011 (Part 1).
- 2) The derived HSLs are presented in Appendix F.
- 3) Find the pages that correspond to the source type (soil, groundwater, soil vapour) for the given scenario (residential / commercial / recreational / intrusive maintenance). Note indicator chemicals and TPH have been separated.
- 4) For the corresponding soil category, depth and chemical, the Vapour Intrusion HSL and saturation/solubility concentration is presented in the columns on the right.
- 5) If this HSL is divided by 10 and the result is greater than Csat (for soil) or saturation limit (for groundwater), then the revised HSL is still NL. Otherwise the result is the revised Vapour HSL.

Cumulative cancer risk

(Refer to Section 3.6.1 of Application Document)

HSLs for benzene have been based on 1×10^{-5} cancer risk. In most jurisdictions it is required to assess total carcinogenic risks based on 1×10^{-5} cancer risk. If HSLs are not NL for benzene and another carcinogenic chemical is identified, such as PAHs, follow the procedure outlined in Section 3.6.1. The cumulative fraction may also be applied to more than two chemicals.

Note that multiple sources should be considered. For example, a resident may be exposed through direct contact with PAHs in surface soil, but also benzene vapours from soil and groundwater. For vapour risk (benzene), the risk contribution should consider the greatest risk for the receptor from all vapour sources. Because multiple sources do not have an additive effect, the source with the greatest risk needs to be identified (refer to Section 3.5 for discussion on multiple vapour sources). This means that for all sources/depths the source concentration should be divided by their respective HSLs to calculate the benzene contribution to cumulative risk. The highest fraction determines which source poses the greatest risk to receptors. The same may be carried out for carcinogenic PAHs. The sum of the highest benzene fraction and the highest PAH fraction results in the highest possible cumulative fraction.

Issue No.	Audit Comments (November 2023)	Responses (Tierra Environment) 24 November 2023	Issue close out (Revision A) 28 November 2023
Tierra Environment Glen Helen Discovery Park Groundwater Monitoring Plan DRAFT 24 November 2023 Prepared for Ngurratjuta/Pmara Ntjarra Aboriginal Corporation			
1	Section 1.1, General. Please amend the term 'restricted site contamination audit' to 'environmental audit' to be consistent with NT terminology. The term USTs has not been introduced / explained in the document. So suggest in this first paragraph amending it from "...now removed underground fuel tanks" to read "...now removed underground storage tanks (USTs) that were used for fuel storage...."	Will change accordingly	Amendment included. No further comments or queries.
2	Section 1.3.5, Glen Helen Discovery Park, Groundwater Monitoring Event May 2023, July 2023 – Tierra Environment. First sentence. Suggest amending "sampling and analytical analyses..." to simply "sampling and analyses...." Second paragraph. Suggest amending from "As the wells were not developed when originally installed...." To "As there were some uncertainties whether the wells were adequately development of when originally installed" Third paragraph. Suggest amending first sentence from "LNAPL was identified" to "Light non-aqueous liquid (LNAPL) was not identified...." Sixth paragraph. Suggest amending first sentence from "Risks to the Finke River are expected to be unlikely...." to "Risks to the Finke River are expected to be acceptably low...."	Will change accordingly	Amendment included. No further comments or queries.
3	Section 1.5, Roles and Responsibilities. Site owner. According to our info, the current owner is not the aboriginal corporation as currently listed in the table. The table should be amended to reflect the details of the current owner which are provided below. Beston Parks Land Co Pty Ltd (ACN 111 783 423) (trading as / known as) Discovery Parks who acquired the site in August 2021. The current owner's responsibility should simply be to allow access for the monitoring under the GMP and to ensure the monitoring bores are maintained in a suitable working condition.	Will change accordingly	Amendment included. No further comments or queries.

Issue No.	Audit Comments (November 2023)	Responses (Tierra Environment) 24 November 2023	Issue close out (Revision A) 28 November 2023
	The aboriginal corporation are the former owners who are responsible for implementation of the GMP. So suggest amending the table to reflect this. Please add another responsibility for the consultant. "To make amendments to the GMP as may be necessary, and to make recommendations at the appropriate time when it is considered monitoring under the GMP should cease." Please add another responsibility for the auditor. "To review the reporting of monitoring under this GMP, review and approve amendments to the GMP as may be required, and ultimately make a recommendation to the NT EPA whether or not the monitoring program should cease."		
4	Section 1.6, Changes to the GMP and Review. This says the GMP will apply for 2 years, but in section 1.3.5 it says the recommendation was for 12 months of monitoring. This needs to be made consistent. I suggest amending this section to state 12 months to be consistent. I think this would be reasonable and appropriate to satisfy the objectives of the monitoring program (provided the results come out ok of course).	Will change accordingly	Amendment included. No further comments or queries.
5	Section 2.1, Well Locations Suggest including a sentence something like "The monitoring bores shall be provided with surface completions / covers in accordance with relevant state and national guidelines. Ideally these should be metal and flush mounted to enable protection of the monitoring bores, and easy location of monitoring bores for future GMEs. This should be a priority item to be addressed as part of the first GME scheduled under this GMP."	Will change accordingly	Amendment included. Survey data for the monitoring bores also provided by Tierra Environment. No further comments or queries.
6	Section 2.2, Monitoring Frequencies. As per comments earlier, suggest stating the program is to comprise biannual GMEs over a 12-month period followed by a review.	Will change accordingly	Amendment included. No further comments or queries.
7	Section 2.3, Standards and guidelines. As the audit was prepared under the Victorian environmental audit regime, please include the following references: - o Environment Protection Act 2017 (Vic) - o Environment Reference Standard, Victoria Government Gazette No. S245 (26 May 2021)	Will change accordingly	Amendment included. No further comments or queries.

Issue No.	Audit Comments (November 2023)	Responses (Tierra Environment) 24 November 2023	Issue close out (Revision A) 28 November 2023
	0 Environment Protection Authority Victoria. Groundwater Sampling Guidelines, Publication 669.1, February 2022.		
8	Section 2.5, Contaminants of Concern. Suggest adding another sentence after the first one that reads "These have been selected as the appropriate indicators of fuel related impacts to be included in this monitoring program."	Will change accordingly	Amendment included. No further comments or queries.
9	Section 3.1.3 reporting Reporting need only occur once at the end of each year of monitoring unless triggers are exceeded. The list of items to be reported includes "an evaluation of the direction and rate of groundwater movement". Is Tierra proposing to survey the wells and do field tests to assess hydraulic conductivity to allow this interpretation? If not, then reconsider whether this is included in the list of information to be reported. The list of items to be reported includes "a plan showing the inferred extent of the plume of contaminants of concern". Suggest this might be difficult given there are only three wells in this monitoring network. Suggest reconsidering whether this is included in the list of information to be reported. The list of items to be reported includes "an assessment of generated data against criteria G1 to G4". We can't readily find any reference to these criteria anywhere in the GMP. Are we missing something here?	Will change reporting to once a year unless triggers are exceeded. Will remove reference to the rate of groundwater movement That reference appears to be incorrect. Will amend.	Survey has been completed and the surveyor report provided for the three located wells. Amendment included. No further comments or queries.
10	Section 4.1, General Suggest paragraph two should also include exceeding ANZG freshwater ecosystems criteria, given that the site is located within a protected national park.	Will add	Amendment included. No further comments or queries.
11	Section 4.4, Stage 3 Contingency Measures – Data Review. Suggest the 3rd dot point in this contingency stage be amended from "contaminant behaviour" to read "changes in the risk profile to receptors including occupants at the accommodation facility or the Finke River, or uncertainties in the level of risk to these receptors that warrant further consideration." Last sentence. Suggest amending from "In the event of additional groundwater or monitoring being required, Stage 4 ..." to read "In the event it is deemed the	Will change accordingly	Amendment included. No further comments or queries.

Issue No.	Audit Comments (November 2023)	Responses (Tierra Environment) 24 November 2023	Issue close out (Revision A) 28 November 2023
	circumstances have changed sufficiently or there is inadequate information for such decision making, then Stage 4 of the contingency measures shall be implemented.”		
12	Section 4.5, Stage 4 Contingency Measure – Additional Investigation and Modelling. Suggest this section could be described more simply something like “A program of additional investigation and/or monitoring shall be determined in consultation with the Auditor. The scope will take into account the specific uncertainties and information gaps that might have become apparent over the source of the previous monitoring. The scope must consider what if any additional information is required to assess the nature and extent of impacts and associated risks to occupants of the accommodation facility, and to the Finke River.”	Will change accordingly	Amendment included. No further comments or queries.

Survey Report

Subject: Monitoring Well Levels, NTP 830, Glen Helen Resort

Locality: Glen Helen Resort, 8495 Namatjira Drive

Plan Number: A315

Survey Completed: 2nd June 2023

Surveyed by: Louis Carmichael, Project Surveyor



1. General

The survey was performed in June of 2023 to establish the heights of the 3 monitoring wells found and uncovered by Tierra Environmental, in the Glen Helen Resort car park.

2. Datum

The datum has been assumed from the original concrete block A217254 in the northeastern corner of the caravan park, with the RL of 637.311 obtained from the NT Atlas and Spatial Data Directory.

3. CRMs and Survey Marks

The CRM, A217254 and a concrete nail "GH05" established via long-term GNSS static observation for a previous survey, have been connected to in this closed-looped level run.

4. Survey Methodology

A Leica DNA 03 level was used to carry out the survey. The 3 monitoring wells were observed 3 times independently throughout the level run to determine a precise level and the closed loop level run had a misclosure of 1mm. The concrete nail "GH05" was also included in the level run. The level difference measured was found to be within 17mm of the difference measured between GNSS observations performed on the CRM and nail for the previous survey, which is within acceptable tolerances. This then validates the CRM used as not being disturbed recently. The monitoring wells were measured on the north facing lip of the pipe inside the PVC casing. Positions were recorded at the centre of the well.

5. Results

Out of the 4 monitoring wells that were included in the search, only 3 were found: Monitoring well 1 (MW1), monitoring well 3 (MW3) and monitoring well 4 (MW4).

The levels were found to be:-

MW1 – 630.044m

MW3 – 629.898m

MW4 – 629.199m

MGA Zone 53 Coordinates measured with GNSS were :-

MW1 – E 262720.334 N 7378611.505

MW3 – E 262736.691 N 7378605.748

MW4 – E 262765.902 N 7378608.385

Yours faithfully,



Louis Carmichael

Project Surveyor



Brian Blakeman B.Tech. (Surv) L.S.

Licensed Surveyor

Survey Report - Monitoring Well Levels Glen Helen Resort

8 June 2023