

Site Audit Report



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ASSOCIATED REPORTS

Draft Site Remediation and Validation Report, Former Glenorie Service Station and Depot, Site ID: 28366S, 912-914 Old Northern Road, Glenorie NSW, prepared by Coffey Environments Australia Pty Ltd (ref. ENAURHOD02051AA-R01c), dated 1 March 2013

Notes:

1. The *Site Remediation and Validation Report* remains in draft form for the reasons indicated in Section 3.1 of this report.
2. During the course of the project, several other reports were prepared by the consultant and reviewed by the Auditor.

However, those reports have not been listed herein because:

- Any significant information that they contained has been included within the *Site Remediation and Validation Report*.
- The Auditor has not relied upon those reports.



Analytes – Organic

BaP	benzo(a)pyrene
BTEX	benzene, toluene, ethylbenzene, xylene
OCP	organochlorine pesticides
OPP	organophosphorus pesticides
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
PCE	tetrachloroethene
TPH	total petroleum hydrocarbons
TRH	total recoverable hydrocarbons
VHC	volatile halogenated compounds

List of Abbreviations

CMJA



Measures

$\mu\text{g/L}$	micrograms per litre
$\mu\text{g/m}^3$	micrograms per cubic metre
m	metre
m^2	square metre
mbgs	metres below ground surface
mg/kg	milligrams per kilogram
mg/m^3	milligrams per cubic metre
mm	millimetre

General

AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure 1999
AST	above-ground storage tank
Caltex	Caltex Australia Petroleum Pty Ltd
CEMP	Construction Environmental Management Plan
CLM Act	Contaminated Land Management Act
CMJA	C. M. Jewell & Associates Pty Ltd
Coffey	Coffey Environments Pty Ltd
Council	The Hills Shire Council
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DECCW	Department of Environment, Climate Change and Water
DP	deposited plan
DQO	data quality objectives
EPA	Environment Protection Authority
GME	groundwater monitoring event
GMP	Groundwater Management Plan
HDPE	high-density polyethylene
HIL	Health Screening Level
IT	IT Environmental Pty Ltd
LEP	Local Environmental Plan
LNAPL	light non-aqueous-phase liquid
LOR	limit of reporting
MPVE	multi-phase vacuum extraction
NEPM	National Environment Protection Measure
NW	north-west
OEHL	Office of Environment and Heritage
ppm	parts per million
QA	quality assurance
QC	quality control
RMS	Roads and Maritime Services
SAR	site audit report
SAS	site audit statement
SCEW	Standing Council on Environment and Water
The Site	912-914 Old Northern Road, Glenorie
UST	underground storage tank

1.0 INTRODUCTION

1.1 Background

This Site Audit Report relates to land located at 912-914 Old Northern Road, Glenorie, in New South Wales (the site). The location of the site is illustrated on Figure 1.

As at the date of this report:

- The site is described as Lot 4 in DP616348.
- The land is owned by Mr & Mrs Shore and leased by Caltex Australia Petroleum Pty Ltd (Caltex).

Previously, a service station and fuel depot was located on the land and operated by Caltex.

The Site Audit that this report describes was requested on 15 January 2007 by Mr & Mrs Shore and Caltex for the purpose of complying with Condition 1.1 of a Deed of Release between Mr & Mrs Shore and Caltex. The Site Audit is thus a non-statutory Site Audit under the provisions of Section 47 of the Contaminated Land Management Act 1997 (the Act).

This audit was conducted for the purpose of determining the matters that are listed below (using the terminology and numbering of Section 4 of the Act):

- (i) the nature and extent of any contamination of the land,
- (ii) the nature and extent of any management of actual or possible contamination of the land,
- (iii) whether the land is suitable for any specified use or range of uses,

The Site Audit Report has been prepared in accordance with the guidelines issued by the NSW Environment Protection Authority¹ (EPA), in *Guidelines for the NSW Site Auditor Scheme*, 2nd edition, 2006. It has been prepared by Christopher Jewell, who is a Site Auditor accredited under the NSW Contaminated Land Management Act 1997.

The Site Audit relates to the investigation, decommissioning, remediation and validation work completed by Coffey Environments Pty Ltd (Coffey).

Note: The work was commenced by IT Environmental Pty Ltd (IT), which was subsequently acquired by Coffey. The Auditor considers IT to be included within the entity identified herein as Coffey.

The Site Auditor and his assistant (Steven Hallam) have visited the site on many occasions to observe and verify, as far as practicable, the site conditions and the progress of the work being audited.

1.2 Scope and Structure of the Site Audit Report

Section 2 of this report provides:

- Basic identification and location information concerning the site.
- An indication of the layout, topography, drainage, geology and hydrogeological setting of the site, together with an overview of its history.
- A list of any known or potential contaminant sources, and the associated primary contaminant groups of concern.
- An outline of the intended use of the site, and the associated assessment criteria.

¹Being the NSW statutory body responsible for regulation pursuant to the Contaminated Land Management Act 1997.

Section 3 provides an overview of relevant work completed by Coffey and it includes the Auditor's evaluation of the quality of the associated data.

Section 4 of this report presents an assessment of the completeness and adequacy of the information provided and the standard of reporting. The assessment was carried out against the criteria established by the NSW EPA publication, *Guidelines for the NSW Site Auditor Scheme*, 2nd edition (2006), but also incorporates the reviewer's own judgement; reference has been made to other guideline publications issued or endorsed by the NSW EPA, including *Guidelines for Consultants Reporting on Contaminated Sites* (2011), *Guidelines for Assessing Service Station Sites* (1994), *Sampling Design Guidelines* (1995) and the *National Environment Protection (Assessment of Site Contamination) Measure* (1999, as amended 2013), as appropriate.

Section 5 provides the Auditor's assessment with regard to, in particular, any remaining risks to human health, structures and the environment; regulatory compliance; possible contaminant migration; and the requirement for short-term management.

Section 6 provides the Auditor's assessment of the condition of off-site groundwater.

Section 7 presents the Auditor's opinion of the adequacy of the investigation, remediation and validation work that has been completed, and it discusses the Site Audit Statement (SAS) that he has issued. A copy of the SAS is attached to this report.

Appendix A provides a list of the individual compounds that make up the primary contaminant groups of concern (that are listed in Section 2).

Appendix B provides, on CD, a draft copy of the Coffey's *Site Remediation and Validation Report*, being the primary report to which this audit relates.

Notes:

1. The *Site Remediation and Validation Report* remains in draft form for the reasons indicated in Section 3.1 of this report.
2. During the course of the project, several other reports were prepared by Coffey and reviewed by the Auditor.

However, those reports have not been listed herein because:

- Any significant information that they contained has been included within the *Site Remediation and Validation Report*.
 - The Auditor has not relied upon those reports.
3. Within this report extensive use has been made of Coffey's *Site Remediation and Validation Report*. Specifically, sections of that report have been adopted for use in this report.
 4. For a more detailed description of the layout, topography, drainage, geology, hydrogeology and history of the site – and of the associated work that has been completed – reference should be made to the Coffey report.

Appendix C provides copies of relevant letter reports, supporting documentation and communications. (Note: Copies of all other associated documents that were forwarded to the Auditor during the course of this audit are held on file.)

Appendix D provides a copy of the Auditor's assessment of the use of data quality objectives, data quality indicators and quality assurance/quality controls.

Although the site has been extensively investigated and remediated, sections of pipework and, in particular, hydrocarbons at concentrations exceeding the assessment criteria may remain within the ground with sporadic distribution and may be encountered during redevelopment work. Also, hydrocarbon contamination is known to remain along the northern boundary of the site and beneath a part of the eastern wall of the workshop, and at least a few more hotspots probably remain. Hydrocarbon odour emanating from any soil that is excavated, may also be present.

Accordingly, the Auditor considers that when the site is redeveloped, it should be subject to the following Construction Environmental Management Plan (CEMP) that he has prepared – and he has placed a condition upon the SAS requiring that when the site is redeveloped, it is managed in accordance with the plan.

Construction Environmental Management Plan, 912-914 Old Northern Road, Glenorie,
prepared by C. M. Jewell & Associates Pty Ltd (ref. J1257.35R-rev0), dated October 2013

A copy of the plan is provided as Appendix E of this report.

During the course of the work it became evident that hydrocarbons had migrated from the site via groundwater and Caltex duly notified the EPA under Section 60 of the Act.

When the site was notified to the EPA, one of the issues that was recognised was the presence of Phase Separated Hydrocarbons (i.e. Light Non-Aqueous Phase Liquid – LNAPL) within off-site groundwater monitoring wells. As at the date of this report, LNAPL remains and the Auditor considers that an off-site groundwater monitoring program (GMP) is required. A plan for the GMP has been developed by Coffey and a copy of it is provided as Appendix F of this report.

Note: The existence of the plan is noted on the SAS, but because it relates solely to off-site issues, implementation is not a condition of the SAS.

A compliance checklist has also been completed by the Auditor and is held on file.

1.3 Limitations and Intellectual Property Matters

This report has been prepared by C. M. Jewell & Associates Pty Ltd for the use of the clients identified in Section 1.1 and relevant government agencies (in particular, the NSW EPA and The Hills Shire Council), for the specific purpose described in that section.

The work has been carried out, and this report prepared, utilising the standards of skill and care normally expected of a site auditor practising in New South Wales under the requirements of the Contaminated Land Management Act 1997. The level of confidence of the conclusions reached is governed, as in all such work, by the scope of the investigation carried out and by the availability and quality of the data. The Auditor has satisfied himself that the available data are adequate to support the conclusions he has reached, and comply with the minimum requirements indicated in the guideline documents specified for the NSW Site Auditor Scheme. Where limitations or uncertainties in conclusions are known, they are identified in this report. However, no liability can be accepted for failure to identify conditions or issues which arise in the future and which could not reasonably have been assessed or predicted using the site information and analytical data available for review.

Data collected by others have, of necessity, been used to support the conclusions of this report. Those data have been subjected to reasonable scrutiny but have essentially, and necessarily, been used in good faith. Liability cannot be accepted for errors in data collected by others where such errors could not have been detected by reasonable scrutiny of the data and supporting information supplied to or requested by the Auditor.

This report, any original data contained in the report, and its findings and conclusions remain the intellectual property of C. M. Jewell & Associates Pty Ltd. A licence to use the report for the specific purpose identified in Section 1.1 is granted to the persons identified in that section on the condition of receipt of full payment for the services involved in the preparation of the report.

It is recognised that other persons and government agencies may ultimately have access to this report. In this event, it is recommended that this report should not be used by other persons and government agencies, or for other purposes than those identified in this report, without prior reference to the Auditor.

The report must not be reproduced except in full and with the permission of C. M. Jewell & Associates Pty Ltd.

2.0 SITE INFORMATION

This section provides:

- Basic identification and location information concerning the site.
- An indication of the layout, topography, drainage, geology and hydrogeological setting of the site, together with an overview of its history.
- A list of any known or potential contaminant sources, and the associated primary contaminant groups of concern. *Note:* A list of the individual compounds that make up the primary contaminant groups of concern is provided as Appendix A.
- An outline of the intended use of the site, and the associated assessment criteria.

Sections below generally relate to information provided by Coffey and incorporate any relevant responses to comments raised by the Auditor during the course of the audit.

For a more detailed description of the layout, topography, drainage, geology, hydrogeology and history of the site, reference should be made to the Coffey report provided as Appendix B.

2.1 Site Identification and Location

This Site Audit Report (SAR) relates to land located at 912-914 Old Northern Road, Glenorie, New South Wales (the site). The location of the site is shown on Figure 1.

Australian Map Grid Zone 56H co-ordinates of the centre of the site are approximately 315613E and 6279871N.

With regard to the site, as at the date of this report:

- It is described as Lot 4 in DP616348.
- It is owned by Mr & Mrs Shore.
- It lies within The Hills Shire Council (Council) local government area, in the Parish of Nelson, County of Cumberland.
- It is zoned RU6 – Transition, as per Council's Local Environmental Plan 2012 (LEP).

2.2 Site Setting

The site is located on the south-eastern outskirts of Glenorie in a predominantly rural area, as illustrated on Figure 2.

The site is bounded as outlined below.

<i>To the north</i>	Old Northern Road, with rural / residential land use beyond.
<i>To the east</i>	Rural / residential land use.
<i>To the south</i>	Rural / residential land use.
<i>To the west</i>	Whites Road, with rural / residential land use beyond.

2.3 Site Layout, Topography and Drainage

2.3.1 Site Layout

The site is L-shaped, with an area of approximately 9200 m².

Previously:

- The front (northern) part of the site was used as a service station and included a workshop, a residential property and an outbuilding.
- The rear (southern) part of the site was used as a fuel depot and included a drum store.

The site has been cleared of all above and below ground structures, other than:

- The former workshop.
- The residential property.
- The outbuilding.

X The structures are in a dilapidated condition.

The layout of the site as at the date of this report is illustrated on Figure 3.

2.3.2 Topography

The site is essentially level, with a slight slope down towards the north-north-west at a gradient of approximately 4%.

Note: The gradient in the immediate vicinity of the workshop is greater than the average gradient for the site due to cut and fill earthworks that were undertaken in order to create a level platform for construction of the workshop.

The south of the site is at an elevation of approximately 165 metres above Australian Height Datum (AHD), the north of the site is at an elevation of approximately 160 metres AHD.

The site is not considered flood prone.

2.3.3 Drainage

As at the date of this report, drainage of the site is primarily through surface infiltration and surface runoff. With regard to runoff from the site, it is likely to flow in a north-north-westerly direction.

The nearest surface water body to the site is Glenorie Creek, which is located approximately 100 metres north of the site. (*Note:* Within the vicinity of the site, several dams have been constructed along Glenorie Creek.)

Glenorie Creek flows to the north-west, turning to the north approximately 500 metres from the site, and discharges into the Hawkesbury River about 15 kilometres to the north of the site.

2.4 Geology and Soil Landscape

A review of the Sydney 1:100 000 Soil Landscape Series Sheet 9130 indicates that the site is underlain by erosional soils of the Glenorie Soil Landscape group.

This group comprises shallow to moderately deep Red Podzolic Soils on crests; moderately deep Red and Brown Podzolic Soils on upper slopes; deep Yellow Podzolic Soils on lower slopes; and Humic Gleys, Yellow Podzolic Soils, and Gleyed Podzolic Soils along drainage lines.

A review of the Sydney 1:100 000 Geological Series Sheet 9130 (Edition 1) 1983 indicates that the sequence of geological materials underlying the site is as follows:

<i>Ground surface ↓</i>
Superficial / regolith materials, predominantly silts and clays.
Ashfield Shale (member of the Triassic-age Wianamatta Group), comprising black to dark-grey shale and laminite.
Mittagong Formation , comprising interbedded shale, laminite, and medium-grained quartz sandstone.
Hawkesbury Sandstone , comprising medium to coarse-grained quartz sandstone, very minor shale and laminite lenses.

The Ashfield Shale occurs in the Glenorie area as a thin cap on the north-south trending ridge. The Mittagong formation outcrops as outliers, and is sometimes present beneath the Ashfield Shale.

Information available from the site investigations indicates that the superficial / regolith materials have a thickness ranging from 0.5 to 2.8 metres with an average across the site of approximately 1.1 metres.

Beneath the site, the top of the Hawkesbury Sandstone is expected to be present within a depth of approximately 15 metres from the surface.

2.5 Hydrogeology

The Auditor notes:

- The Triassic rocks in general form low-transmissivity aquifers in which the matrix permeability is very low.
- Groundwater flow in the Triassic rocks is almost entirely by way of secondary features such as joints and other fractures.
- In general, Triassic rocks provide only low yields.

Coffey conducted a search of the NSW Natural Resources Atlas. The search indicated that there were twenty-four registered groundwater bores within 1 kilometre of the site, with feature information being available for five of those bores, as summarised in Table 1.

TABLE 1 Summary of Registered Groundwater Bores					
Bore ID	Date Installed	Bore Depth (mbgs)	Standing Water Level (mbgs)	Authorised Purpose	Distance and Direction from the Site
GW038041	May 1975	31.6	12.4	Irrigation	750 m to the north-east
GW065500	March 1992	48.8	36.0	Farming	1000 m to the north-east
GW066433	No data	121	No data	No data	575 m to the east
GW103883	December 1999	148	6.0	Test bore	700 m to the north-west
GW108069	February 2006	324	124	Test bore	600 m to the south-east

With regard to Coffey's investigation of the site, the Auditor noted the following, in particular:

- Groundwater is expected to broadly flow in a north-north-westerly direction.
- Groundwater seepage velocity is expected to be less than 2 metres year.
- The depth from the ground surface to the water table varied spatially and temporally, but was typically within the range of 2 to 4 metres. This water table generally lies within the superficial materials.
- Coffey considered that groundwater beneath the site and surrounding areas may discharge into Glenorie Creek, being the nearest surface water body to the site and the nearest sensitive receptor.

Note: Glenorie Creek is located approximately 100 metres north of the site.

2.6 Site History

As indicated in Section 2.3.1, previously:

- The front (northern) part of the site was used as a service station and included a workshop and a residential property.
- The rear (southern) part of the site was used as a fuel depot and included a drum store.

Prior to the use of the site as a service station and fuel depot, Coffey indicated that the land had probably been used for agricultural purposes; in particular, as an orchard.

Auditor's Comments

The Auditor has reviewed the associated information provided by Coffey and he has visited the site.

The Auditor considers the abovementioned uses to be an adequate summary of the pertinent historical uses of the site.

2.7 Potential Contaminant Sources

During the course of the audit, Coffey identified the following potential contaminant sources / contaminating activities that required assessment:

- The workshop and associated in-ground hoist.
- The service station and associated underground storage tanks (USTs), above ground storage tanks (ASTs), fuel distribution lines and fill points, bowsers, and appurtenances.
- The fuel depot and associated USTs, ASTs, fuel distribution lines and fill points, bowsers, and appurtenances.

- The drum store.
- Asbestos cement sheeting associated with the buildings.
- Imported (contaminated) fill material.
- The historical use of the site and surrounding land for agricultural purposes.

Auditor's Comments

The Auditor has reviewed the associated information provided by Coffey and he has visited the site.

The Auditor considers the list above to be an adequate summary of the potential contaminant sources that required assessing by Coffey.

2.8 Primary Contaminant Groups of Concern

Coffey indicated the primary contaminant groups of concern within soils across the site to be:

- heavy metals; in particular, lead
- polycyclic aromatic hydrocarbons (PAH)
- phenol
- total petroleum hydrocarbons (TPH)
- monocyclic aromatic hydrocarbons – specifically, benzene, toluene, ethylbenzene and xylenes (BTEX)

The individual compounds that make up these contaminant groups are listed in Appendix A.

With regard to groundwater, Coffey indicated the primary contaminant groups of concern to be:

- heavy metals; in particular, lead
- PAH; in particular naphthalene
- phenol
- TPH
- BTEX

Auditor's Comments

The Auditor considers Coffey's assessment of the primary contaminant groups of concern to be appropriate.

The Auditor also notes that Coffey analysed / inspected selected samples for the presence of:

- organochlorine pesticides (OCP)
- organophosphorus pesticides (OPP)
- polychlorinated biphenyls (PCB)
- volatile halogenated compounds (VHC)
- asbestos

2.9 Proposed Development

The Auditor understands that, having obtained appropriate Council consent, the owners of the land (i.e. Mr and Mrs Shore) intend to construct a new service station within the front part of the site (constituting 'commercial / industrial' use for the purposes of this audit) and to redevelop the rear part of the site for a yet to be determined 'commercial / industrial' use.

Note: Council has indicated that consent for the use of the rear part of the site as a fuel depot has lapsed, whilst Schedule 1 (Additional Permitted Uses) of the LEP permits the front part of the site to be used for the purposes of a service station (with consent).

2.10 Assessment Criteria

On 11 April 2013, the Standing Council on Environment and Water (SCEW) agreed to amend the National Environment Protection (Assessment of Site Contamination) Measure 1999 (ASC NEPM). The amendment came into effect on 16 May 2013.

With regard to transitional arrangements, the EPA released the following statement on 16 July 2013.

Regulatory authorities in all Australian states and territories have agreed, in principle, to a transition period of up to 12 months for full implantation of the amended ASC NEPM. The transition period allows for regulators to implement any legislative or administrative steps required to put the amendment into effect, including the update of relevant guidelines.

In NSW, the amended ASC NEPM and its supporting schedules apply to works completed after 15 May 2013.

Any exemptions from applying the amended ASC NEPM must be appropriately justified and only when all of the following circumstances are met:

- reports are almost complete by 15 May 2013, and
- significant additional works and/or cost would be necessary to meet the amended ASC NEPM, and
- there are no unacceptable risks associated with applying the original ASC NEPM.

Coffey's remediation and validation report was received by the Auditor on 6 March 2013. The report does not discuss the then impending amendment of the ASC NEPM.

2.10.1 Soil

The criteria adopted, in the first instance, by the Auditor to assess the soil data presented in Coffey's reports are listed in Table 2. These are appropriate to the continuing / intended use of the site, being commercial and industrial use.

For metals, PAH, and phenol, the appropriate soil investigation criteria are the guideline levels set out in Column 4 of the table: 'Soil Investigation Levels for Urban Development Sites in NSW', in the NSW EPA's *Guidelines for the NSW Site Auditor Scheme*, 2nd edition (2006).

Criteria for TPH and BTEX are those published in the NSW EPA's *Guidelines for Assessing Service Station Sites* (1994) and listed in its Table 3 – 'Threshold Concentrations for Sensitive Land Use – Soils'

These criteria were used, in the first instance, rather than the criteria provided in the ASC NEPM because they correspond to those used by Coffey during its site work.

With regard to the ASC NEPM, the relevant criteria are also provided within Table 2.

Petroleum Hydrocarbon Compounds and Fractions as described within the ASC NEPM
During the preparation of the ASC NEPM, Health Screening Levels (HSL) for vapour intrusion were developed for BTEX and naphthalene plus four carbon chain fractions.

The fractions are listed below:

Fraction number	Equivalent carbon number range
F1	C ₆ – C ₁₀
F2	>C ₁₀ – C ₁₆
F3	>C ₁₆ – C ₃₄
F4	>C ₃₄ – C ₄₀

Where, the BTEX results should be subtracted from the Total Recoverable Hydrocarbon* (TRH) C₆ – C₁₀ analytical result for comparison with the HSL (mg/kg) for F1, and the naphthalene result should be subtracted from the >C₁₀ – C₁₆ result for comparison with the HSL (mg/kg) for F2.

Note: Chemicals in the >C₁₆ – C₃₄ and >C₃₄ – C₄₀ fractions are non-volatile and therefore not of concern for vapour intrusion.

With regard to exposure via direct contact pathways (dermal contact and inhalation of soil particles), the ASC NEPM references the CRC for Contamination Assessment and Remediation of the Environment, Technical Report no. 10, *Health screening levels for petroleum hydrocarbons in soil and groundwater, Part 1: Technical development document*, E. Friebe and P. Nadebaum, 2011.

For commercial / industrial sites and maintenance workers conducting intrusive work, the HSLs (mg/kg) for direct contact are listed below:

Chemical	Commercial / Industrial	Intrusive Maintenance Work
Toluene	99,000	120,000
Ethylbenzene	27,000	85,000
Xylenes	81,000	130,000
Naphthalene	11,000	29,000
Benzene	430	1,100
C ₆ – C ₁₀	26,000	82,000
>C ₁₀ – C ₁₆	20,000	62,000
>C ₁₆ – C ₃₄	27,000	85,000
>C ₃₄ – C ₄₀	38,000	120,000

* The term TRH is equivalent to TPH, but has differing carbon chain fractions to TPH as per below:

TRH	TPH
C ₆ – C ₁₀	C ₆ – C ₉
>C ₁₀ – C ₁₆	C ₁₀ – C ₁₄
>C ₁₆ – C ₃₄	C ₁₅ – C ₂₈
>C ₃₄ – C ₄₀	C ₂₉ – C ₃₆

TABLE 2 Assessment Criteria – Soils (mg/kg)						
Analyte	EPA Column 4* Commercial / Industrial	EPA Sensitive Land Use – Soils [†]	ASC NEPM Commercial / Industrial (D) Clayey Soils			
			0 to <1 m	1 to <2 m	2 to <4 m	4 m+
Metals and Metalloids						
			Health-based Investigation Levels (HILs)			
Arsenic (total)	500	-	3000			
Cadmium	100	-	900			
Chromium (III)	600,000	-	-			
Copper	5000	-	240,000			
Lead	1500	-	1500			
Mercury (inorganic)	75	-	730			
Nickel	3000	-	6000			
Zinc	35,000	-	400,000			
Organics						
PAHs (total)	100	-	4000			
Benzo(a)pyrene	5	-	-			
Phenol	42,500	-	240,000			
Carcinogenic PAHs (as BaP TEQ)	-	-	40			
Petroleum Hydrocarbon Components						
			Health Screening Levels (HSLs) for Vapour Intrusion			
Naphthalene	-	-	NL	NL	NL	NL
TPH C ₆ -C ₉	-	65	-	-	-	-
TPH C ₁₀ -C ₄₀	-	1000	-	-	-	-
F1	-	-	310	480	NL	NL
F2	-	-	NL	NL	NL	NL
Monocyclic Aromatic Hydrocarbons						
Benzene	-	1	4	6	9	20
Toluene	-	130§	NL	NL	NL	NL
Ethylbenzene	-	50¶	NL	NL	NL	NL
Total xylenes	-	25¶	NL	NL	NL	NL

Notes: *

EPA (2006)

† EPA (1994)

§ Human health and ecologically based protection level for toluene. The threshold concentration presented here is the Netherlands intervention value for the protection of terrestrial organisms. Other considerations such as odours and the protection of groundwater may require a lower remediation criterion.

¶ Human health based protection level for ethylbenzene or total xylenes as shown. The threshold concentration presented here is the Netherlands intervention value. Other considerations such as odours and the protection of groundwater may require a lower remediation criterion.

F1 To obtain F1 subtract the sum of BTEX concentrations from the C₆-C₁₀ fraction.F2 To obtain F2 subtract naphthalene from the >C₁₀-C₁₆ fraction.

NL No Limit

2.10.2 Groundwater

The applicable investigation criteria for groundwater are those guideline levels set out in:

- Table 3.4.1 of the ANZECC (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, and
- Table 4 of the EPA's *Guidelines for Assessing Service Station Sites* (1994).

The criteria used by the Auditor to assess groundwater data presented in Coffey's reports are listed in Table 3.

Analyte	ANZECC Guidelines: Trigger values for the protection of 95% of species in freshwater	EPA Guideline: Protection of freshwater aquatic ecosystems
Arsenic (as III)	24	-
Arsenic (as V)	13	-
Cadmium	0.2	-
Copper	1.4	-
Lead	3.4	1 - 5
Mercury	0.6	-
Nickel	11	-
Zinc	8.0	-
Naphthalene	16	-
Benzo(a)pyrene	-	-
Total PAH	-	3
Phenol	320	50
Benzene	950	300
Toluene	-	300
Ethylbenzene	-	140
para-xylene	200	-
ortho-xylene	350	-
Total Xylene	-	380

With regard to TPH, benzo(a)pyrene, toluene, ethylbenzene and xylenes, in the first instance, the following criteria were adopted by Coffey:

TPH C ₆ -C ₉	–	40 µg/L
TPH C ₁₀ -C ₁₄	–	100 µg/L
TPH C ₁₅ -C ₂₈	–	200 µg/L
TPH C ₂₉ -C ₃₆	–	200 µg/L
Benzo(a)pyrene	–	0.1 µg/L
Toluene	–	180 µg/L
Ethylbenzene	–	80 µg/L
Xylenes	–	75 µg/L

Also, for benzene and phenol, Coffey occasionally utilised a lower criterion of 10 µg/L and 2 µg/L, respectively.

3.0 INVESTIGATION, DECOMMISSIONING, REMEDIATION AND VALIDATION

Between 2005 and 2012, the site was progressively investigated, decommissioned, remediated and validated, where remediation comprised the excavation and on-site landfarming of hydrocarbon contaminated soil and was conducted depending on the results of the associated validation sampling and accompanying investigation sampling.

The Auditor has reviewed the Coffey report and notes that much of the earlier investigation sampling and much of the earlier remediation and associated validation sampling was superseded by later work.

Because much of the earlier work has been superseded and because the primary purpose of this audit is to determine whether the site is now suitable for commercial / industrial use, the Auditor has focused his review and reporting on the later work conducted by Coffey, being the work upon which the suitability of the site for commercial / industrial use is dependant.

Sections below provide the Auditor's comments with regard to the work conducted at the site, comprising:

- Investigation sampling (soil, groundwater and vapour).
- Decommissioning of:
 - all known and encountered USTs and associated pipework, bowsers and appurtenances;
 - the ASTs and associated infrastructure; and
 - an in-ground hydraulic hoist.
- Demolition of the drum storage shed.
- Excavation and on-site landfarming of hydrocarbon contaminated soil (i.e. remediation).
- Validation of formed excavations.
- Validation of landfarmed soil prior to reinstatement.

3.1 Reporting

The Auditor received from Coffey a draft copy of the following report, for his review:

Site Remediation and Validation Report, Former Glenorie Service Station and Depot,
Site ID: 28863S, 912-914 Old Northern Road, Glenorie NSW, prepared by
Coffey Environments Pty Ltd, ref. ENAURHOD02051AA, dated 1 March 2013

The Auditor commenced his review of the report and identified some issues that required addressing by Coffey before he could complete his review.

In particular, he considered that he could not effectively follow:

- The work that had been completed within the fuel depot part of the site.
- The validation of the stockpiles.

The Auditor advised Coffey accordingly in a letter dated 3 June 2013, with additional advice being provided in an email dated 13 June 2013.

On 7 August 2013, the Auditor received from Coffey a copy of the following letter report:

Addendum to draft Site Remediation and Validation Report, Former Caltex Glenorie Service Station and Depot (Site ID: 28863S), 912-914 Old Northern Road, Glenorie NSW, prepared by Coffey Environments Pty Ltd, ref. ENAURHOD2051AA-L06b, dated 5 August 2013

Note: A copy of the addendum is provided in Appendix C.

Subsequently, in conjunction with the addendum letter report, the Auditor completed his review of the draft report.

Summary

The Auditor considers that the draft report does not contain as much detailed information as he would normally expect for such a report. Indeed, to some extent Coffey is aware of this issue, as indicated in Table 13.7 of the report and the comment that '*...documentation regarding the removal and disposal of the fuel-related infrastructure from the depot is lacking...*'. The Auditor also considers that the format of the report is overly complex, that it contains many inaccuracies, and that a large part of the report cannot be effectively followed.

However, the Auditor also considers that it is appropriate that the report remains in draft form because:

- Amending the report so that it accurately documents the work would require a disproportionate amount of effort by Coffey and the Auditor relative to any tangible benefit that may be gained from preparing such a report.

In any event, the Auditor considers it unlikely that the report can be finalised so that it accurately documents and readily describes all of the work that was undertaken.
- Simply finalising the report in its present form would imply a level of detail and accuracy that would not be appropriate.
- In conjunction with the addendum letter report, it is sufficient for the Auditor's needs given his knowledge of the work that was conducted, his findings following his review of the report and its underlying data, his long-term involvement with the project, and his understanding of the key issues.

The Auditor adds:

1. He has inspected the site on several occasions.
2. He is aware of the work that has been conducted since he was engaged. He is also aware of the work that was conducted before his engagement.
3. He is aware that Coffey maintained poor record keeping during at least the early stages of the project and that many personnel have worked on the project, and this is reflected in the draft report.

Note: The project was commenced by IT Environmental Pty Ltd (IT), which was subsequently acquired by Coffey. The Auditor considers IT to be included within the entity identified herein as Coffey.

3.2 Decommissioning Work

The Auditor considers it likely that all petroleum storage and delivery infrastructure associated with the site's former use as a service station and fuel depot have been removed. However, although the site has been extensively investigated and remediated, sections of pipework may remain within the ground and may be encountered during redevelopment work. Accordingly, the Auditor considers that when the site is redeveloped, it should be subject to the Construction Environmental Management Plan (CEMP) that he has prepared. See Section 5.1.1 for further discussion.

The Auditor also considers that overall, contamination of land beneath the decommissioned infrastructure has been adequately investigated and that where hydrocarbon contamination was identified, the contamination has been adequately remediated and the resulting excavation adequately validated.

See sections below for further discussion with regard to the investigation, remediation and validation work conducted by Coffey and others.

3.3 Demolition Work

The Auditor notes that the drum store has been demolished and that because hydrocarbon contamination was encountered, the land beneath it has been remediated.

See sections below for further discussion with regard to the investigation, remediation and validation work conducted by Coffey and others.

3.4 Investigation, Remediation and Validation

3.4.1 Former Forecourt Area of the Service Station

EX1 to EX5, EX6 and EX13

Initial investigation of the former forecourt area of the service station identified the presence of hydrocarbon contamination at six locations. The contamination was excavated and the resulting excavations identified as EX1 to EX5.

Subsequently, the five excavations and surrounding area were formed into one larger excavation, identified as EX6, resulting in the majority of the forecourt area being excavated.

Although samples were obtained from EX1 to EX5, they were rendered meaningless when the much larger and deeper excavation EX6 was formed. Accordingly, the Auditor has focussed his review on the adequacy of the validation of EX6.

With regard to EX6, the Auditor notes that:

- It covered the majority of the former forecourt and it included the area where the (three) USTs were located.
- Final validation samples indicate that the contamination has been adequately chased-out to the south, east and west.
- Hydrocarbon contamination remained along the northern face of EX6 and which could not be readily chased-out because of the presence of some utilities.

Coffey assessed the significance of the contamination and the presence of the utilities and subsequently slightly extended EX6 to the north with the extension being identified as EX13. However, all of the contamination could (still) not be chased-out, because of the utilities. Hydrocarbon contamination thus remains along the northern face of EX13 and this cannot be readily remediated.

The Auditor considers that EX6 was adequately validated to the south, east and west. With regard to the hydrocarbon contamination that remains along the northern face of EX13, see below for further discussion.

Northern Boundary

In October 2010, to assess whether contamination had migrated beyond the utilities, Coffey excavated four test pits within the narrow strip of land located immediately to the north of the utilities.

(Note: The northern boundary of the site is located only a few metres to the north of the utilities, thus Coffey could only assess the strip of land located between the utilities and the site's northern boundary.)

The investigation identified the presence of contamination within the strip of land and it also indicated that contamination had potentially migrated beyond the northern boundary of the site.

Additionally:

- In February 2011, Coffey conducted soil vapour sampling at two locations (SV4 and SV5). Significant concentrations of hydrocarbon compounds were reported for both samples.
- In October 2011, Coffey installed a further seven vapour monitoring probes (identified as SV6 to SV12) along the northern and western boundary of the site.
- In November 2011, Coffey obtained vapour samples from SV5, SV10 and SV12. Significant concentrations of hydrocarbon compounds were not reported.

Note: SV4 was unable to be located; SV6, SV7, SV9 and SV11 contained water, thus precluding sampling; and SV8 was blocked.

- Coffey conducted a Tier 1 risk assessment with respect to the hydrocarbon contamination that remained along the northern boundary of the site.

Coffey concluded that:

- The residual hydrocarbon contamination is unlikely to pose an unacceptable risk to users of the (commercial / industrial) site via direct contact.
- The residual hydrocarbon contamination is unlikely to pose an unacceptable inhalation risk to maintenance workers for both on-site and off-site work.
- The residual hydrocarbon contamination is unlikely to pose an unacceptable risk to maintenance workers via direct contact, for both on-site and off-site work.

The Auditor has reviewed the associated data and the risk assessment performed by Coffey. In particular, he has reviewed the data against the ASC NEPM criteria provided in Section 2.10.1 of this report. Notwithstanding the differing TRH carbon chain fractions from the TPH fractions that were reported by the laboratory, the Auditor considers that the ASC NEPM criteria were not exceeded.

The Auditor considers Coffey's conclusion that the residual hydrocarbon contamination that remains between the northern boundary of EX13 and the northern boundary of the site is unlikely to pose an unacceptable risk to users of the (commercial / industrial) site and to any maintenance workers that may conduct maintenance work on the utilities, to be viable, subject to the implementation of the CEMP that he has prepared.

With regard to contamination potentially migrating beyond EX13 and hence beyond the northern boundary of the site, see Section 3.4.2 for further discussion.

EX8 and EX9

The Auditor notes that during later investigations within areas of the forecourt that had not been excavated, hydrocarbon contamination was encountered at two, isolated, locations (TPI and TPM), and that TPM was addressed via excavation EX8 and that TPI was addressed via excavation EX9.

With regard to EX8 and EX9, the Auditor considers that the excavations were adequately validated.

EX12

The Auditor notes that excavation EX12 was formed following the removal of:

- Some vent lines that were observed by Coffey to remain in the ground.
- The identification by Coffey of some contamination originating from an above ground storage tank (AST) that had been removed several years earlier by others.

Validation samples indicated that the contamination had been adequately chased-out to the north, south and east. However, hydrocarbon contamination remained beneath a part of the eastern wall of the workshop and this could not be readily remediated because of the presence of the workshop.

With regard to the hydrocarbon contamination that remained beneath the workshop, Coffey conducted a Tier 1 risk assessment.

Coffey concluded that the:

- Residual hydrocarbon contamination is unlikely to pose an unacceptable inhalation risk to users of the (commercial / industrial) site.
- Residual hydrocarbon contamination is unlikely to pose an unacceptable risk to users of the (commercial / industrial) site via direct contact.
- Residual hydrocarbon contamination is unlikely to pose an unacceptable inhalation risk to maintenance workers at the site.
- Residual hydrocarbon contamination is unlikely to pose an unacceptable risk to maintenance workers at the site via direct contact.

The Auditor considers that EX12 was adequately validated to the north, south and east.

With regard to the hydrocarbon contamination that remains beneath the workshop, the Auditor has reviewed the associated data and the risk assessment performed by Coffey. In particular, he has reviewed the data against the ASC NEPM criteria provided in Section 2.10.1 of this report. Notwithstanding the differing TRH carbon chain fractions from the TPH fractions that were reported by the laboratory, the Auditor considers that the ASC NEPM criteria were not exceeded.

The Auditor considers Coffey's conclusion that the residual hydrocarbon contamination that remains beneath the workshop is unlikely to pose an unacceptable risk to users of the (commercial / industrial) site and to any maintenance workers, to be viable, subject to the implementation of the CEMP that he has prepared.

Summary

The Auditor notes that the USTs, AST, associated pipework, bowzers and appurtenances that were located within the former forecourt have been removed from the site.

With regard to the hydrocarbon contamination that remains between the northern boundary of EX13 and the northern boundary of the site and which cannot be readily remediated because of the presence of utilities, the Auditor considers Coffey's conclusion that the contamination is unlikely to pose an

unacceptable risk to users of the (commercial / industrial) site and to any maintenance workers that may conduct maintenance work on the utilities, to be viable, subject to the implementation of the CEMP that he has prepared.

With regard to the hydrocarbon contamination that remains beneath a part of the eastern wall of the workshop and which cannot be readily remediated because of the presence of the workshop, the Auditor considers Coffey's conclusion that the contamination is unlikely to pose an unacceptable risk to users of the (commercial / industrial) site and to any maintenance workers, to be viable, subject to the implementation of the CEMP that he has prepared.

The Auditor considers that, overall, the former forecourt has been adequately investigated and that where contamination was identified, where feasible, it has been adequately remediated and the resulting excavations adequately validated. (Note: Accordingly, the Auditor also considers that contamination of land beneath the decommissioned infrastructure has been adequately addressed.)

However, although the former forecourt has been extensively investigated and remediated, sections of pipework and, in particular, soil contaminated with hydrocarbons at concentrations exceeding the assessment criteria may remain within the ground with sporadic distribution and may be encountered during redevelopment work. Also, as stated above, hydrocarbon contamination is known to remain along the northern boundary of the site and beneath a part of the eastern wall of the workshop. Accordingly, the Auditor considers that when the site is redeveloped, it should be subject to the CEMP that he has prepared. See Section 5.1.1 for further discussion.

3.4.2 Beyond the Northern Boundary of the Site

The Auditor notes that Coffey investigated the (Council owned) land located immediately beyond the northern boundary of the site and encountered hydrocarbon contamination within soil bores SB32, SB33 and SB34.

The Auditor is aware that Council, NSW Roads and Maritime Services (RMS), 916 Old Northern Road, and the EPA have been duly notified of the presence of the contamination (in both soil and groundwater). Copies of Coffey's letters advising Council, RMS and 916 Old Northern Road are included within Appendix C of this report.

A copy of this Site Audit Report has also been forwarded to the EPA.

See Section 3.8.2 for further discussion.

3.4.3 Workshop

EX10

Initial investigation of the workshop identified the presence of hydrocarbon contamination of soil at one location (WSB4). The contamination was excavated and the resulting excavation identified as EX10. Subsequently, EX10 was extended in order to chase-out contamination.

With regard to EX10, the Auditor considers that the excavation was adequately validated.

Note: The Auditor discussed with Coffey an inconsistency between the location of WSB4 as illustrated by Coffey on Figure 16 and the location of EX10 as illustrated by Coffey on Figure 17. Coffey confirmed that WSB4 was remediated by EX10 and indicated that the illustrated location of EX10 was incorrect.

EX11

The in-ground hoist was removed and the resulting excavation identified as EX11. Subsequently, EX11 was extended in order to chase-out contamination.

With regard to EX11, the Auditor considers that, in conjunction with EX15 (see below for further discussion), the excavation was adequately validated.

EX14 and EX15

The Auditor notes that during later investigations within the workshop, hydrocarbon contamination of soil was encountered at two locations (SB43 and SB48) and that SB48 was addressed via excavation EX14 and that SB43 was addressed via excavation EX15.

With regard to EX14 and EX15, the Auditor considers that the excavations were adequately validated.

Notes:

- When SB48 was being remediated, a fragment of material that potentially contained asbestos was encountered. The fragment was removed and the surrounding area excavated (EX16).

Samples were obtained from the walls and base of the excavation and submitted to a laboratory for asbestos identification. No asbestos was observed.

The fragment was disposed off-site as asbestos waste.

- EX15 is better described as an extension of EX11.

Soil Vapour Sampling

The Auditor notes that soil vapour sampling was conducted at three locations (SV1, SV2 and SV3) beneath the floor of the workshop in order to supplement the soil and groundwater assessments.

Other than an elevated concentration of xylene (0.012 mg/m^3) and an elevated concentration of tetrachloroethene (0.26 mg/m^3) in sample SV1 and an elevated concentration of tetrachloroethene (0.22 mg/m^3) in sample SV2, the results were below the laboratory's limits of reporting.

The Auditor has reviewed the results against applicable criteria presented in the ASC NEPM.

For land being utilised for commercial / industrial purposes:

- For tetrachloroethene (PCE), the interim soil vapour health investigation level is 8 mg/m^3 (ref. Schedule B1, Table 1A(2)).
- For ground surface to less than 1.0 metre depth in clay, for xylenes, the soil vapour health screening level is 1200 mg/m^3 (ref. Schedule B1, Table 1A(5)).

The Auditor considers the reported concentrations not to be of concern, given the site's intended commercial / industrial use and that redevelopment of the site will be subject to a CEMP.

Note: When assessing the elevated tetrachloroethene concentrations, in the first instance, Coffey utilised the Region 9 Remediation Screening Levels (USEPA, May 2010) for industrial indoor air quality. For this site, the Auditor considers the Region 9 criteria not to be applicable. In any event, the Auditor notes that the industrial indoor air quality criterion for tetrachloroethene was revised by the USEPA in May 2012 to $47 \text{ } \mu\text{g/m}^3$ (0.047 mg/m^3) and that using an attenuation factor of 100, this equates to a soil vapour screening level of 4.7 mg/m^3 (versus the 0.21 mg/m^3 determined by Coffey), being greater than the concentrations reported for SV1 and SV2.

Summary

The Auditor notes that the in-ground hoist that was located within the workshop has been removed from the site.

The Auditor considers that, overall, the workshop has been adequately investigated and that where contamination was identified, it has been adequately remediated and the resulting excavations adequately validated. (*Note:* Accordingly, the Auditor also considers that contamination of land beneath the decommissioned hoist has been adequately addressed.)

However, although the workshop has been extensively investigated and remediated, hydrocarbons at concentrations exceeding the assessment criteria may remain within the ground with sporadic distribution and may be encountered during redevelopment work. Also, hydrocarbon contamination is known to remain beneath a part of the eastern wall of the workshop, as indicated in Section 3.4.1. Accordingly, the Auditor considers that when the site is redeveloped, it should be subject to the CEMP that he has prepared. See Section 5.1.1 for further discussion.

3.4.4 The Former Fuel Depot and Drum Store part of the Site

The Auditor notes that:

- The former fuel depot and drum store part of the site has been progressively investigated at approximately 120 locations via the use of test pits, soil bores and groundwater monitoring wells, and that the locations were spread across the entire area.

Furthermore, an additional eleven test pits (TP66 to TP76) were excavated by Coffey in response to the Auditor's comments dated 3 June 2013.

- Remedial work to remove identified hydrocarbon contamination was progressively undertaken between October 2006 and October 2011, and that the work resulted in thirteen excavations being formed. The excavations were identified as EX1a-USTs, EX1a-ASTs, EX2a, EX3a, EX4a, EX5a, EX7, EX17, EX18, EX19, EX20, EX21 and EX22. Further discussion with regard to each excavation is provided below.

Note: Some of the excavations resulted from chasing-out contamination that remained within a sidewall of an existing excavation (i.e. some of the excavations were an extension to an existing excavation rather than being a standalone excavation).

- Although most of the contamination that was identified during the initial investigations has been remediated, a few locations were not remediated because subsequent investigations provided no evidence of the contamination.

The locations are:

TP20 (2006) at 1.0 metre	-	1340 mg/kg of TPH C ₁₀ -C ₃₆
TP43 (2006) at 0.3 metre	-	1950 mg/kg of TPH C ₁₀ -C ₃₆
TP44 (2006) at 0.3 metre	-	1395 mg/kg of TPH C ₁₀ -C ₃₆
TP45 (2006) at 0.3 metre	-	2960 mg/kg of TPH C ₁₀ -C ₃₆
TP42 ² (2006) at 0.15 metre	-	1900 mg/kg of lead
TP64 (2009) at 0.1 metre	-	1170 mg/kg of TPH C ₁₀ -C ₃₆

² TP42 was located in close proximity to the workshop. However, for ease of reporting it has been discussed within this section rather than in Section 3.4.3.

The Auditor considers Coffey's decision – that remediation of the previously identified contamination was not required – to be justified, because:

- The concentrations only marginally exceeded the adopted criteria.
- At least some bioremediation of any significant hydrocarbon contamination that remained following the samples being obtained would be likely to have occurred since that time.
- Any remaining hydrocarbon contamination would be likely to fall within the $>C_{10}$ range and not contain a significant concentration of naphthalene. The ASC NEPM provides a 'No Limit' soil HSL for vapour intrusion (mg/kg) for F2 ($>C_{10} - C_{16}$ range minus naphthalene) at commercial / industrial sites.
- The overall extent of investigation, remediation and validation work that has been performed within the fuel depot part of the site.

Furthermore, supplementary investigation conducted by Coffey in response to the Auditor's comments dated 3 June 2013 identified:

- (i) No TPH contamination within the area where TP43, TP44 and TP45 had been excavated.
- (ii) No lead contamination within the area where TP42 had been excavated.
- The intended use of the site is commercial / industrial.
- Redevelopment of the site will be subject to a CEMP.
- Test pit sample TP Depo 09 (1010 mg/kg of TPH $C_{10}-C_{36}$) was not remediated because it only marginally exceeded the adopted criteria. The Auditor considers Coffey's decision to be justified, for previously indicated reasons.

EX1a-USTs

Coffey indicated that EX1a-USTs was formed in the south-eastern corner of the site and adjacent to where the three largest USTs (T11, T12, and T13) were located.

The Auditor has reviewed the data and information provided by Coffey with respect to EX1a-USTs and considers it to be incomplete, confusing, and inconsistent. However, he is satisfied that the three USTs that were located within the south-eastern corner of the site have been removed and that the final excavation has been adequately validated.

The Auditor's opinion is based on the following:

- Three validation samples (V48, V49 and V50) were obtained from the base and these had reported hydrocarbon concentrations below the adopted criteria.
- Two validation samples (V40 and V41) were obtained from the northern wall and these had reported hydrocarbon concentrations below the adopted criteria.
- Six validation samples (V1, V2, V3, V4, V42 and V43) were obtained from the eastern wall and these had reported hydrocarbon concentrations below the adopted criteria.
- Two validation samples (V46 and V47) were obtained from the southern wall and these had reported hydrocarbon concentrations below the adopted criteria.
- Although no validation samples were (apparently) obtained from the western wall, three test pits (TP-Depo-07, TP-Depo-08 and TP-Depo-09) were subsequently excavated to the west of the excavation, with one sample obtained from TP-Depo-07 and one sample obtained from TP-Depo-09 being submitted for analysis. No hydrocarbon contamination was reported for the sample obtained from TP-Depo-07, a minor exceedance of 1010 mg/kg of TPH $C_{10}-C_{36}$ was reported for the sample obtained from TP-Depo-09.

Note: Laboratory results were reported for two associated validation samples identified as V44 and V45; however, the locations from where the samples were obtained were not indicated by Coffey. It is possible that the samples were obtained from the western wall of the excavation. No hydrocarbon contamination was reported for the samples.

- Six testpits (TP-Depo-01 to TP-Depo-06) were subsequently excavated within the reinstated excavation, with two samples obtained from TP-Depo-02 and two samples obtained from TP-Depo-06 being submitted for analysis. No hydrocarbon contamination was reported.
- A groundwater monitoring well (MW9) was installed along the downgradient side of the excavation – albeit located within the reinstated excavation and screened within the backfill material – with no soil or groundwater hydrocarbon contamination being reported.
- Photographs of the excavation indicated the absence of hydrocarbon contamination within its base and walls.
- Field staff reported the absence of hydrocarbons within the base and walls of the excavation.
- The base of the excavation was at 7 metres below the ground surface. Accordingly, any undisturbed hydrocarbon contamination remaining within the footprint of the excavation would be present at a depth greater than 7 metres.
- The USTs were removed and the remedial work was conducted in 2006. At least some bioremediation of any significant hydrocarbon contamination that remained following the work would be likely to have occurred since that time.
- If any significant hydrocarbon contamination remains around the excavation, it would probably be sporadically distributed.
- Any remaining hydrocarbon contamination would be likely to fall within the $>C_{10}$ range and not contain a significant concentration of naphthalene. The ASC NEPM provides a 'No Limit' soil HSL for vapour intrusion (mg/kg) for F2 ($>C_{10} - C_{16}$ range minus naphthalene) at commercial / industrial sites.
- Groundwater issues are no longer of concern at the site; see Section 3.8.1 for further discussion.
- The intended commercial / industrial use of the site.
- Redevelopment of the site will be subject to a CEMP.

EX1a-ASTs

Coffey indicated that EX1a-ASTs was formed following the removal of the three ASTs (T8, T9, and T10) and associated infrastructure that were located within the eastern part of the fuel depot.

The Auditor has reviewed the data and information provided by Coffey with respect to EX1a-ASTs and considers it to be incomplete, confusing, and inconsistent. He also notes that the actual locations from where validation samples V17 to V24 and V28 to V39 were obtained are not known (whilst acknowledging Coffey's comment that the samples were likely to have been evenly distributed throughout the base and walls of the associated excavation) and that incomplete information was available with regard to the depth of the excavation. However, he is satisfied that the three ASTs and associated infrastructure that were located within the eastern part of the depot have been removed and that the final excavation has been adequately validated.

The Auditor's opinion is based on the following:

- In total, thirty-nine validation samples (V5 to V39 and V99 to V102) were obtained from across the final excavation and these had reported hydrocarbon concentrations below the adopted criteria.
- In 2006, testpits TP44, TP45 and TP46 were excavated to the north-west of EX1a-ASTs. No contamination was reported for the sample obtained from TP46. With regard to TP44 and TP45, see the introduction to this section (Section 3.4.4) above for further discussion.
- In 2010:
 - One testpit (TP11) was excavated within the reinstated excavation with two samples being submitted for analysis. No hydrocarbon contamination was reported.
 - Seven testpits (TP-Depo-07, TP-Depo-08, TP-Depo-09, TP-Depo-10, TP12, TP13, and TP14) were excavated around the excavation, with a total of nine samples being submitted for analysis. A minor exceedance of 1010 mg/kg of TPH C₁₀-C₃₆ was reported for the sample obtained from TP-Depo-09, no hydrocarbon contamination was reported for the other eight samples.
- A groundwater monitoring well (MW7) had been located to the north-west of the ASTs. No significant soil or groundwater hydrocarbon contamination was reported.
- The ASTs were removed and the remedial work was conducted in 2006. At least some bioremediation of any significant hydrocarbon contamination that remained following the work would be likely to have occurred since that time.
- If any significant hydrocarbon contamination remains around the excavation, it would probably be sporadically distributed.
- Any remaining hydrocarbon contamination would be likely to fall within the >C₁₀ range and not contain a significant concentration of naphthalene. The ASC NEPM provides a 'No Limit' soil HSL for vapour intrusion (mg/kg) for F2 (>C₁₀ – C₁₆ range minus naphthalene) at commercial / industrial sites.
- Groundwater issues are no longer of concern at the site; see Section 3.8.1 for further discussion.
- The intended commercial / industrial use of the site.
- Redevelopment of the site will be subject to a CEMP.

EX2a and EX7

Coffey indicated that:

- EX2a was initially formed following the removal of a UST (T4) and associated infrastructure that was located along the western boundary of the site.
- EX2a was extended as necessary in order to chase-out contamination.
- EX7 was formed following the removal of the drum store and continued on from EX2a. (Note: EX7 could be described as an extension of EX2a.)
- EX7 was extended as necessary in order to chase-out contamination.
- Because of the manner in which the two excavations were formed and extended, a potential exists (albeit unlikely) for a small area located at the centre of the final extent of the combined excavations not to have been remediated. The location is represented by

validation samples V233 (1340 mg/kg of TPH C₁₀-C₃₆) and V234 (1410 mg/kg of TPH C₁₀-C₃₆).

- Hydrocarbon contamination that had previously been identified in TP19 (2006), TP21 (2006), TP22 (2006), TP55 (2009), TP56 (2009), TP57 (2009), and TP59 (2009) was remediated as part of the work.

The Auditor has reviewed the data and information provided by Coffey with respect to EX2a and EX7.

The Auditor is satisfied that:

- The UST and associated infrastructure that was located along the western boundary of the site has been removed.
- The drum store has been appropriately demolished.
- Contamination that had previously been identified in TP19, TP21, TP22, TP55, TP56, TP57, and TP59 has been remediated.
- Any remaining contamination represented by validation samples V233 and V234 is not a significant issue of concern.
- The final extent of combined excavations EX2a and EX7 has been adequately validated.

The Auditor's opinion is based on the following:

- Other than V233 and V234, identified contamination was chased-out by Coffey.
- V233 and V234 are not considered to be of concern because:
 - The concentrations only marginally exceeded the adopted criteria.
 - At least some bioremediation of any significant hydrocarbon contamination that remained following the samples being obtained in 2008 is likely to have occurred since that time.
- An adequate number of validation samples were obtained from across the base and walls of the final combined excavation and these had reported hydrocarbon concentrations below the adopted criteria.
- If any significant hydrocarbon contamination remains around the excavation, it would probably be sporadically distributed.
- Any remaining hydrocarbon contamination would be likely to fall within the >C₁₀ range and not contain a significant concentration of naphthalene. The ASC NEPM provides a 'No Limit' soil HSL for vapour intrusion (mg/kg) for F2 (>C₁₀ – C₁₆ range minus naphthalene) at commercial / industrial sites.
- Groundwater issues are no longer of concern at the site; see Section 3.8.1 for further discussion.
- The intended commercial / industrial use of the site.
- Redevelopment of the site will be subject to a CEMP.

See Section 3.5 for further discussion with regard to the reinstatement of EX2a.

EX3a, EX4a, EX21 and EX22

Coffey indicated that:

- EX3a was initially formed in order to remediate contamination that had been indicated to be present within TP3 (2006). *Note:* Upon subsequent review by Coffey, it was observed that contamination was not present within TP3.

Validation samples were obtained from the base (V89 and V90), the northern wall (V93), the eastern wall (V91), and the southern wall (V92). A minor exceedance of 2370 mg/kg of TPH C₁₀-C₃₆ was reported for V91, no hydrocarbon contamination was reported for the other four samples.

Subsequently, the contamination identified within the eastern wall was chased-out, resulting in the excavation extending to the eastern boundary of the site.

Note: In 2011, being after EX3a had been reinstated, Coffey formed EX21 along the eastern boundary of the site in order to verify that the contamination had been appropriately chased-out. No contamination was identified.

- EX4a was initially formed in order to remediate contamination that had been identified within TP4 (2006). The excavation was located immediately to the west of EX3a.

Eight validation samples obtained from the excavation were submitted for analysis. A minor exceedance of 2850 mg/kg of TPH C₁₀-C₃₆ was reported for a sample (V115) obtained from the southern wall, no hydrocarbon contamination was reported for the other seven samples.

Subsequently, the excavation was extended to the south and re-validated. Contamination was identified in the south-western corner (V138) and along the southern wall (V145).

V138	-	1120 mg/kg of TPH C ₁₀ -C ₃₆
V145	-	2750 mg/kg of TPH C ₁₀ -C ₃₆

In 2011, being after EX4a had been reinstated, Coffey formed EX22 in order to remediate V138 and V145 and obtained six validation samples. No hydrocarbon contamination was reported.

Note: In response to Auditor comments, Coffey confirmed that EX22 encompassed V138 and V145, and that any discrepancies between locations was due to inaccurate field notes.

The Auditor is satisfied that:

- Contamination that had previously been identified in TP4 (2006) has been remediated.
- The final extent of combined excavations EX3a, EX4a, EX21 and EX22 has been adequately validated.

The Auditor's opinion is based on the following:

- All identified contamination was chased-out by Coffey.

Note: Should V138 and/or V145 not have been remediated, neither would be considered to be of concern because:

- The concentrations only marginally exceeded the adopted criteria.
- At least some bioremediation of any significant hydrocarbon contamination that remained following the samples being obtained in 2008 would be likely to have occurred since that time.

- An adequate number of validation samples were obtained from across the base and walls of the final combined excavation and these had reported hydrocarbon concentrations below the adopted criteria.
- If any significant hydrocarbon contamination remains around the excavation, it would probably be sporadically distributed.
- Any remaining hydrocarbon contamination would be likely to fall within the $>C_{10}$ range and not contain a significant concentration of naphthalene. The ASC NEPM provides a 'No Limit' soil HSL for vapour intrusion (mg/kg) for F2 ($>C_{10} - C_{16}$ range minus naphthalene) at commercial / industrial sites.
- Groundwater issues are no longer of concern at the site; see Section 3.8.1 for further discussion.
- The intended commercial / industrial use of the site.
- Redevelopment of the site will be subject to a CEMP.

EX5a and EX18, overlapping with EX19 and EX20

Coffey indicated that:

- EX5a was initially formed (in 2007) in order to remediate contamination that had been identified within TP23 (2006).

Ten validation samples obtained from the excavation were submitted for analysis. No hydrocarbon contamination was reported for eight of the samples, minor exceedances were reported for samples V45 and V49, which had been obtained from the southern wall.

V45	-	1430 mg/kg of TPH $C_{10}-C_{36}$
V49	-	1425 mg/kg of TPH $C_{10}-C_{36}$

In 2008, the walls of the excavation were 'shaved' – which resulted in the removal of V45 and V49 – and the excavation resampled. In total, 34 validation samples were obtained from the base and walls and submitted for analysis. The following exceedances were reported:

V88	-	2620 mg/kg of TPH $C_{10}-C_{36}$	-	northern wall
V94	-	1190 mg/kg of TPH $C_{10}-C_{36}$	-	northern wall
V106	-	2140 mg/kg of TPH $C_{10}-C_{36}$	-	southern wall
V121	-	1040 mg/kg of TPH $C_{10}-C_{36}$	-	western wall

Subsequently,

- V88 and V94 were remediated by EX18, as described below.
 - V106 was addressed by EX20, as described further below.
 - V121 was addressed by EX19, as described further below.
- EX18 was located to the north of EX5a and was initially formed in order to remediate contamination that had been identified within TP64 (2011) and TP65 (2011). Seven validation samples obtained from the excavation were submitted for analysis. No hydrocarbon contamination was reported.

Subsequently, the excavation was extended to the south in order to remediate TP37 (2010) and abovementioned V88 and V94. Six validation samples obtained from the excavation were submitted for analysis. No hydrocarbon contamination was reported.

Notes:

1. In response to Auditor comments, Coffey confirmed that EX18 encompassed V88 and V94, and that any discrepancies between locations was due to inaccurate field notes
2. QA/QC sample QC237 reported a marginal exceedance of 1120 mg/kg of TPH C₁₀-C₃₆ whilst the primary sample (V696) reported a concentration of 540 mg/kg and a triplicate sample (QC237A) reported a concentration of 850 mg/kg. Coffey reviewed the data and concluded that the QA/QC exceedance was not of concern. The Auditor has also reviewed the data and considers Coffey's conclusion to be appropriate.
3. Hydrocarbon contamination that had previously been identified in SB12/MW12 (2008) was also remediated by EX18.

The Auditor is satisfied that:

- Contamination that had previously been identified in TP23 (2006), SB12/MW12 (2008), TP37 (2010), TP64 (2011), and TP65 (2011) has been remediated.
- The final extent of combined excavations EX5a, EX18 and EX19 and EX20 has been adequately validated.

The Auditor's opinion is based on the following:

- All identified contamination was likely chased-out by Coffey.
Note: Should V88 and V94 not have been remediated by EX18, V106 not have been remediated by EX20, and V121 not have been remediated by EX19, none of the (four) exceedances would be considered to be of concern because:
 - The concentrations only marginally exceeded the adopted criteria.
 - At least some bioremediation of any significant hydrocarbon contamination that remained following the samples being obtained in 2008 would be likely to have occurred since that time.
- An adequate number of validation samples were obtained from across the base and walls of the final combined excavation (comprising EX5a, EX18 and EX19 and EX20) and these had reported hydrocarbon concentrations below the adopted criteria.
- If any significant hydrocarbon contamination remains around the excavation, it would probably be sporadically distributed.
- Any remaining hydrocarbon contamination would be likely to fall within the >C₁₀ range and not contain a significant concentration of naphthalene. The ASC NEPM provides a 'No Limit' soil HSL for vapour intrusion (mg/kg) for F2 (>C₁₀ – C₁₆ range minus naphthalene) at commercial / industrial sites.
- Groundwater issues are no longer of concern at the site; see Section 3.8.1 for further discussion.
- The intended commercial / industrial use of the site.
- Redevelopment of the site will be subject to a CEMP.

EX17

Coffey indicated that:

- EX17 was formed in order to remediate contamination that had been identified within TP42 (2010) and TP43 (2010).
 - TP42 - 1730 mg/kg of TPH C₁₀-C₃₆
 - TP43 - 3225 mg/kg of TPH C₁₀-C₃₆
- Validation samples were obtained from the base (V664, V670, and V673), the northern wall (V662, V665, V668, V674, and V675), the eastern wall (V672), the southern wall (V666 and V669), and the western wall (V663). No hydrocarbon contamination was reported.

Note: In response to Auditor comments, Coffey confirmed that EX17 encompassed TP42 and TP43, and indicated that any discrepancies between locations was due to inaccurate field notes.

The Auditor is satisfied that:

- Contamination that had previously been identified in TP42 (2010) and TP43 (2010) is no longer of concern.
- EX17 has been adequately validated.

The Auditor's opinion is based on the following:

- Should TP42 and/or TP43 not have been remediated by EX17, neither would be considered to be of concern because:
 - The concentrations only marginally exceeded the adopted criteria.
 - At least some bioremediation of any significant hydrocarbon contamination that remained following the samples being obtained in 2010 would be likely to have occurred since that time.
 - Likely, at least TP43 would have been remediated by EX18, which was located approximately 5 metres to the south-west of EX17.
- An adequate number of validation samples were obtained from across the base and walls of the excavation and these had reported hydrocarbon concentrations below the adopted criteria.
- If any significant hydrocarbon contamination remains around the excavation, it would probably be sporadically distributed.
- Any remaining hydrocarbon contamination would be likely to fall within the >C₁₀ range and not contain a significant concentration of naphthalene. The ASC NEPM provides a 'No Limit' soil HSL for vapour intrusion (mg/kg) for F2 (>C₁₀ – C₁₆ range minus naphthalene) at commercial / industrial sites.
- Groundwater issues are no longer of concern at the site; see Section 3.8.1 for further discussion.
- The intended commercial / industrial use of the site.
- Redevelopment of the site will be subject to a CEMP.

EX19

Coffey indicated that:

- EX19 was formed in order to remediate contamination that had been identified within TP51 (2011) and validation sample V121 (associated with EX5a).

TP51 - 1415 mg/kg of TPH C₁₀-C₃₆

V121 - 1040 mg/kg of TPH C₁₀-C₃₆

- Validation samples were obtained from the base (V710), the northern wall (V708), the eastern wall (V711), the southern wall (V707), and the western wall (V709). No hydrocarbon contamination was reported.

Notes:

1. In response to Auditor comments, Coffey confirmed that EX19 encompassed V121.
2. EX19 could loosely be described as an extension of EX5a, which had been located less than 2 metres to the east.

The Auditor is satisfied that:

- Contamination that had previously been identified in TP51 and V121 is no longer of concern.
- EX19 has been adequately validated.

The Auditor's opinion is based on the following:

- Should TP51 and/or V121 not have been remediated by EX19, neither would be considered to be of concern because:
 - The concentrations only marginally exceeded the adopted criteria.
 - At least some bioremediation of any significant hydrocarbon contamination that remained following V121 being obtained in 2008 would be likely to have occurred since that time.
 - At least some bioremediation of any significant hydrocarbon contamination that remained following TP51 being obtained in 2011 would be likely to have occurred since that time.
 - Probably, TP51 and V121 were remediated by EX19.
- An adequate number of validation samples were obtained from across the base and walls of the excavation and these had reported hydrocarbon concentrations below the adopted criteria.
- If any significant hydrocarbon contamination remains around the excavation, it would probably be sporadically distributed.
- Any remaining hydrocarbon contamination would be likely to fall within the >C₁₀ range and not contain a significant concentration of naphthalene. The ASC NEPM provides a 'No Limit' soil HSL for vapour intrusion (mg/kg) for F2 (>C₁₀ – C₁₆ range minus naphthalene) at commercial / industrial sites.
- Groundwater issues are no longer of concern at the site; see Section 3.8.1 for further discussion.
- The intended commercial / industrial use of the site.
- Redevelopment of the site will be subject to a CEMP.

EX20

Coffey indicated that:

- EX20 was formed in order to remediate contamination that had been identified within validation sample V106 (associated with EX5a).

V106 - 2140 mg/kg of TPH C₁₀-C₃₆

- Validation samples were obtained from the base (V721), the eastern wall (V718), the southern wall (V719), and the western wall (V720). No hydrocarbon contamination was reported.

Note: EX20 could be described as an extension of EX5a, which had been located immediately to the north.

The Auditor is satisfied that:

- Contamination that had previously been identified in V106 is no longer of concern.
- EX20 has been adequately validated.

The Auditor's opinion is based on the following:

- Should V106 not have been remediated by EX20, it would not be considered to be of concern because:
 - The concentration only marginally exceeded the adopted criteria.
 - At least some bioremediation of any significant hydrocarbon contamination that remained following V106 being obtained in 2008 would be likely to have occurred since that time.
 - Probably, V106 was remediated by EX20.
- An adequate number of validation samples were obtained from across the base and walls of the excavation and these had reported hydrocarbon concentrations below the adopted criteria.
- If any significant hydrocarbon contamination remains around the excavation, it would probably be sporadically distributed.
- Any remaining hydrocarbon contamination would be likely to fall within the >C₁₀ range and not contain a significant concentration of naphthalene. The ASC NEPM provides a 'No Limit' soil HSL for vapour intrusion (mg/kg) for F2 (>C₁₀ – C₁₆ range minus naphthalene) at commercial / industrial sites.
- Groundwater issues are no longer of concern at the site; see Section 3.8.1 for further discussion.
- The intended commercial / industrial use of the site.
- Redevelopment of the site will be subject to a CEMP.

Summary

The Auditor notes that the USTs, ASTs, associated pipework, and appurtenances that were located within the former fuel depot have been removed from the site. The Auditor also notes that the former drum store has been demolished.

Although the Auditor considers that some of the data and information provided by Coffey is incomplete, confusing and inconsistent, overall, he considers that the former fuel depot and drum store part of the site has been adequately investigated and that where contamination was identified, it has been adequately remediated and the resulting excavations adequately validated. (*Note: Accordingly, the Auditor also considers that contamination of land beneath the decommissioned infrastructure has been adequately addressed.*)

However, although the former fuel depot and drum store part of the site has been extensively investigated and remediated, sections of pipework and, in particular, soil contaminated with hydrocarbons at concentrations exceeding the assessment criteria may remain within the ground with sporadic distribution and may be encountered during redevelopment work. Hydrocarbon odour emanating from any soil that is excavated, may also be present. Accordingly, the Auditor considers that when the site is redeveloped, it should be subject to the CEMP that he has prepared.

See Section 5.1.1 for further discussion.

3.4.5 The Residential Property

The Auditor notes that:

- The residential part of the site has been progressively investigated at approximately thirty-five locations via the use of test pits, soil bores and groundwater monitoring wells, and that the locations were spread across the entire area.
- During investigations, 2100 mg/kg of lead was detected in a QA/QC sample obtained from TP35. However, the contamination was not remediated because subsequent investigations provided no further evidence of the contamination.

The Auditor considers Coffey's decision – that remediation of the previously identified contamination was not required – to be justified, because:

- The concentration only marginally exceeded the adopted criteria.
- Supplementary investigation conducted by Coffey in response to the Auditor's comments dated 3 June 2013 identified no lead contamination within the area where TP35 had been excavated.
- The intended use of the site is commercial / industrial.
- Redevelopment of the site will be subject to a CEMP.

3.5 Landfarming and Validation of Excavated Soils

Excluding the validation of soil used to reinstate excavation EX2a and stockpile SP6a (see below for further discussion), and four stockpiles that were disposed off-site (see Section 3.6), the Auditor notes that excavated contaminated soil was stockpiled on the site and landfarmed until successfully validated as being suitable for re-use on the site. Following successful validation, which was generally based on sampling carried out at the rate of at least one sample per 25 m³ of soil, the soil was backfilled into an open excavation.

The Auditor has reviewed the validation sampling conducted and considers that, from an environmental perspective, the landfarmed soil was suitable for re-use on the site given the site's intended commercial / industrial use and that redevelopment of the site will be subject to the CEMP that he has prepared. (Note: A few TPH results marginally exceeded the adopted criteria; however, the Auditor considered the exceedances not to be of concern.) See Section 5.1.1 for further discussion.

EX2a

EX2a was mistakenly backfilled with landfarmed soil that had not been validated. To address this issue, Coffey excavated eight test pits (identified as TPA to TPH) within the EX2a footprint and obtained nine samples for laboratory analysis. No exceedances of the adopted assessment criteria were reported by the laboratory. The Auditor notes that EX2a had a volume of approximately 225 m³ and that nine samples equates to a sampling density of one sample per 25 m³ of soil.

The Auditor has reviewed the validation sampling conducted and considers that, from an environmental perspective, the soil used to reinstate EX2a was suitable for re-use on the site given the site's intended commercial / industrial use and that redevelopment of the site will be subject to the CEMP that he has prepared. See Section 5.1.1 for further discussion.

Stockpile SP6a

The Auditor noted that the following (final) validation samples exceeded the adopted criteria:

S78	-	1033 mg/kg TPH C ₁₀ -C ₃₆
S91	-	11,300 mg/kg TPH C ₁₀ -C ₃₆
S97	-	5681 mg/kg TPH C ₁₀ -C ₃₆
S112	-	79 mg/kg TPH C ₆ -C ₉ and 10,800 mg/kg TPH C ₁₀ -C ₃₆
S113	-	2109 mg/kg TPH C ₁₀ -C ₃₆
S124	-	1027 mg/kg TPH C ₁₀ -C ₃₆
S126	-	1135 mg/kg TPH C ₁₀ -C ₃₆

Note: The fate of SP6a was unclear.

Coffey reviewed the data and concluded that, if SP6a was reused on-site as was likely:

- Any residual hydrocarbon contamination is unlikely to pose an unacceptable inhalation risk to users of the (commercial / industrial) site.
- Any residual hydrocarbon contamination is unlikely to pose an unacceptable risk to users of the (commercial / industrial) site via direct contact.
- Any residual hydrocarbon contamination is unlikely to pose an unacceptable inhalation risk to maintenance workers at the site.
- Any residual hydrocarbon contamination is unlikely to pose an unacceptable risk to maintenance workers at the site via direct contact.

Coffey documented its review in the following letter:

Stockpile SP6a – Former Glenorie Service Station and Depot (Site ID: 28863S), 912-914 Old Northern Road, Glenorie NSW, prepared by Coffey Environments Pty Ltd, ref. ENAURHOD2051AA-L07 Rev.1, dated 3 October 2013

The Auditor has reviewed the associated data and the risk assessment performed by Coffey. In particular, he has reviewed the data against the ASC NEPM criteria provided in Section 2.10.1 of this report. Notwithstanding the differing TRH carbon chain fractions from the TPH fractions that were reported by the laboratory, the Auditor considers that the ASC NEPM criteria were not exceeded.

The Auditor considers Coffey's conclusion that any residual hydrocarbon contamination associated with SP6a is unlikely to pose an unacceptable risk to users of the (commercial / industrial) site and to any maintenance workers, to be viable, subject to the implementation of the CEMP that he has prepared.

3.5.1 Stockpile Footprints and Associated Runoff Areas

Contaminated Soil Placed onto Concrete or HDPE Sheeting

The Auditor notes that in most cases, the soil to be landfarmed had been placed either onto a concrete slab (associated with the former service station and workshop) or onto HDPE sheeting and that because of this, validation of the stockpile footprints and associated runoff areas was not specifically performed by Coffey.

The Auditor considers Coffey's decision – not to specifically investigate the footprints and associated runoff areas of the stockpiles placed onto concrete or HDPE – to be justified, given the following.

- The site's intended commercial / industrial use.
- Redevelopment of the site will be subject to a CEMP.
- The stockpiles were placed onto a low-permeability surface.
- The stockpiles were bunded to minimise runoff.
- No hydrocarbon contamination that was not subsequently remediated, was identified during 2010 and 2011 supplementary investigations that were conducted across the site during / following landfarming activities.

Contaminated Soil Placed Directly onto the Ground Surface

In a few instances, contaminated soil was placed directly onto the ground surface. These areas were incidentally investigated as part of the abovementioned 2010 and 2011 supplementary investigations.

The Auditor considers that the footprints of the stockpiles placed directly onto the ground surface have been adequately assessed, given the site's intended commercial / industrial use, that redevelopment of the site will be subject to a CEMP, and the findings of the 2010 and 2011 supplementary investigations.

3.6 Off-site disposal of Contaminated Soils

The Auditor understands that four stockpiles, identified as SP8, SP33, SP35 and SP47, were transported to an appropriately licensed landfill facility for disposal.

With regard to the associated transport and disposal dockets, Coffey advised the Auditor that they were 'no longer available'.

3.7 Imported Fill Material

The Auditor notes that VENM was imported onto the site for the purpose of backfilling some of the excavations. The Auditor considers that the material was (environmentally) suitable for use on the site.

The Auditor also notes that sand was brought onto the site and used to stabilise the excavation that was located adjacent to the site's northern boundary and the utilities, and that the sand was not assessed by Coffey because it was considered to be a manufactured construction material. The Auditor considers this decision by Coffey to be justified.

3.8 Summary of Groundwater Investigations

3.8.1 On-site

Between April 2005 and November 2011, Coffey installed the following groundwater monitoring wells across the site. Significant exceedances of the adopted criteria were reported for MW1, MW4 and MW5.

Identification	Location	Purpose
MW1	Service Station	Assessment
MW2	Service Station	Assessment
MW3	Service Station	Assessment
MW4	Service Station	Assessment
MW5	Service Station	Assessment
MW20	NW corner of the service station / site	Assessment
MW21	Northern boundary of the service station / site	Assessment
MW22	NE corner of service station / site	Assessment
MW23	SE corner of the service station	Assessment
MW24	Southern boundary of the service station	Assessment
MW25	SW corner of the service station	Assessment
MW26	Western boundary of the service station / site	Assessment
MW-Wshop	Southern end of the workshop	Assessment
-----	-----	-----
MW6	Fuel Depot	Assessment
MW7	Fuel Depot	Assessment
MW8	Fuel Depot	Assessment
MW9	Fuel Depot	Assessment
MW10	Fuel Depot	Assessment
MW11	Fuel Depot	Assessment
MW12	Fuel Depot	Assessment
MW29	Fuel Depot	Assessment
MW30	Southern boundary of the fuel depot / site	Assessment
MW31	Southern boundary of the fuel depot / site	Assessment

The Auditor notes that the wells were variably monitored between 2008 and 2012 and that for the wells that remained intact following remedial work, the analytical results at the time of their last round of sampling were as follows.

Identification	Last Monitored	Results
MW1	Destroyed during the work.	-
MW2	Destroyed during the work.	-
MW3	Destroyed during the work.	-
MW4	Destroyed during the work.	-
MW5	Destroyed during the work.	-
MW20	August 2012	See Note 1
MW21	November 2010	TPH, BTEX, PAH < LOR
MW22	November 2010	TPH, BTEX, PAH < LOR
MW23	November 2010	TPH, BTEX, PAH < LOR
MW24	November 2010	TPH, BTEX, PAH < LOR
MW25	May 2012	TPH, BTEX, PAH < LOR and/or criterion
MW26	August 2012	See Note 2
MW-Wshop	May 2012	TPH, BTEX, PAH < LOR and/or criterion
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MW6	Destroyed during the work.	-
MW7	Destroyed during the work.	-
MW8	Destroyed during the work.	-
MW9	November 2010	TPH, BTEX, PAH < LOR
MW10	November 2010	TPH, BTEX, PAH < LOR
MW11	November 2010	TPH, BTEX, PAH < LOR
MW12	Destroyed during the work.	-
MW29	November 2010	TPH, BTEX, PAH < LOR
MW30	May 2012	TPH, BTEX, PAH < LOR and/or criterion
MW31	November 2010	TPH, BTEX, PAH < LOR

Note 1

MW20 reported the following (marginal) exceedances of the adopted criteria:

- 190 µg/L of TPH C₆-C₉,
- 160 µg/L TPH C₁₀-C₃₆,
- 60 µg/L benzene.

Other concentrations were less than the respective LOR.

Note 2

MW26 reported the following (marginal) exceedances of the adopted criteria:

- 90 µg/L of TPH C₆-C₉,
- 26 µg/L benzene.

Other concentrations were less than the respective LOR.

Coffey concluded that:

- The marginal TPH and benzene exceedances reported for MW20 and MW26 were not of concern.
- Elevated manganese, copper, nickel and zinc concentrations that were reported for some of the wells were most likely attributable to natural sources.

The Auditor has reviewed the groundwater data. He considers that groundwater issues are no longer of concern at this site, given the following.

- The hydrogeology of the site.
- The decommissioning / remediation / validation work that has been completed.
- The analytical results for the last round of groundwater sampling conducted.

Note: See Section 3.8.2 – Footnote⁴ for further discussion.

- The slightly elevated concentration of metals noted by Coffey may be attributable to natural sources or to regional anthropogenic sources.
- The remedial work and the last round of groundwater sampling adequately addressing the significant exceedances that were reported for MW1, MW4 and MW5 during the initial investigation of the site.
- Redevelopment of the site will be subject to a CEMP.

3.8.2 Off-site

Because hydrocarbons had migrated from the site via groundwater, in order to assess the extent of the contaminant plume and to conduct and observe remedial activities (comprising the extraction of hydrocarbons), Coffey progressively installed the following groundwater wells.

Identification	Location	Purpose
MW13	Old Northern Road	Assessment
MW14	Old Northern Road	Assessment
MW15	Old Northern Road	Assessment
MW27	Old Northern Road	Assessment
MW16	Whites Road	Assessment
MW17	Whites Road	Assessment
MW18	Whites Road	Assessment
MW19	Whites Road	Assessment
MW28	Whites Road	Assessment
-----	-----	-----
MW32	Whites Road	Extraction well
MW33	Whites Road	Extraction well
MW34	Whites Road	Extraction well
MW35	Whites Road	Extraction well
-----	-----	-----
MW16a	Whites Road	Observation well
MW28a	Whites Road	Observation well
MW37*	NW corner of the site	Observation well
MW38*	NW corner of the site	Observation well
SB32-OW*	NW corner of the site	Observation well

Note: * MW37, MW38, and SB32-OW were installed along the boundary of the site, at the corner of Old Northern Road and Whites Road.

The Auditor notes that Coffey conducted three multi-phase vacuum extraction (MPVE) events with the aim of removing Light Non-Aqueous Phase Liquid (LNAPL) that had been measured within some of the wells.

On completion of the work Coffey considered that LNAPL present beneath Whites Road had been removed to the extent practicable. Coffey considered the 32 mm of LNAPL that remained in MW34 and the dissolved phase hydrocarbon concentrations that remained in MW16, MW27 and MW28 had stabilised and were expected to reduce into the future through natural attenuation, and that the residual contamination did not pose an unacceptable risk to human health and/or environmental receptors.

Unless specifically engaged to do so, the Auditor does not normally become involved with off-site groundwater issues beyond him ensuring that the EPA has been duly notified³ of any significant concentrations of contaminants that have migrated from the site he has been engaged to audit.

However, for this site the associated Deed of Release between the site owner and the tenant indicates that the appointed Auditor should review any impacts to off-site groundwater. Accordingly, the Auditor has reviewed the off-site work conducted by Coffey.

From his review of the remediation and validation report, the Auditor noted that at the time (i.e. October 2012) Coffey considered that groundwater had been remediated to the extent practicable, the following impacts remained.

MW34	-	32 mm of LNAPL
MW16	-	49,000 µg/L of TPH C ₆ -C ₉ , 14,800 µg/L of TPH C ₁₀ -C ₃₆ , 14,000 µg/L of benzene, 13,000 µg/L of toluene, 1800 µg/L of ethylbenzene, 10,000 µg/L of total xylenes.
MW27	-	1300 µg/L of TPH C ₆ -C ₉ , 2400 µg/L of TPH C ₁₀ -C ₃₆ , 18 µg/L of benzene, 29 µg/L of total xylenes.
MW28	-	32,000 µg/L of TPH C ₆ -C ₉ , 4400 µg/L of TPH C ₁₀ -C ₃₆ , 10,000 µg/L of benzene, 7500 µg/L of toluene, 1300 µg/L of ethylbenzene, 6,300 µg/L of total xylenes.

The Auditor considered the LNAPL that was present in MW34 and the dissolved phase hydrocarbons that were present in MW16 and MW28 to be of particular concern.

³ The Auditor is aware that the EPA has been duly notified. The Auditor is also aware that the EPA has been kept apprised of the progress of the off-site groundwater investigation and remediation, and that the EPA has requested a copy of this Site Audit Report to assist it in its assessment of off-site residual hydrocarbon impacts to groundwater.

Accordingly, on 15 April 2013, being six months since Coffey conducted its last groundwater monitoring event in October 2012, the Auditor requested that Coffey re-sample MW16, MW27, MW28 and MW34 and measure field parameters to assist in the verification of Coffey's statement that *'residual hydrocarbon impact to groundwater is considered to be stable and is expected to reduce into the future through natural attenuation...'*

On 28 May 2013, the Auditor received from Coffey a copy of a letter report (dated that day) outlining the findings of the (April 2013) Groundwater Monitoring Event (GME) that it had conducted in response to the Auditor's request.

The Auditor reviewed the report and noted⁴ that:

- LNAPL was present in MW16 and MW28A.
- A hydrocarbon sheen was present in MW16A, MW34 and MW35.
- Exceedances of the criteria were reported for MW27 and MW28.

Based on the results of the April 2013 GME, the Auditor considers that off-site groundwater contamination has been remediated to the extent that it does not present a risk to human health or the environment, and is unlikely to present such a risk in the future.

However, because, in particular, LNAPL remains present, he also considers that an off-site groundwater monitoring program should be instigated with the aim, in the first instance, of confirming that residual hydrocarbon impact to groundwater has stabilised and, in due course, of confirming that:

- Residual hydrocarbon impact to groundwater reduces over the next few years through natural attenuation and that ground conditions will enable it to continue to do so into the future.
- Unacceptable risks to human health and/or environmental receptors remain unlikely to arise following cessation of the groundwater monitoring program. *Note:* Potential receptors are illustrated on Figure 4.

See Section 6 for further discussion.

⁴ The Auditor also noted that, during the April 2013 GME, Coffey sampled on-site wells MW20 and MW26 and that the results were as follows:

MW20	-	20 µg/L of TPH C ₆ -C ₉	MW26	-	<20 µg/L of TPH C ₆ -C ₉
		100 µg/L of TPH C ₁₀ -C ₃₆			<100 µg/L of TPH C ₁₀ -C ₃₆
		2 µg/L of benzene			<1 µg/L of benzene
		1 µg/L of toluene			<1 µg/L of toluene
		2 µg/L of ethylbenzene			<1 µg/L of ethylbenzene
		<3 µg/L of total xylenes			<3 µg/L of total xylenes

3.9 Summary of Soil Investigations

The Auditor has reviewed the investigations conducted by Coffey.

With regard to exceedances of the adopted criteria (i.e. contaminated soil was identified at a specified location), the Auditor noted the following.

Identification	Comment
MW1 (2005)	Remediated by excavation EX4 / EX5
MW2 (2005)	Remediated by excavation EX1
MW3 (2005)	Remediated by excavation EX3
MW4 (2005)	Remediated by excavation EX5
SB1 (2005)	Remediated by excavation EX2
SB2 (2005)	Remediated by excavation EX6
TP4 (2006)	Remediated by excavation EX4A
TP19 (2006)	Remediated by excavation EX7 ⁽¹⁾
TP20 (2006)	Not remediated: No further action deemed necessary by Coffey because further investigation in the vicinity of the TP20 reported hydrocarbon concentrations below the adopted criteria
TP21 (2006)	Remediated by excavation EX2A
TP22 (2006)	Remediated by excavation EX2A
TP23 (2006)	Remediated by excavation EX5A
TP35 (2006)	Not remediated: see Section 3.4.5 for further discussion
TP42 (2006)	Not remediated: see Section 3.4.4 for further discussion
TP43 (2006)	Not remediated: see Section 3.4.4 for further discussion
TP44 (2006)	Not remediated: see Section 3.4.4 for further discussion
TP45 (2006)	Not remediated: see Section 3.4.4 for further discussion
SB12/MW12 (2008)	Remediated by excavation EX18
TP55 (2009)	Remediated by excavation EX7
TP56 (2009)	Remediated by excavation EX7
TP57 (2009)	Remediated by excavation EX7
TP59 (2009)	Remediated by excavation EX7
TP64 (2009)	Not remediated: No further action deemed necessary by Coffey because further investigation in the vicinity of the TP64 reported hydrocarbon concentrations below the adopted criteria
WSB4 (2009)	Remediated by excavation EX10
TPI (2009)	Remediated by excavation EX9
TPM (2009)	Remediated by excavation EX8
TP Depo 09 (2010)	Not remediated: No further action deemed necessary because the exceedance was marginal.
TP37 (2010)	Remediated by excavation EX18
TP42 (2010)	Remediated by excavation EX17
TP43 (2010)	Remediated by excavation EX17
TP51 (2011)	Remediated by excavation EX19
TP64 (2011)	Remediated by excavation EX18 ⁽²⁾
TP65 (2011)	Remediated by excavation EX18
SB43 (2011)	Remediated by excavation EX15
SB48 (2011)	Remediated by excavation EX14

Notes:

- (1) Coffey reported a slight discrepancy between the location of EX7 and the location of TP19. The Auditor has reviewed the associated data and considers this not to be an issue of concern because:
- The discrepancy was likely due to field measurement error and that TP19 was (likely) remediated, as indicated by Coffey in its addendum report.
 - Nearby (EX7) validation samples V483, V488, V529, and V530 reported hydrocarbon concentrations below the adopted criteria.
 - Nearby investigation testpits TP60 (2009), TP63 (2009), TP61 (2011), and TP74 (2013) reported hydrocarbon concentrations below the adopted criteria.
 - The identified contamination (2160 mg/kg and 2660 mg/kg of TPH C₁₀-C₃₆) only marginally exceeded the adopted criteria.
 - Any remaining hydrocarbon contamination would be likely to fall within the >C₁₀ range and not contain a significant concentration of naphthalene. The ASC NEPM provides a 'No Limit' soil HSL for vapour intrusion (mg/kg) for F2 (>C₁₀ – C₁₆ range minus naphthalene) at commercial / industrial sites.
 - The intended use of the site is commercial / industrial.
 - Redevelopment of the site will be subject to a CEMP.
- (2) Coffey reported a slight discrepancy between the location of EX18 and the location of TP64 (2011). The Auditor has reviewed the associated data and considers this not to be an issue of concern because:
- The discrepancy was likely due to field measurement error and that TP64 was (likely) remediated, as indicated by Coffey in its addendum report.
 - Nearby (EX18) validation sample V693 reported hydrocarbon concentrations below the adopted criteria.
 - Nearby investigation testpits TP39 (2010) and TP55 (2011) reported hydrocarbon concentrations below the adopted criteria.
 - The identified contamination (1105 mg/kg of TPH C₁₀-C₃₆) only marginally exceeded the adopted criteria.
 - Any remaining hydrocarbon contamination would be likely to fall within the >C₁₀ range and not contain a significant concentration of naphthalene. The ASC NEPM provides a 'No Limit' soil HSL for vapour intrusion (mg/kg) for F2 (>C₁₀ – C₁₆ range minus naphthalene) at commercial / industrial sites.
 - The intended use of the site is commercial / industrial.
 - Redevelopment of the site will be subject to a CEMP.

The Auditor has also reviewed the data with respect to where an elevated PID reading (i.e. >100ppm) was reported and/or a significant hydrocarbon odour was observed in the **absence** of an exceedance of the adopted criteria.

The locations are as follows.

Identification	Comment
SB20/MW20 (2010)	Located in the north-western corner of the service station, along the western boundary.
TPJ (2009)	Located along the northern edge of excavation EX12.
TPK, TPL, TPN, TPO (2009)	Located between the workshop and excavation EX6.
WSB1 (2009)	Located within the workshop adjacent to excavation EX11.
SB44 (2011)	Located within the workshop adjacent to excavation EX15.
TP47 (2006)	Located adjacent to the workshop.
TP54 (2009)	Located along the northern edge of excavation EX7.
TP59 (2011)	Located to the east of the former drum store.
TP63 (2011)	Located within excavation EX18.
TP6 (2006)	Located to the east of excavation EX18 and in the vicinity of TP20 where contaminated soil was identified but not remediated.
TP11 (2010)	Located within excavation EX1A.

The Auditor is satisfied that:

- Where an elevated PID reading (i.e. >100ppm) was reported and/or a significant hydrocarbon odour was observed in the **absence** of an exceedance of the adopted criteria, either the issue was remediated due to other reasons or the observation did not indicate the presence of significant hydrocarbon contamination that has not been remediated.
- Hydrocarbon odour is no longer an issue of concern given:
 - The overall extent of investigation, remediation and validation work conducted.
 - That following reinstatement, significant hydrocarbon odour was not observed by the Auditor and Coffey.
 - The intended commercial / industrial use of the site.
 - That redevelopment of the site will be subject to a CEMP.

Summary

The Auditor is satisfied that:

- The site has been adequately investigated and that where contamination was identified and/or suspected, generally, it has been adequately addressed.
- Hydrocarbon odour is no longer an issue of concern.

However, although the site has been extensively investigated and remediated, sections of pipework and, in particular, hydrocarbons at concentrations exceeding the assessment criteria may remain within the ground with sporadic distribution and may be encountered during redevelopment work.

Also, hydrocarbon contamination is known to remain along the northern boundary of the site and beneath a part of the eastern wall of the workshop, and at least a few more hotspots probably remain. Hydrocarbon odour emanating from any soil that is excavated, may also be present. Accordingly, the Auditor considers that when the site is redeveloped, it should be subject to the CEMP that he has prepared.

See Section 5.1.1 for further discussion.

3.10 Data Evaluation

3.10.1 Data Quality Objectives

By 2008 (i.e. within its RAP for the service station part of the site) Coffey had appropriately adopted the data quality objectives (DQOs) process endorsed by the NSW EPA.

A copy of the Auditor's assessment of Coffey's use of DQOs is provided in Appendix D of this Site Audit Report.

3.10.2 QA/QC Evaluation

The field and laboratory QA/QC measures presented by Coffey in its remediation and validation report have been reviewed and, overall, are considered to substantially comply with the relevant guidelines and to be adequate to ensure the integrity of the data set that has been used to assess the site.

The QA/QC criteria list examined in this review included:

- Precision
- Accuracy
- Sensitivity
- Representativeness
- Comparability
- Completeness
- Holding times
- Blanks

Data Quality Indicators

The data quality indicators (DQIs) presented by Coffey have also been reviewed.

The Auditor considers that appropriate DQIs were used adequately to assess field procedures and analytical results. The DQIs are considered to substantially comply with the relevant guidelines and to be adequate to ensure the integrity of the data set that has been used to assess the site.

A copy of the Auditor's assessment of QA/QC measures presented by Coffey, including Coffey's use of DQIs, is (also) provided within Appendix D of this Site Audit Report.

3.10.3 Summary

The Auditor considers that the overall quality of Coffey's data and their presentation are of an adequate standard to support the conclusions he has reached.

4.0 AUDITOR'S ASSESSMENT OF THE ADEQUACY OF PROVIDED INFORMATION AND REPORTING STANDARD

The Auditor assessed the completeness and adequacy of the information provided by Coffey within its associated report and he assessed the adequacy of the reporting standard.

Draft Site Remediation and Validation Report, Former Glenorie Service Station and Depot, Site ID: 28366S, 912-914 Old Northern Road, Glenorie NSW, prepared by Coffey Environments Australia Pty Ltd (ref. ENAURHOD02051AA-R01c), dated 1 March 2013

The Auditor considered that the report did not contain as much detailed information as he would normally have expected for such a report, its format was overly complex, it contained many inaccuracies, and a large part of it could not be effectively followed.

Coffey largely addressed the Auditor's comments within the following addendum:

Addendum to draft Site Remediation and Validation Report, Former Caltex Glenorie Service Station and Depot (Site ID: 28863S), 912-914 Old Northern Road, Glenorie NSW, prepared by Coffey Environments Pty Ltd, ref. ENAURHOD2051AA-L06b, dated 5 August 2013

When the draft report and addendum are considered collectively, the following information was provided and is considered by the Auditor to be adequate for the purposes of his audit:

1. site identification, location and description
2. review of site history, including potential contaminant sources / contaminating activities
3. outline of actual or potential contamination
4. identification of primary contaminant groups of concern
5. description of soil stratigraphy and hydrogeology
6. discussion of investigation, remediation, and validation work
7. quality assurance and quality control plan
8. discussion of analytical results
9. discussion of environmental quality criteria
10. assessment of risks to human health and structures
11. discussion of evidence of migration of contaminants
12. discussion of groundwater issues
13. assessment of aesthetic issues
14. recommendation for short-term management of residual contamination
15. recommendation for long-term management of residual contamination
16. recommendations and conclusions

The following information was not provided, but was not considered relevant by the Auditor given the reported historical uses of the site, the finding of the investigations undertaken, and the remediation and validation work completed:

17. assessment of chemical mixtures

However, the Auditor also considers that it is appropriate that the Site Remediation and Validation Report remains in *draft* form because:

- Amending the report so that it accurately documents the work would require a disproportionate amount of effort by Coffey and the Auditor relative to any tangible benefit that may be gained from preparing such a report.

In any event, the Auditor considers it unlikely that the report can be finalised so that it accurately documents and readily describes all of the work that was undertaken.

- Simply finalising the report in its present form would imply a level of detail and accuracy that would not be appropriate.
- In conjunction with the addendum, it is sufficient for the Auditor's needs given his knowledge of the work that was conducted, his findings following his review of the report and its underlying data, his long-term involvement with the project, and his understanding of the key issues.

Summary

When the draft report and addendum are considered collectively, overall, the information provided and the standard of reporting are considered to be adequate for the purposes of this audit and satisfy the requirements of the EPA's *Guidelines for Consultants Reporting on Contaminated Sites* (2011) and the EPA's *Guidelines for the NSW Site Auditor Scheme*, 2nd edition (2006).

5.0 AUDITOR'S ASSESSMENT OF SITE CONDITION

5.1 Short-Term and Long-Term Management

5.1.1 Short-Term / Construction Management

Although the site has been extensively investigated and remediated, sections of pipework and, in particular, mid-range hydrocarbons at concentrations exceeding the assessment criteria may remain within the ground with sporadic distribution and may be encountered during redevelopment work. Also, hydrocarbon contamination is known to remain along the northern boundary of the site and beneath a part of the eastern wall of the workshop, and at least a few more hotspots probably remain. Hydrocarbon odour emanating from any soil that is excavated, may also be present.

Accordingly, the Auditor considers that when the site is redeveloped, it should be subject to the following CEMP that he has prepared – and he has placed a condition upon the SAS requiring that when the site is redeveloped, it is managed in accordance with the plan.

Construction Environmental Management Plan, 912-914 Old Northern Road, Glenorie, prepared by C. M. Jewell & Associates Pty Ltd (ref. J1257.35R-rev0), dated October 2013

A copy of the plan is provided as Appendix E of this report.

5.1.2 Long-term Management

The Auditor considers that long-term management of the site is not required.

5.2 Risks to Human Health

Subject to the implementation of the specified CEMP, it is the Auditor's opinion that there are no remaining identifiable unmanaged contamination risks to human health at the site.

This conclusion is based on the Auditor's review of the investigation, decommissioning, remediation and validation work that has been completed, whilst considering the intended commercial / industrial use of the site.

5.3 Risk to Structures

Subject to the implementation of the specified CEMP, it is the Auditor's opinion that there are no remaining identifiable unmanaged contamination risks to structures at the site.

This conclusion is based on the Auditor's review of the investigation, decommissioning, remediation and validation work that has been completed.

5.4 Risk to the Environment

Subject to the implementation of the specified CEMP, it is the Auditor's opinion that there are no remaining identifiable unmanaged contamination risks to the environment at the site.

This conclusion is based on the Auditor's review of the investigation, decommissioning, remediation and validation work that has been completed, whilst considering the intended commercial / industrial use of the site.

5.5 Groundwater Issues

It is the Auditor's opinion that whilst groundwater issues associated with this site remain, these are unlikely to be associated with unacceptable human health or environmental risks.

This conclusion is based on the Auditor's review of the investigation, decommissioning, remediation and validation work that has been completed. See Section 6 for further discussion.

5.6 Regulatory Compliance

The Auditor considers that remediation was generally conducted in accordance with the relevant regulations and legislation, but notes the following:

- Coffey reported that four stockpiles, identified as SP8, SP33, SP35 and SP47, were transported to an appropriately licensed landfill facility for disposal. However, the associated transport and disposal dockets were '*no longer available*'.
- On 16 September 2009, whilst landfarming hydrocarbon contaminated soil, surface water that had accumulated within a bunded area broke through a section of the bund and discharged onto Old Northern Road.

5.7 Visual Aesthetic Issues and Odour

Subject to the implementation of the specified CEMP, it is the Auditor's opinion that visual aesthetic issues and odours are no longer issues of concern on this site.

This conclusion is based on the Auditor's review of the investigation, decommissioning, remediation and validation work that has been completed, whilst considering the intended commercial / industrial use of the site.

5.8 Chemical Mixtures

It is the Auditor's opinion that the potential for chemical mixtures to be present is no longer an issue of concern on this site.

This conclusion is based on the Auditor's review of the reported historical uses of the site, the finding of the investigations undertaken, and the remediation and validation work completed:

5.9 Potential Contaminant Migration

The Auditor notes that Coffey investigated the (Council owned) land located immediately beyond the northern boundary of the site and encountered hydrocarbon contamination within soil bores SB32, SB33 and SB34. During the course of the work it also became evident that hydrocarbons had migrated from the site via groundwater.

Accordingly, Caltex duly notified the EPA under Section 60 of the Act.

When the site was notified to the EPA, one of the issues that was recognised was the presence of LNAPL within off-site groundwater monitoring wells. As at the date of this report, LNAPL remains and the Auditor considers that an off-site groundwater monitoring program is required; see Section 6 for further discussion.

The Auditor is aware that Council, RMS, 916 Old Northern Road, and the EPA have been duly notified of the presence of the contamination (in both soil and groundwater). Copies of Coffey's letters advising Council, RMS and 916 Old Northern Road are included within Appendix C of this report.

Copies of this Site Audit Report have also been forwarded to the EPA and Council.

6.0 AUDITOR'S ASSESSMENT OF OFF-SITE GROUNDWATER CONDITION

As indicated in Section 3.8.2, based on the results of Coffey's April 2013 GME, the Auditor considers that off-site groundwater contamination has been remediated to the extent that it does not present a risk to human health or the environment, and is unlikely to present such a risk in the future.

However, because, in particular, LNAPL remains present, he also considers that an off-site groundwater monitoring program should be instigated with the aim, in the first instance, of confirming that residual hydrocarbon impact to groundwater has stabilised and, in due course, of confirming that:

- Residual hydrocarbon impact to groundwater reduces over the next few years through natural attenuation and that ground conditions will enable it to continue to do so into the future.
- Unacceptable risks to human health and/or environmental receptors remain unlikely to arise following cessation of the groundwater monitoring program. *Note:* Potential receptors are illustrated on Figure 4.

Accordingly, Coffey prepared the following plan:

Off-site Groundwater Monitoring Program, Former Caltex Service Station, 912-914 Old Northern Road, Glenorie, NSW, ref. ENAURHOD02051AA, dated 29 July 2013

The Auditor has reviewed and approved the plan and a copy of it is included as Appendix F.

The Auditor has also discussed the plan with the EPA and copies of the associated communications are included within Appendix C.

Notes:

- The existence of the plan is noted on the SAS, but because it relates solely to off-site issues, implementation is not a condition of the SAS.
- Before the audit had been finalised Coffey had conducted the August 2013 GME. The Auditor has reviewed the associated report (a copy of which is provided within Appendix C) and he has noted its contents. In particular, he noted that LNAPL was only measured in MW16 (10 mm) and MW28A (2 mm).

7.0 AUDITOR'S CONCLUSIONS AND RECOMMENDATIONS

7.1 Adequacy of Investigation, Remediation and Validation Works

The Auditor considers that, except as noted in this report:

1. The site has been investigated to the required standard and that where contamination was identified, generally, the contamination has been remediated and validated to the required standard.
2. Where exceptions to point 1. above have been identified, no adverse consequences are likely to arise.
3. The investigation, remediation, and validation works were carried out in an adequate and appropriate manner, and generally in accordance with relevant guidelines.
4. All significant issues identified by the Auditor have been adequately addressed.

See below for further discussion.

7.2 Suitability of Site for Intended Use

The Auditor considers that analysis of validation samples demonstrates that most measured concentrations of contaminants of concern remaining on the site are within the criteria applicable to its intended commercial / industrial use.

However, although the site has been extensively investigated and remediated, sections of pipework and, in particular, mid-range hydrocarbons at concentrations exceeding the assessment criteria may remain within the ground with sporadic distribution and may be encountered during redevelopment work.

Also, hydrocarbon contamination is known to remain along the northern boundary of the site and beneath a part of the eastern wall of the workshop, and at least a few more hotspots probably remain. Hydrocarbon odour emanating from any soil that is excavated, may also be present.

The Auditor has thus concluded that it is appropriate to issue a Site Audit Statement certifying that, in his opinion, the site is suitable for commercial / industrial use subject to compliance with the following Construction Environmental Management Plan (CEMP) that he has prepared:

Construction Environmental Management Plan, 912-914 Old Northern Road, Glenorie,
prepared by C. M. Jewell & Associates Pty Ltd (ref. J1257.35R-rev0), dated October 2013

The CEMP is required in order to assist in managing residual impacts that are encountered during redevelopment works. A copy of the plan is provided as Appendix E.

The Auditor understands that, having obtained appropriate Council consent, the owners of the land (i.e. Mr and Mrs Shore) intend to construct a new service station within the front part of the site (constituting 'commercial / industrial' use for the purposes of this audit) and to redevelop the rear part of the site for a yet to be determined 'commercial / industrial' use.

Subject to the implementation of the specified CEMP during any further development of the site, the Auditor is satisfied that the site has been made suitable for any commercial / industrial uses permitted under its current zoning, being RU6 – Transition, as per Council's Local Environmental Plan 2012 (LEP), but notes that a number of more sensitive uses are permitted (with consent) under that zoning.

The Auditor also considers that the site is suitable for its previous use, being a service station and fuel depot, but understands from Council that the consent for the use of the rear part of the site as a fuel depot has lapsed.

Note: Schedule 1 (Additional Permitted Uses) of the LEP permits the front part of the site to be used for the purposes of a service station (with consent).

The Auditor repeats the following statements from earlier sections of this report:

Coffey investigated the (Council owned) land located immediately beyond the northern boundary of the site and encountered hydrocarbon contamination within soil bores SB32, SB33 and SB34. During the course of the work it also became evident that hydrocarbons had migrated from the site via groundwater.

Accordingly, Caltex duly notified the EPA under Section 60 of the Act.

When the site was notified to the EPA, one of the issues that was recognised was the presence of Light Non-Aqueous Phase Liquid (LNAPL) within off-site groundwater monitoring wells. As at the date of this report, LNAPL remains.

The Auditor considers that off-site groundwater contamination has been remediated to the extent that it does not present a risk to human health or the environment, and is unlikely to present such a risk in the future.

However, because, in particular, LNAPL remains present, he also considers that an off-site groundwater monitoring program should be instigated with the aim, in the first instance, of confirming that residual hydrocarbon impact to groundwater has stabilised and, in due course, of confirming that:

- Residual hydrocarbon impact to groundwater reduces over the next few years through natural attenuation and that ground conditions will enable it to continue to do so into the future.
- Unacceptable risks to human health and/or environmental receptors remain unlikely to arise following cessation of the groundwater monitoring program. *Note:* Potential receptors are illustrated on Figure 4.

Accordingly, Coffey prepared the following plan:

Off-site Groundwater Monitoring Program, Former Caltex Service Station, 912-914 Old Northern Road, Glenorie, NSW, ref. ENAURHOD02051AA, dated 29 July 2013

The Auditor has reviewed and approved the plan, a copy of it is included as Appendix F, and its existence is noted on the Site Audit Statement (SAS) – but because it relates solely to off-site issues, implementation is not a condition of the SAS. . }

The Auditor is aware that Council, RMS, 916 Old Northern Road, and the EPA have been duly notified of the presence of the contamination (in both soil and groundwater).

7.3 Recommendations

The Auditor recommends that:

- Any soil that is removed from the site should first be appropriately classified in accordance with the waste classification guidelines applicable at that time.
- Any soil (including topsoil) that is imported to the site should first be assessed as being suitable for use on the site.
- Given local contamination issues and because groundwater quality may change with time, groundwater should not be extracted for any purpose without appropriate assessment.

REFERENCES

- ANZECC 2000, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, National Water Quality Management Strategy, Australian and New Zealand Environment and Conservation Council/Agriculture and Resource Management Council of Australia and New Zealand.
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- NSW EPA 1995, *Sampling Design Guidelines*, NSW Environment Protection Authority, Sydney NSW.
- NSW EPA 1994, *Guidelines for Assessing Service Station Sites*, NSW Environment Protection Authority, Sydney NSW.
- Taylor, R. and A. J. Langley 1996, *Exposure scenarios and exposure settings*, in Markey, BR, & Langley, AJ (eds), *Proceedings of the third national workshop on the health risk assessment and management of contaminated sites*, pp. 111-136, South Australian Health Commission.



Important Information About Your Site Audit Report

These notes will help you to interpret your Site Audit report. They are based on guidelines prepared by the NSW Department of Environment and Conservation.

Introduction to the NSW Site Auditor Scheme

Objectives

The objectives of the NSW Site Auditor Scheme are to:

- ensure that public health and the environment are protected through proper management of contaminated sites, particularly during changes of land use
- improve access to technical advice on contaminated sites for planning authorities and the community by establishing a pool of accredited site auditors
- provide greater certainty for planning authorities and the community through the independent review by those auditors of contaminated site assessment and remediation reports, and reports that validate the successful completion of the assessment of remediation.

Background

In Australia, the use of accredited auditors to review work conducted by contaminated site consultants was first introduced in Victoria in 1989 through the Victorian EPA's Environmental Auditor (Contaminated Land) Scheme.

In 1998, NSW commenced its own Site Auditor Scheme under the *Contaminated Land Management Act 1997* (CLM Act). The scheme is administered by the Department of Environment and Conservation (DEC).

The CLM Act empowers DEC to accredit individuals as site auditors and to establish guidelines for them.

The Contaminated Land Management Regulation 1998 (CLM Regulation) specifies some of the procedural requirements of the scheme.

Site Audits in Relation to Contaminated Sites

Site auditors review the work of contaminated site consultants. The CLM Act calls these reviews 'site audits' and defines a site audit as an independent review:

- a) that relates to investigation or remediation carried out (whether under the CLM Act or otherwise) in respect of the actual or possible contamination of land, and

- b) that is conducted for the purpose of determining any one or more of the following matters:

- i) the nature and extent of any contamination of the land
- ii) the nature and extent of the investigation or remediation
- iii) whether the land is suitable for any specified use or range of uses
- iv) what investigation or remediation remains necessary before land is suitable for any specified use or range of uses
- v) the suitability and appropriateness of a plan of remediation, a long-term management plan, a voluntary investigation proposal or a remediation proposal.

The main products of a site audit are a 'site audit statement' and a 'site audit report'.

A **site audit statement** is the written opinion by a site auditor, on a DEC-approved form, of the essential findings of a site audit. It includes, where relevant, the auditor's conclusions regarding the suitability of the site for its current or proposed use.

Before issuing a site audit statement, the site auditor must prepare and finalise a detailed **site audit report**. The report must be clearly expressed and presented and contain the information, discussion and rationale that support the conclusions in the site audit statement.

In some circumstances a site audit is required by law. These audits are known as '**statutory site audits**' and may be carried out only by site auditors accredited under the CLM Act. A statutory site audit is one that is required by:

- a regulatory instrument issued under the CLM Act, including DEC agreements issued by DEC to voluntary proposals.
- the *Environmental Planning and Assessment Act 1979*, including an environmental planning instrument or development consent condition
- any other Act.

Role of Site Auditors

The services of a site auditor can be used by anyone who needs an independent and authoritative review of information relating to possible or actual contamination of a site. The review may involve independent expert technical advice or 'sign-off' of contaminated site assessment, remediation or

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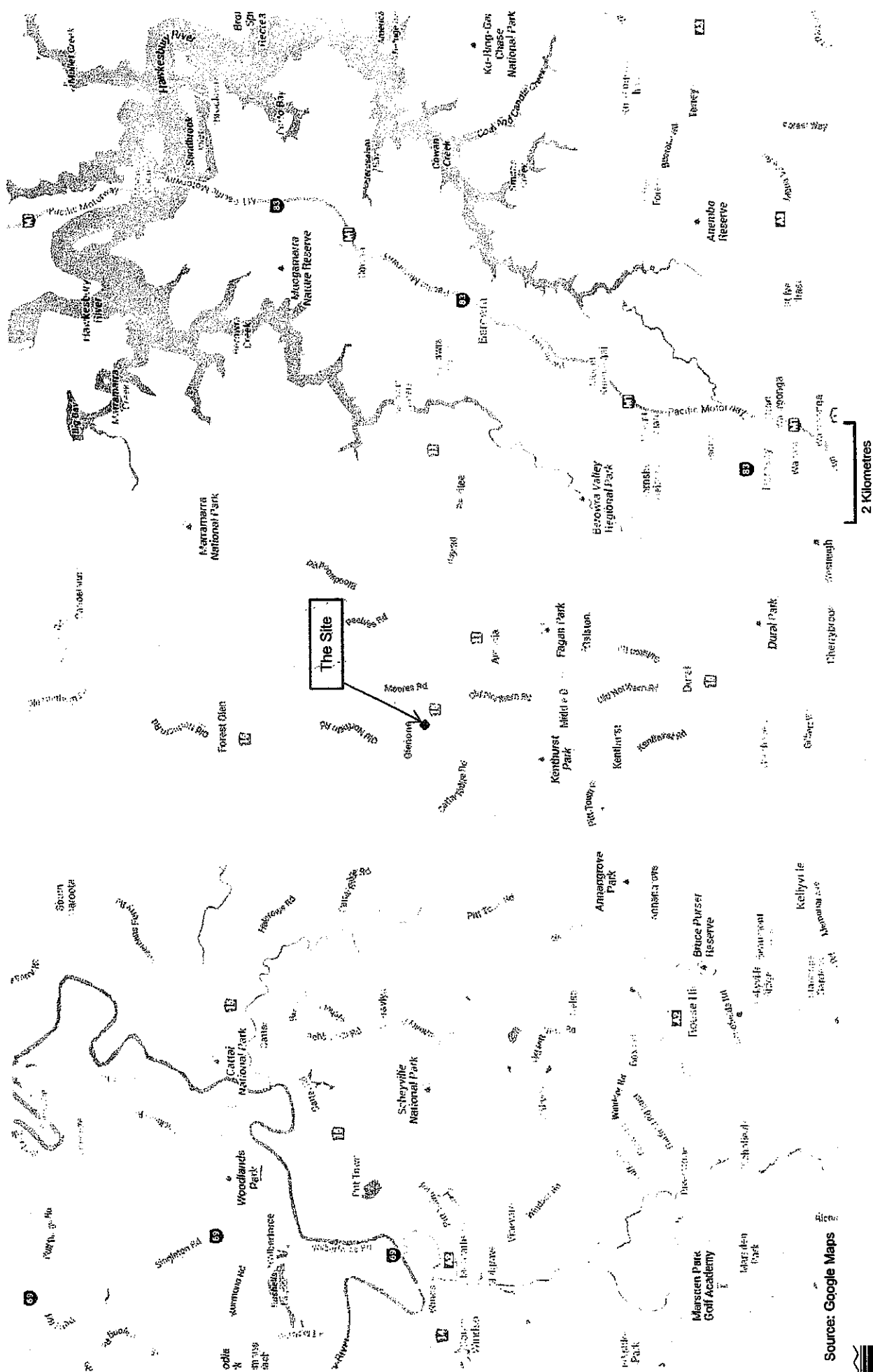


Figure 1

Site Location

Report Ref: J1257.29R

Rev: 0

Rev Date: 18-Sep-13

Author: NAA

Source: Google Maps



Source: SIX NSW

200 metres

The Site

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The Site

30 metres

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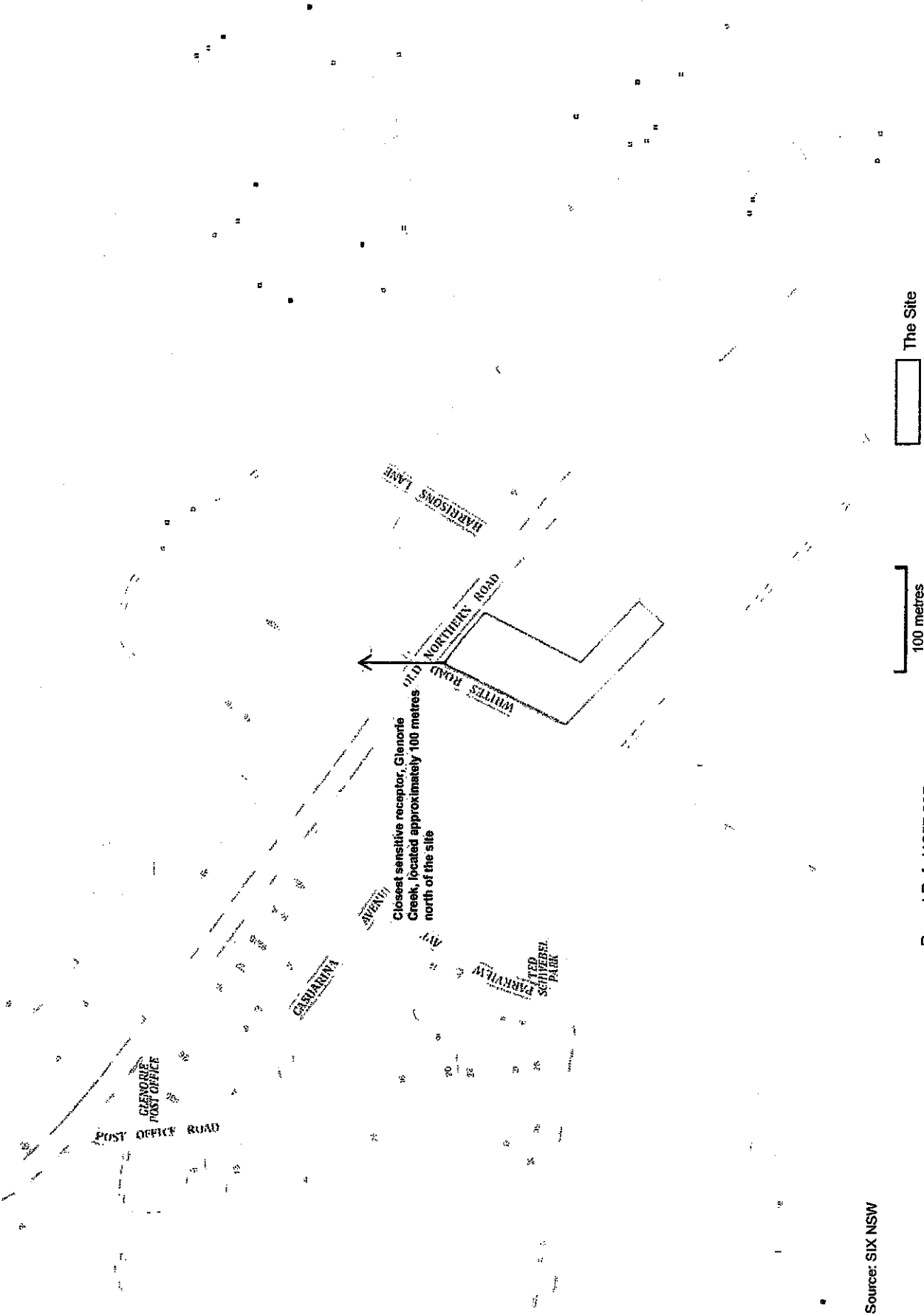


Figure 4
Potential Receptors

Source: SIX NSW

Report Ref: J1257.29R
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Author: NAA

validation work conducted by a contaminated site consultant.

Site Assessment and Audit Process

The usual stages in the assessment, remediation and validation of a contaminated site, and in the audit of those activities, are as follows:

Consultant is Commissioned to Assess Contamination

In most cases, a site owner or developer engages a contaminated site consultant to assess a site for contamination and, where required, to develop a remediation plan, implement the plan and validate the remediation.

The contaminated site consultant designs and undertakes the site assessment and, where required, all remediation and validation activities to achieve the objectives specified by the owner or developer.

Site Auditor Reviews the Consultant's Work

The site owner or developer commissions the site auditor to review the consultant's work. The auditor prepares a site audit report and a site audit statement at the conclusion of the review, which are given to the owner or developer.

Where the local planning authority or DEC uses its legal powers to require the carrying out of a site audit, the site owner or developer must commission a site auditor accredited under the CLM Act to perform this task. This is known as a 'statutory' audit. The CLM Act requires that an auditor must notify DEC when he or she has been commissioned by anyone other than DEC to perform a statutory site audit. The auditor is also required to furnish the local authority and DEC with a copy of the completed site audit statement.

In some cases, the site owner or developer may wish to have a site audit undertaken although it is not a legal requirement. The audit is termed 'non-statutory'. If their intention is to obtain a site audit statement, they must commission a site auditor accredited under the CLM Act to perform this task. This is because only a site auditor so accredited can issue a site audit statement and they are obliged to issue one at the end of any site audit. For non-statutory audits, the site auditor must give a copy of the site audit report to the local authority or DEC, or both, on request.

As required by the CLM Act, DEC maintains a record of all statutory site audit statements issued in relation to land that is the subject of a regulatory instrument under the CLM Act. Copies are available for public inspection through DEC's website at www.environment.nsw.gov.au. If the local council

receives a copy of a site audit statement, it must list the statement on any certificate it issues under section 149 of the *Environmental Planning and Assessment Act 1979* in relation to the land concerned.

Limitations of Your Site Audit Report

The following notes have been added by the Auditor who prepared this report, to highlight some important limitations on the use of this report.

This report has been prepared by C. M. Jewell & Associates Pty Ltd for the use of the client who commissioned it, and relevant government agencies, for the specific purpose described in the report.

Consistently with the objectives of the NSW Site Auditor Scheme, it may be appropriate for others to rely upon this report in some circumstances.

However, the original purpose of this report and the site conditions prevailing at the time the report was prepared – as described in the report – should be considered first.

If you are not the person for whom the report was prepared, or you wish to use it for a different purpose to that for which it was prepared, or site conditions appear to differ from those described in this report, or a significant period of time has elapsed since the report was prepared, then PLEASE CONSULT THE SITE AUDITOR BEFORE RELYING UPON THE REPORT.

It is also important to recognise that a site audit is primarily a review of work carried out by other companies and individuals.

The site auditor has checked data and interpretations, ascertained whether or not appropriate guidelines have been followed, and satisfied himself that the available data are adequate to support the conclusions he has reached.

However, all environmental sampling programs have an inherent degree of uncertainty. Even when sampling fully complies with guidelines, it is possible for areas of contamination to remain undetected, but be revealed by more extensive excavations during site redevelopment. This risk is usually quantified using statistical confidence limits.

The site audit report identifies data limitations and uncertainties where these are recognised, but users must accept the finite and unavoidable risk that some contamination may remain undetected during even a diligent site assessment and audit process.

If there is a need to copy this report, it must be reproduced in full. No reliance whatsoever should be placed upon partial copies of a site audit report.