RAMBOLL ENVIRON

ENVIRONMENT
& HEALTH

31 October 2017

Art Gallery of New South Wales Trust
Attention: Nicholas Wolff
Art Gallery Road, The Domain
Sydney NSW 2000

Dear Nicholas,

Re: Cover Letter for 'Site Audit Report – Remedial Action Plan for Art Gallery of NSW Expansion – Sydney Modern Project'

I previously prepared and issued 'Site Audit Report – Remedial Action Plan for Art Gallery of NSW Expansion – Sydney Modern Project' and accompanying site audit statement TO-004 dated 2 December 2016. The purpose of the statutory site audit was to determine if the site can be made suitable for a particular use by implementation of a remedial action plan. The audit concluded that the site can be made suitable for 'park, recreation open space, playing field' and 'commercial/industrial' use if remediated in accordance with the following report:

- 'Art Gallery of NSW, Remedial Action Plan, Art Gallery of NSW Expansion - Sydney Modern Project, Art Gallery Road, Sydney, NSW', 14 November 2016, Coffey Geotechnics Pty Ltd

It is understood that the proposed extent and layout of the development have changed since the site audit report and statement were issued. Attachment 1 shows the proposed site plan. The remedial action plan has not been revised and this is not warranted since the changes to the development do not affect the planned remedial works. The conclusions of the audit are therefore considered to remain valid.

Yours faithfully,
Ramboll Environ Australia Pty Ltd

Tom Onus

EPA Accredited Site Auditor 1505

Attachment 1

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

T +61 2 9954 8100
F +61 2 9954 8150
www.ramboll-environ.com

Job Number: AS122007

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


LEGEND
EXHIBITION SPACE
CIRCULATION / AMENITY
BACK OF HOUSE AREA
TERRACE
LANDSCAPING
PAVING
SITE AREA
TEMPORARY EXHIBITION HOUSES
PROPOSED TREE
EXISTING TREE TO REMAIN
EXISTING TREE TO BE TRANSPLANTED
PROPOSED LOCATION OF NEWLY TRANSPLANTED TREE
NEW BUILDING AREA
SANAA
architectus
ART GALLERY NSW
APT GALLERY OF NSW EXPANSION
PROJECT - SYDNEY MODERN
Proposed Site Plan
DA_0100
(1)
Revision Description Date
B SSDA DRAFT 06.10.2017
C SSDA Issue 19.10.2017
D SSDA Issue 26.10.2017
(1) Issued for Information 30.10.2017
ART GALLERY ROAD
DOMAIN TUNNEL
EASTERN SUBURBS RAILWAY
JUBILEE PLACE
PLAZA CAFE
EXISTING STAIR
EXISTING RAMP
PROPOSED CONCRETE
PROPOSED TIMBER
PROPOSED GLASS
PROPOSED TIMBER LOUVRE
PROPOSED TRANSPARENT ROOF
PROPOSED TRANSLUCENT ROOF
PROPOSED PLANTER
PROPOSED PLANTER WITH TREE
PROPOSED PLANTER WITH SEATING
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Prepared for

Art Gallery of New South Wales Trust

Prepared by

Ramboll Environ Australia Pty Ltd

Date

December 2016

Project Number

AS122007

Audit Number

TO 004

SITE AUDIT REPORT

REMEDIAL ACTION PLAN FOR ART GALLERY OF NSW EXPANSION - SYDNEY MODERN PROJECT

RAMBOLL ENVIRON

RAMBOLL ENVIRON

2 December 2016

Art Gallery of New South Wales Trust
Attn.: Nicholas Wolff
Art Gallery Road, The Domain
Sydney NSW 2000

Dear Nicholas

SITE AUDIT REPORT - REMEDIAL ACTION PLAN FOR ART GALLERY OF NSW EXPANSION - SYDNEY MODERN PROJECT

I have pleasure in submitting the Site Audit Report for the subject site. The Site Audit Statement, produced in accordance with the NSW *Contaminated Land Management Act 1997*, follows this letter. The Audit was commissioned by The Art Gallery of New South Wales Trust to assess the suitability of a remedial action plan.

The Audit was initiated to comply with a condition of the Secretary's Environmental Assessment Requirements, application number SSD 6471, issued 21 May 2014 and last modified 8 June 2016, and is therefore a statutory audit.

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

Yours faithfully,
Ramboll Environ Australia Pty Ltd

Tom Onus
EPA Accredited Site Auditor 1505

cc: NSW EPA – Statement only
City of Sydney Council

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

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www.ramboll-environ.com

Ref AS122007

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

NSW Site Auditor Scheme
SITE AUDIT STATEMENT

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

This form was approved under the* Contaminated Land Management Act 1997 *on 31st October 2012. For more information about completing this form, go to Part IV.

PART I: Site audit identification

Site audit statement no. TO-004

This site audit is a **statutory audit~~/non-statutory audit~~*** within the meaning of the *Contaminated Land Management Act 1997*.

Site auditor details (as accredited under the *Contaminated Land Management Act 1997*)

Name:	Tom Onus	Company:	Ramboll Environ Australia Pty Ltd
Address:	Level 3, 100 Pacific Highway (PO Box 560)		
	North Sydney NSW	Postcode:	2060
Phone:	02 9954 8100	Fax:	02 9954 8150

Site details

Address: Art Gallery Road, The Domain, Sydney, NSW

Postcode: 2000

Property description *(attach a list if several properties are included in the site audit)*

Art Gallery – part Lot 102 DP854472, part Lot 34 DP39586, Lot 4 DP259027, part Lot 1013 DP1199151, part Lot 107, part 108 and part 115 DP1105308 (See attachment at the end of Part I)

Seawater heat exchange - part Lot 51 DP47732, part Lot 35 DP39586, part Lot 9 DP1007565 and Lincoln Crescent (no Lot and DP)

Local Government Area: City of Sydney Council

Area of site (e.g. hectares): 3.94 ha

Current zoning: *Art Gallery* - RE1 Public Recreation, SP2 Infrastructure Classified Road and B8 Metropolitan Centre under Sydney Local Environmental Plan 2012. *Seawater heat*

exchange - RE1 Public Recreation (Sydney LEP 2012) and W6 Scenic Water Active Use (Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005)

To the best of my knowledge, the site ~~**is/**~~**is not*** the subject of a declaration, order, agreement or notice under the *Contaminated Land Management Act 1997* or the *Environmentally Hazardous Chemicals Act 1985*.

Declaration/Order/Agreement/Proposal/Notice* no(s): N/A

Site audit commissioned by

Name: John Wicks Company: The Art Gallery of New South Wales Trust

Address: Art Gallery Road, The Domain, Sydney, NSW

Postcode: 2000

Phone: NA Fax: NA

Name and phone number of contact person (if different from above)

Nicholas Wolff, Project Director Sydney Modern Project, 9225 1799

Purpose of site audit

☐ ~~A. To determine land use suitability *(please specify intended use[s])*~~

~~**OR**~~

- ☑ B(i) To determine the nature and extent of contamination, and/or
- ☑ B(ii) To determine the appropriateness of an ~~**investigation/**~~**remedial action**~~**/management**~~ **plan***, and/or
- ☑ B(iii) To determine if the land can be made suitable for a particular use or uses by implementation of a specified **remedial action plan**~~**/management plan***~~ *(please specify intended use[s])*

  Art gallery, incorporating exhibition spaces, shop, food and beverage facilities, visitor amenities, art research and education spaces, landscaping, loading and service areas, services infrastructure and an ancillary seawater heat exchange system

Information sources for site audit

Consultancy(ies) which conducted the site investigation(s) and/or remediation

- Environmental & Earth Sciences Pty Ltd (EES)
- Gutteridge Haskins & Davey Pty Ltd (GHD)
- Coffey Geotechnics Pty Ltd (Coffey)
- Hibbs & Associates Pty Ltd (Hibbs)
- Taylor Thomson Whitting (NSW) Pty Ltd (TTW)
- Wilkinson Murray Pty Ltd (Wilkinson Murray)
- Time Planning and Programming Pty Ltd (TPP)

Title(s) of report(s) reviewed:

- 'Further Contamination Assessment of the Fuel Bunker at Woolloomooloo New South Wales', 1996, EES (incomplete).
- 'Woolloomooloo Fuel Bunker, Report on Stage 1 Preliminary Site Investigation', September 1997, GHD.
- 'Groundwater Monitoring adjacent to Bunker Fuel Tank Site, Art Gallery of NSW', 2 July 2014, Coffey.
- 'Former Garden Island Fuel Bunker – Preliminary Odour Assessment', 15 April 2016, Hibbs.
- 'Sydney Modern Project – Groundwater monitoring adjacent to former fuel bunkers', 30 May 2016, Coffey.
- 'Art Gallery of New South Wales, Sydney Modern Project, Fuel Bunker Inflow Assessment', 15 July 2016, Coffey.
- 'Revised Preliminary Acid Sulfate Soil Management Plan, Art Gallery of NSW Expansion 0 Sydney Modern Project, Art Gallery Road, Sydney NSW', 29 July 2016, Coffey.
- 'Sydney Modern Project, Art Gallery of NSW Extension, Air Quality Assessment', 31 July 2016, Wilkinson Murray.
- 'Art Gallery of NSW, Sydney Modern Project, Revised Stage 1 Preliminary Environmental Study', 14 November 2016, Coffey.
- 'Art Gallery of NSW, Remedial Action Plan, Art Gallery of NSW Expansion - Sydney Modern Project, Art Gallery Road, Sydney, NSW', 14 November 2016, Coffey.
- 'Draft Preliminary Construction Management Plan', November 2016, TPP.
- 'Sydney Modern, Oil Bunker Report', undated draft, TTW.

Other information reviewed (including previous site audit reports and statements relating to the site)

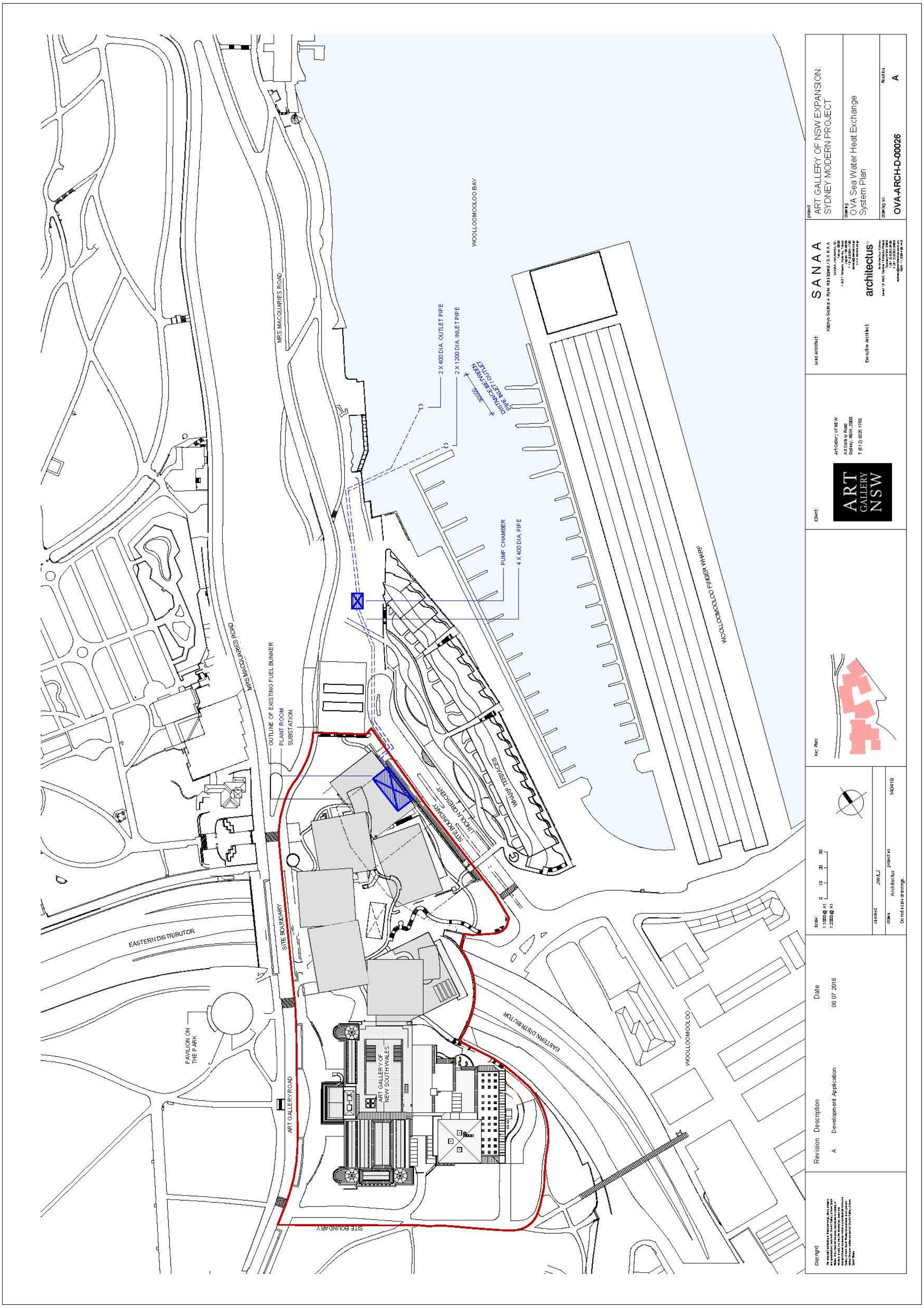
- 'Woolloomooloo Fuel Bunker, Summary Audit Report' (WCFM10), 14 April 1999, Frank Mohen of AGC Woodward-Clyde Pty Ltd (incomplete).

Site audit report

Title: Site Audit Report – Remedial Action Plan for Art Gallery of NSW Expansion – Sydney Modern Project

Report no. TO-004 (Ramboll Environ Ref: AS122007)

Date: December 2016


WOOLLOOMOOLOO BAY
MRS MACQUARIES ROAD
2 X 400 DIA. OUTLET PIPE
2 X 1200 DIA. INLET PIPE
PUMP CHAMBER
4 X 400 DIA. PIPE
WOOLLOOMOOLOO FINGER WHARF
OUTLINE OF EXISTING FUEL BUNKER
PLANT ROOM
SUBSTATION
SITE BOUNDARY
LINCOLN CRESCENT
WHARF TERRACES
EASTERN DISTRIBUTOR
PAVILION ON THE PARK
ART GALLERY ROAD
ART GALLERY OF NEW SOUTH WALES
WOOLLOOMOOLOO
ART GALLERY OF NSW EXPANSION: SYDNEY MODERN PROJECT
OVA Sea Water Heat Exchange System Plan
OVA-ARCH-D-00026
A
SANAA
architectus
ART GALLERY NSW
Revision Description
A Development Application
Date 08 07 2016
Do not scale drawings

PART II: Auditor's findings

Please complete either Section A or Section B, **not** both. *(Strike out the irrelevant section.)*

Use Section A where site investigation and/or remediation has been completed and a conclusion can be drawn on the suitability of land use(s).

Use Section B where the audit is to determine the nature and extent of contamination and/or the appropriateness of an investigation or remedial action or management plan and/or whether the site can be made suitable for a specified land use or uses subject to the successful implementation of a remedial action or management plan.

Section A

❑ **I certify that, in my opinion, the site is SUITABLE for the following use(s)** *(tick all appropriate uses and strike out those not applicable)*:

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

subject to compliance with the following environmental management plan *(insert title, date and author of plan)* **in light of contamination remaining on the site:**

OR

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

Overall comments:

Section B

Purpose of the plan[1] which is the subject of the audit was to present a remediation strategy that could be used during development of the site for art gallery use.

I certify that, in my opinion:

- ☑ **the nature and extent of the contamination HAS~~/HAS NOT~~* been appropriately determined**

AND~~/OR~~

- ☑ **the ~~investigation/~~remedial action plan~~/management plan~~* IS~~/IS NOT~~* appropriate for the purpose stated above**

AND~~/OR~~

- ☑ **the site CAN BE MADE SUITABLE for the following uses** *(tick all appropriate uses and strike out those not applicable)*:
  - ~~☐ Residential, including substantial vegetable garden and poultry~~
  - ~~☐ Residential, including substantial vegetable garden, excluding poultry~~
  - ~~☐ Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry~~
  - ~~☐ Day care centre, preschool, primary school~~
  - ~~☐ Residential with minimal opportunity for soil access, including units~~
  - ~~☐ Secondary school~~
  - ☑ Park, recreational open space, playing field
  - ☑ Commercial/industrial
  - ~~☐ Other *(please specify)* ……~~

if the site is remediated~~/managed~~* in accordance with the following remedial action plan~~/management plan~~* *(insert title, date and author of plan)*

- 'Art Gallery of NSW, Remedial Action Plan, Art Gallery of NSW Expansion - Sydney Modern Project, Art Gallery Road, Sydney, NSW', 14 November 2016, Coffey Geotechnics Pty Ltd

subject to compliance with the following condition(s):

1. Groundwater is not abstracted from the site for beneficial use.
2. A Section A site audit statement is prepared at the completion of remediation and validation certifying suitability for the proposed use.

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

**** Strike out as appropriate***

Overall comments

The Art Gallery of NSW proposes to undertake existing building upgrades and a major expansion of the existing art gallery in the eastern part of the Royal Botanic Gardens and Domain. The expansion is located north of the existing gallery, and extends over the Eastern Distributor land bridge and a disused Navy fuel bunker. The new expansion, known as the Sydney Modern Building, comprises a new entry plaza, new exhibition spaces, shop, food and beverage facilities, visitor amenities, art research and education spaces, new roof terraces and landscaping and associated site works and infrastructure, including loading and service areas, services infrastructure and an ancillary seawater heat exchange system.

Intrusive investigations identified fill material in the north of the site containing elevated concentrations of polycyclic aromatic hydrocarbon and petroleum hydrocarbons in material described as ‘coal-like gravel’ and characterised by a strong hydrocarbon odour. The material was not found in all investigation locations undertaken to delineate the material, and therefore may be found in discrete pockets.

Fill material elsewhere on the site contained anthropogenic material, such as brick, glass and tile. Further investigation is required to adequately characterise fill material from unknown sources placed on the site during previous development. Investigation of potential sources of contamination that are not accessible until demolition is complete (substation) is also proposed.

Part of the site comprises a former fuel bunker used for storage of furnace fuel. Investigation and remediation of the former fuel bunker was undertaken between 1995 and 1999. An Audit of the bunker by Frank Mohen of AGC Woodward-Clyde Pty Ltd (1999) concluded that the site was suitable for commercial/industrial use subject to ongoing groundwater monitoring, and noted that minor oil seeps from joints or boltholes may occur.

Coffey undertook indoor air sampling within the fuel bunker and did not report contaminant concentrations exceeding the adopted criteria protective of human health. Coffey also undertook groundwater monitoring, and did not identify contamination that would present a risk to future occupants of the fuel bunker.

Remediation will include excavation and off-site disposal of hydrocarbon impacted fill material in the north of the site. Fill material in other areas of the site will be excavated for off-site disposal to allow construction, including above the fuel bunker and above the landbridge over the expressway. Other areas will be assessed by additional investigations to be implemented as part of the remediation action plan.

PART III: Auditor's declaration

I am accredited as a site auditor by the NSW Environment Protection Authority under the *Contaminated Land Management Act 1997* (Accreditation No. 1505).

I certify that:

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

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

Signed...  Date... 2/12/16

PART IV: Explanatory notes

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

How to complete this form

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

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

The auditor is to complete either Section A or Section B of Part II, **not** both.

In **Section A** the auditor may conclude that the land is *suitable* for a specified use(s) OR *not suitable* for any beneficial use due to the risk of harm from contamination.

By certifying that the site is *suitable*, an auditor declares that, at the time of completion of the site audit, no further remediation or investigation of the site was needed to render the site fit for the specified use(s). Any **condition** imposed should be limited to implementation of an environmental management plan to help ensure the site remains safe for the specified use(s). The plan should be legally enforceable: for example a requirement of a notice under the *Contaminated Land Management Act 1997* (CLM Act) or a development consent condition issued by a planning authority. There should also be appropriate public notification of the plan, e.g. on a certificate issued under s.149 of the *Environmental Planning and Assessment Act 1979*.

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

In **Section B** the auditor draws conclusions on the nature and extent of contamination, and/or suitability of plans relating to the investigation, remediation or management of the land, and/or whether land can be made suitable for a particular land use or uses upon implementation of a remedial action or management plan.

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

For a site that *can be made suitable*, any **conditions** specified by the auditor in Section B should be limited to minor modifications or additions to the specified plan. However, if the auditor considers that further audits of the site (e.g. to validate remediation) are required, the auditor must note this as a condition in the site audit statement.

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

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

Where to send completed forms

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

EPA (NSW)
Contaminated Sites Section
PO Box A290, SYDNEY SOUTH NSW 1232
nswauditors@epa.nsw.gov.au

AND

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

CONTENTS

LIST OF TABLES

APPENDICES

LIST OF ABBREVIATIONS

Measures

%	per cent
µg/L	Micrograms per Litre
µg/m^3	Micrograms per Cubic Metre
ha	Hectare
km	Kilometres
m	Metre
mAHD	Metres Australian Height Datum
mbgl	Metres below ground level
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Litre
mg/m^3	Milligrams per Cubic Metre
mm	Millimetre
ng/L	Nanograms per Litre
ppm	Parts Per Million

General

ABC	Added Background Concentration
ACL	Added Contaminant Limit
ACM	Asbestos Containing Material
ADWG	Australian Drinking Water Guidelines
AHD	Australian Height Datum
ALS	Australian Laboratory Services
ASET	Australian Safer Environment and Technology Pty Ltd. (Laboratory)
ASS	Acid Sulfate Soil
ANZECC	Australian and New Zealand Environment and Conservation Council
BTEX	Benzene, Toluene, Ethylbenzene & Xylenes (Monocyclic Aromatic Hydrocarbons)
CEC	Cation Exchange Capacity
CMP	Construction Management Plan
CLM Act	NSW Contaminated Land Management Act 1997
COC	Chain of Custody
Coffey	Coffey Geotechnics Pty Ltd
Council	City of Sydney Council
CRC CARE	Cooperative Research Centre for Contamination Assessment and Remediation of the Environment
CSM	Conceptual Site Model
DO	Dissolved Oxygen
DP	Deposited Plan
DQI	Data Quality Indicator
DQO	Data Quality Objective
EES	Environmental & Earth Sciences Pty Ltd
EIL	Ecological Investigation Level
EMP	Environmental Management Plan
Envirolab	Envirolab Services Pty Ltd
EPA	Environment Protection Authority (NSW)
ESL	Ecological Screening Level
GHD	Gutteridge Haskins & Davey Pty Ltd
GIL	Groundwater Investigation Level
Hibbs	Hibbs & Associates Pty Ltd
HIL	Health Investigation Level
HSL	Health Screening Level
LCS	Laboratory Control Sample
LEP	Local Environment Plan
MAH	Monocyclic Aromatic Hydrocarbons
Mercury	Inorganic mercury unless noted otherwise
Metals	As: Arsenic, Cd: Cadmium, Cr: Chromium, Cu: Copper, Ni: Nickel, Pb: Lead, Zn: Zinc, Hg: Mercury
ML	Management Limits
MS	Matrix Spike
NATA	National Association of Testing Authorities

NC	Not Calculated
ND	Not Detected
NEHF	National Environmental Health Forum
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
NL	Non-Limiting
n	Number of Samples
OCPs	Organochlorine Pesticides
OEH	Office of Environment and Heritage
OH&S	Occupational Health & Safety
OPPs	Organophosphorus Pesticides
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
pH	A measure of acidity, hydrogen ion activity
PID	Photoionisation Detector
PQL	Practical Quantitation Limit
PSH	Phase Separated Hydrocarbon
QA/QC	Quality Assurance/Quality Control
RAP	Remediation Action Plan
RPD	Relative Percent Difference
RSL	Regional Screening Level
SAR	Site Audit Report
SAS	Site Audit Statement
SEARs	Secretary's Environmental Assessment Requirements
SGS	SGS Leeder Consulting
SILs	Soil Investigation Levels
SMP	Sydney Modern Project
SSP	Site Safety Plan
SWL	Standing Water Level
TCLP	Toxicity Characteristic Leaching Procedure
TPHs	Total Petroleum Hydrocarbons
TRHs	Total Recoverable Hydrocarbons
TTW	Taylor Thomson Whitting (NSW) Pty Ltd
UFP	Unexpected Finds Procedure
USEPA	United States Environmental Protection Agency
VENM	Virgin Excavated Natural Material
VOCs	Volatile Organic Compounds
Woodward-Clyde	AGC Woodward-Clyde Pty Ltd
-	On tables is "not calculated", "no criteria" or "not applicable"

1. INTRODUCTION

A site contamination audit has been conducted in relation to the proposed Art Gallery of NSW Expansion - Sydney Modern Project (SMP) building proposed for the Art Gallery for New South Wales (NSW) located at Art Gallery Road, the Domain, Sydney.

The Audit was conducted to provide an independent review by an EPA Accredited Auditor of the suitability and appropriateness of a remedial action plan (RAP) i.e. a "Site Audit" as defined in Section 4 (1) (b) (v) of the NSW *Contaminated Land Management Act 1997* (the CLM Act).

The Art Gallery of NSW proposes to undertake existing building upgrades and a major expansion of the existing art gallery in the eastern part of the Royal Botanic Gardens and Domain. The expansion is located north of the existing gallery, and extends over the Eastern Distributor land bridge and a disused Navy fuel bunker. The new expansion, known as the Sydney Modern Building, comprises a new entry plaza, new exhibition spaces, shop, food and beverage facilities, visitor amenities, art research and education spaces, new roof terraces and landscaping and associated site works and infrastructure, including loading and service areas, services infrastructure and an ancillary seawater heat exchange system. The proposal includes use of part of the former fuel bunkers as exhibition space.

The Audit is a requirement of the Secretary's Environmental Assessment Requirements (SEARs), application number SSD 6471, first issued 21 May 2014 and modified on 13 October 2015 and again on 8 June 2016. Key Issue 8 of the SEARs relates to contamination and requires a site audit statement (SAS) and accompanying site audit report (SAR) as follows:

> *"The RAP* [remedial action plan] *must be accompanied by a Site Audit Statement prepared by a NSW EPA accredited site auditor certifying that the site can be made suitable for the proposed use(s)".*

1.1 Scope of the Audit

Details of the Audit are:

Requested by:	John Wicks of The Art Gallery of New South Wales Trust
Request/Commencement Date:	8 June 2016
Auditor:	Tom Onus
Accreditation No.:	1505

The scope of the Audit included:

- Review of the following reports:
  - 'Further Contamination Assessment of the Fuel Bunker at Woolloomooloo New South Wales', 1996, Environmental & Earth Sciences Pty Ltd (EES) (incomplete).
  - 'Woolloomooloo Fuel Bunker, Report on Stage 1 Preliminary Site Investigation', September 1997, Gutteridge Haskins & Davey Pty Ltd (GHD).
  - 'Woolloomooloo Fuel Bunker, Summary Audit Report' (WCFM10), 14 April 1999, Frank Mohen of AGC Woodward-Clyde Pty Ltd (Woodward-Clyde) (incomplete).
  - 'Groundwater Monitoring adjacent to Bunker Fuel Tank Site, Art Gallery of NSW', 2 July 2014, Coffey Geotechnics Pty Ltd (Coffey).
  - 'Former Garden Island Fuel Bunker – Preliminary Odour Assessment', 15 April 2016, Hibbs & Associates Pty Ltd (Hibbs).
  - 'Sydney Modern Project – Groundwater monitoring adjacent to former fuel bunkers', 30 May 2016(a), Coffey.

  - 'Art Gallery of New South Wales, Sydney Modern Project, Fuel Bunker Inflow Assessment', 15 July 2016(b), Coffey.
  - 'Revised Preliminary Acid Sulfate Soil Management Plan, Art Gallery of NSW Expansion 0 Sydney Modern Project, Art Gallery Road, Sydney NSW', 29 July 2016(c), Coffey.
  - 'Sydney Modern Project, Art Gallery of NSW Extension, Air Quality Assessment', 31 July 2016, Wilkinson Murray Pty Ltd (Wilkinson Murray).
  - 'Art Gallery of NSW, Sydney Modern Project, Revised Stage 1 Preliminary Environmental Study', 14 November 2016(d), Coffey.
  - 'Art Gallery of NSW, Remedial Action Plan, Art Gallery of NSW Expansion - Sydney Modern Project, Art Gallery Road, Sydney, NSW', 14 November 2016(e), Coffey (*the RAP*).
  - 'Draft Preliminary Construction Management Plan', November 2016, Time Planning and Programming Pty Ltd (TPP) (*the CMP*).
  - 'Sydney Modern, Oil Bunker Report', undated draft, Taylor Thomson Whitting (NSW) Pty Ltd (TTW).

- A site visit by the Auditor on 22 July 2016.
- Discussions with The Art Gallery of NSW Trust, and with Coffey who undertook the recent investigations and prepared the RAP.

The investigations were undertaken prior to the Auditor's engagement and no discussion with the consultants was undertaken.

A SAS and accompanying SAR were previously prepared for the fuel bunker: 'Woolloomooloo Fuel Bunker, Summary Audit Report' (WCFM10) dated 14 April 1999, prepared by Frank Mohen of Woodward-Clyde. The SAS concluded that the fuel bunker was suitable for commercial/industrial use subject to ongoing groundwater monitoring. The SAS also noted that *"…minor oil seeps from joints or boltholes may occur in the future. Odour from remaining oil impregnated within the structure should also be considered with appropriate management incorporated into development"*. The SAR refers to a number of previous investigation reports that have not been provided to the Auditor for review.

2. SITE DETAILS

2.1 Location

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

The site details are as follows:

Street address: Art Gallery Road, The Domain, Sydney, NSW 2000

Identifier: The SMP building area comprises part Lot 102 DP854472, part Lot 34 DP39586, Lot 4 DP259027, part Lot 1013 DP1199151, part Lot 107, part 108 and part 115 DP1105308

The seawater heat exchange comprises part Lot 51 DP47732, part Lot 35 DP39586, part Lot 9 DP1007565 and Lincoln Crescent (no Lot and DP)

Local Government: City of Sydney Council

Owner: The Art Gallery of NSW Trust, Royal Botanic Gardens and Domain Trust, Roads and Maritime Services

Site Area: Approximately 3.95 ha (excluding existing Art Gallery building)

The boundaries of the site are not well defined, however include adjacent streets (Art Gallery Road and Lincoln Crescent) and adjoining buildings (substation) in some areas.

The seawater heat exchange system is to be installed adjacent to and within Woolloomooloo Bay. The system will be installed underground between the fuel bunker and Woolloomooloo Bay.

A survey plan of the site has been provided as Attachment 2 in Appendix A.

2.2 Zoning

Coffey (2016d) report that the current zoning of the development site is RE1 Public Recreation, SP2 Infrastructure Classified Road and B8 Metropolitan Centre under the Sydney Local Environmental Plan (LEP) 2012. The seawater heat exchange site is zoned RE1 Public Recreation (Sydney LEP 2012) and W6 Scenic Water Active Use (Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005).

2.3 Adjacent Uses

The site is located within an area of mixed land use. The surrounding land uses include:

North East: Electrical substation and Lincoln Crescent, then a carpark and commercial property, then residential apartments

North West: Art Gallery Road, then the Domain, Cahill Expressway and the Royal Botanic Gardens

South East: Cahill Expressway, then residential and commercial properties

South West: the Domain and Eastern Suburbs Railway line

The Auditor notes that a potential offsite source of contamination is the electrical substation located to the north of the site. This is anticipated to be down gradient of the site development site based on the topography of the area.

The closest sensitive receptor identified by Coffey (2016d) was Woolloomooloo Bay located 80 m to the east of the site.

2.4 Site Condition

Coffey (2016d), GHD (1997) and TTW noted the following with respect to the site condition based on site walkovers and investigations:

- The site is largely grassed and landscaped, with retaining walls and pathways. Vegetation appeared healthy.
- A former fuel bunker is located in the northeast (Attachment 5, Appendix A). It comprises two tanks separated by a concrete wall, with an approximate capacity of 14,200 tonnes each. The bunker is constructed of concrete poured against sandstone bedrock. Joints between concrete slabs are sealed with recessed metal strips. Concrete columns supporting the roof slab are spaced at 4 m intervals. The fuel bunker is approximately 40 m wide, 90 m long and 6 m high. The base is below the level of Lincoln Crescent. The top is covered with approximately 0.5 m of topsoil and grass, apart from access hatches. The eastern wall of the bunker is a stepped concrete retaining wall down to Lincoln Crescent. GHD (1997) report that the interior of the bunker was *"thoroughly cleaned"*.
- A pump room is located to the north of the fuel bunker. Pipes beneath the fuel bunker drain seepage water and groundwater to a sump (2 m by 1.5 m) in the pump room, prior to discharge to sewer.
- A former naval electrical substation is located to the north of the pump room. Further details were not provided.
- Outcropping sandstone is present to the east and south of the fuel bunker.
- The site slopes down to the northeast towards Woolloomooloo Bay. A 5 m high sandstone cliff face and concrete wall are present to the west of the fuel bunker.
- No surface water features are present at the site. The seawater heat exchange includes part of Woolloomooloo Bay located approximately 120 m to the northeast of the fuel bunkers.
- No evidence of contaminating activities or signs of impact from the fuel bunker (staining, odour) were identified by Coffey. Staining and hydrocarbon odour were noted during intrusive investigations (discussed in Section 8).

The following was noted by the Auditor during the site visit on 22 July 2016:

- The fuel bunker had 4 sealed access hatches in the grassed roof. A vent riser was located near the north western corner of the fuel bunker.
- The interior of the fuel bunker could not be accessed.
- The pump room and former naval electrical substation were within one brick building immediately to the north of the fuel bunker. These could not be accessed at the time of the site visit.

2.5 Proposed Development

It is understood that the development is an extension to the existing Art Gallery for NSW building (Attachment 3, Appendix A). It is to comprise a new entry plaza, new exhibition spaces, shop, food and beverage facilities, visitor amenities, art research and education spaces, new roof terraces and landscaping and associated site works and infrastructure, including loading and service areas, services infrastructure and an ancillary seawater heat exchange system. The proposal includes use of part of the former fuel bunkers as exhibition space.

The seawater heat exchange system is to be installed adjacent to and within Woolloomooloo Bay. The system will extend from the fuel bunker, beneath Lincoln Crescent to Woolloomooloo Bay (Attachment 4, Appendix A)

The proposed development is considered to fall within a 'commercial/industrial' and 'open space' land use exposure scenario.

3. SITE HISTORY

Coffey (2016d) provided a site history based on information provided by the Art Gallery of NSW, historical aerial photographs, NSW EPA records, dangerous goods records, Certificates of Title and the previous SAR (Woodward-Clyde, 1999) and has been summarised by the Auditor in Table 3.1.

Table 3.1: Site History

Date	Activity
Pre-1896	Crown land – unknown site use, however likely to be public open space.
1896	Construction of the Art Gallery of NSW façade and old wing commenced and was completed in 1909. The building has been extended several times since then.
1938	Construction of the fuel bunkers for storage of furnace fuel commenced, with completion in 1942. The 1930 aerial photograph appeared to show the area as parkland prior to construction. Sandstone was quarried from the site prior to construction. The furnace oil was pumped from the bunker to a nearby finger wharf and Garden Island Naval Base via a concrete encased pipeline. The pipeline was capped at the pump room. The fuel bunker ceased operation in 1984-1985, however was not drained until 1992-1993.
1943	The aerial photograph shows the fuel bunker area to be bare (i.e. without the current grass cover). Coffey report that the fuel bunkers were filled from Woolloomooloo Bay via the pump room to the north of the bunker. The grass cover was present in the 1961 aerial photograph. Operations extend beyond the footprint of the existing fuel bunkers towards Art Gallery Road. The Art Gallery building had expanded to the east.
1958	Construction of the Cahill Expressway commenced and was completed in 1962.
1979	The aerial photograph shows that the rail easement to the south of the Art Gallery building was constructed sometime after the previous photograph in 1961.
1986	The aerial photograph shows an extension to the Art Gallery was under construction.
1994-2013	No change in the Art Gallery building was evident in the aerial photographs. The land bridge over the Cahill Expressway was installed sometime between 1994 and 2002.

The Coffey (2016d) site history summary did not identify licenses to store dangerous goods or records held by the NSW EPA.

3.1 Auditor's Opinion

The Auditor considers that the site history is broadly understood. The former fuel bunker and associated activities are a potential source of contamination, as well as fill material placed during levelling or landscaping the site. Further investigation is proposed in the RAP to address these potential sources of contamination.

There were no indicators of significant industrial uses surrounding the site that would have the potential to contaminate the site.

4. CONTAMINANTS OF CONCERN

Coffey (2016d) provided a list of the contaminants of concern and potentially contaminating activities. These have been tabulated in Table 4.1.

Table 4.1: Contaminants of Concern

Area	Activity	Potential Contaminants
Surface soils in landscaped areas	Pesticide applications	Organochlorine pesticides (OCPs), organophosphorus pesticides (OPPs) and metals
Entire site	Placement of fill material during previous site developments	Unknown, however could include metals, petroleum hydrocarbons (TRH and BTEX), polycyclic aromatic hydrocarbons (PAHs), OCPs, polychlorinated biphenyls (PCBs) and asbestos.
Fuel bunker	Storage of furnace fuel and seepage through joints in walls and floor	Petroleum hydrocarbons (TRH and BTEX), phenols and PAHs
Former Naval electrical substation	Potential leak or spill of oils from electrical equipment	PCBs and petroleum hydrocarbons (TRH and BTEX)
Hazardous building materials	Weathering of uncontrolled demolition of hazardous building materials	Asbestos and metals

4.1 Auditor's Opinion

The Auditor considers that the analyte list used by Coffey during site investigations and defined in the RAP are generally consistent with the site history and current land use.

5. STRATIGRAPHY AND HYDROGEOLOGY

Following a review of the reports provided, a summary of the site stratigraphy and hydrogeology was compiled as follows.

5.1 Stratigraphy

Coffey (2016d) reviewed geological maps and reported that the site is underlain by Hawkesbury Sandstone, which is described as medium to coarse grained quartz sandstone with minor shale and laminate lenses.

Coffey (2016d) reviewed acid sulfate soil (ASS) maps published by the Department of Land and Water Conservation and Council. The SMP is located on land with no known occurrence of ASS. The seawater heat exchange area is located on land with a high likelihood of ASS being present. Excavation works to be undertaken during construction of the seawater heat exchange are to be managed in accordance with an acid sulfate soil management plan prepared by Coffey.

The sub-surface profile of the site is summarised in Table 5.1.

Table 5.1: Stratigraphy

Depth (mbgl)	Subsurface Profile
From 0.0 to depths of 0.4 to 3.2	Fill material comprising sand with some silt and gravels. Glass, brick, concrete and tile fragments were observed in fill material at several locations. Coal and bitumen fragments were reportedly present in fill material in BH2 and BH4, however were not on the logs.
0.7 to 1.0	Natural clay was present in two locations in the north of the site.
0.6 to depth (>20 mbgl)	Sandstone bedrock, fresh to moderately weathered, medium strength, and medium to coarse grained. The degree of weathering decreased with depth.

mbgl – metres below ground level

The Auditor considers that the depth of fill and underlying stratigraphy have been adequately characterised in the areas investigated. Data gaps remain, which the RAP proposes to address by further investigation (discussed in Section 11).

5.2 Hydrogeology

Coffey (2016d) undertook a search of registered bore licences in April 2014. The closest bores were located greater than 500 m to the south (up gradient) and east (cross gradient) of the site.

Groundwater was not observed during borehole drilling undertaken by Coffey, however groundwater entered some bores overnight and was measured at a depth of 8.3 m to 12 mbgl in three bores (BH4, BH6 and BH8).

Groundwater monitoring wells were not installed by Coffey, however two existing wells (MW1 and MW2) were present on the eastern side of the former fuel bunker (Attachment 5, Appendix A). The wells were gauged and sampled on two occasions, in June 2014 and April 2016. The hydrogeology of the site based on these two wells is summarised in Table 5.2.

Table 5.2: Site-Specific Hydrogeology

Aspect	Details
Geology Investigated	Unknown
Depth to Water	Groundwater was present at depths of 1.9-2.4 mbgl in MW1

Table 5.2: Site-Specific Hydrogeology	
Aspect	**Details**
	and 3.5-4.8 mbgl in MW2
Phase Separated Hydrocarbon (PSH) presence and thickness	Coffey report that a sheen in the form of small oil globules was present in MW2
Hydraulic Parameters	Unknown
Interpreted Flow Direction	Not determined, however likely to be to the east to northeast towards Woolloomooloo Bay located 60 m east
Groundwater Quality	During the most recent monitoring event, groundwater was aerobic (DO 3.2-5.6 mg/L), neutral to slightly acidic (pH 5.8-6.8), mildly to moderately reducing (72-116 mV) and with low electrical conductivity (66-848 µS/cm). The groundwater parameters are largely consistent with the June 2014 results, however lower DO was reported (1.3-1.5 mg/L).

Coffey (2016b) assessed groundwater inflow into the fuel bunker in 2016. They installed water level loggers in the two monitoring wells, the fuel bunker and the sump for a 10 day period. The results indicate that water levels in the fuel bunker and monitoring wells show no significant response to tides. Rainfall was expected to contribute to groundwater entering the fuel bunker, however monitoring was undertaken over a relatively short period and significant rainfall did not occur during the monitoring period.

5.3 Auditor's Opinion

The Auditor considers the geology and hydrogeology conditions adequately known for the purposes of preparing a RAP. Further investigation of data gaps during remediation is proposed in the RAP.

6. EVALUATION OF QUALITY ASSURANCE AND QUALITY CONTROL

The Auditor has assessed the overall quality of the data by review of the information presented in the referenced reports, supplemented by field observations. This excludes reports prepared by EES and GHD which were reviewed in the Woodward-Clyde (1999) audit. The current audit has relied on the findings of the previous audit documented in the SAR as being an accurate review of the environmental assessments and remediation.

The Auditor's assessment follows in Tables 6.1 and 6.2.

Table 6.1: QA/QC – Sampling and Analysis Methodology Assessment

Sampling and Analysis Plan and Sampling Methodology	**Auditor's Opinion**
Data Quality Objectives (DQO) Coffey (2016d) did not specifically define DQOs. The report included a discussion of field and laboratory QA/QC indicators.	On the basis that the consultants have clearly stated the project objectives and have designed effective sampling strategies to achieve them, overall the Auditor considers that the omission of specific DQOs does not affect the outcome of the audit.
Sampling pattern and locations *Soil:* Investigation locations BH1-BH8 and BH2A were spaced to gain coverage of the majority of the site (Attachment 5, Appendix A). HA01-HA05 and BH02 (2016) were undertaken in the north of the site, targeting previous contamination identified in BH2 (2014) and BH4 (Attachment 5, Appendix A). *Groundwater:* Two existing groundwater monitoring wells (MW1 and MW2) were located on the eastern side of the fuel bunker in the pedestrian pathway along Lincoln Crescent (Attachment 5, Appendix A). *Indoor Air:* Samples were collected from within the fuel bunker via the southern tank hatch and northern tank hatch.	The Auditor notes that potential areas of concern were not investigated, including the fuel bunkers, pump room, substation, land bridge, areas surrounding the existing Art Gallery building, and the proposed seawater heat exchange area. Groundwater wells are located on the expected down gradient boundary of the fuel bunker, and therefore considered adequate. Indoor air sample locations are considered acceptable.
Sampling density *Soil:* The sampling density included eight sample points to provided site coverage and six targeted locations. The sampling density over approximately 2.2 ha (site area less existing Art Gallery) is less than the minimum recommended by EPA (1995) *Sampling Design Guidelines* (40 locations). The coverage provides a 95% confidence of detecting a residual hot spot of approximately 47 m diameter. *Groundwater*: A total of two groundwater wells (MW1 and MW2) were installed on the down gradient boundary of the site.	The low soil sampling density has resulted in data gaps that require further investigation, which is proposed in the RAP. In the Auditor's opinion the groundwater and indoor air sampling density was appropriate to identify contamination associated with the former fuel bunker.

Table 6.1: QA/QC – Sampling and Analysis Methodology Assessment	
Sampling and Analysis Plan and Sampling Methodology	**Auditor's Opinion**
Indoor Air: Two samples were collected from the fuel bunker (NT and ST).	
Sample depths Soil samples were collected and analysed from a range of depths, with the primary intervals being near surface (typically 0.2 mbgl), at 0.5 mbgl and 1 mbgl. Eighteen samples were collected, with fourteen comprising fill material and four underlying natural soil and bedrock.	In the Auditor's opinion, this sampling strategy was appropriate and adequate to characterise the primary material types present in the areas investigated.
Well construction Coffey report that groundwater monitoring wells MW1 and MW2 were installed by GHD prior to the Woodward-Clyde site audit in 1999. Well construction details were not available.	The wells are sufficient to provide an indication of the groundwater conditions at the site.
Sample collection method *Soil*: Sample collection was via solid stem auger (BH1-BH8) or hand auger (HA01-HA05 and BH02). Soils were collected from the auger flights. NMLC coring was used when sandstone bedrock was encountered. *Groundwater*: Wells were sampled by disposable bailer. Coffey report that low flow sampling was not used due to the low yield and slow recharge. The sampling method for the sump was not provided. *Indoor Air:* Samples were collected using Radiello passive-diffusive samplers and adsorbing cartridges. The samplers were suspended approximately 4 m below the hatches in the roof of the bunker. The samplers were deployed for 13 days.	Sample collection from the auger flights is not ideal as it can result in loss of volatiles and sample cross contamination. Given the key contaminants at the site are not volatile, this deficiency is not considered to be of great significance. Groundwater sampling by bailer is not ideal as it can lead to agitation of the water column and elevated dissolved oxygen readings. Given the results, this is not considered significant. The Radiello passive-sampler provides a semi-quantitative indoor air concentration. The sampling method is considered adequate given the concentrations reported relative to the adopted criteria (Section 9).
Decontamination procedures *Soil:* Re-used sampling equipment (hand auger) was decontaminated with a Decon 90 solution and rinsed with potable water between samples. *Groundwater*: Dedicated sampling equipment was used for each well. The interface probe was decontaminated between wells with a Decon 90 solution and rinsed with deionised water. *Indoor Air:* dedicated sampling equipment was used for each location.	Acceptable

Table 6.1: QA/QC – Sampling and Analysis Methodology Assessment	
Sampling and Analysis Plan and Sampling Methodology	**Auditor's Opinion**
Sample handling and containers Samples were placed into prepared and preserved sampling containers provided by the laboratory and chilled during storage and subsequent transport to the labs. Samples for asbestos analysis were placed in plastic zip-lock bags. Indoor air samples were collected by Radiello samplers.	Acceptable for soil and groundwater. The Radiello provides semi-quantitative results for air samples suitable for an initial site investigation.
Chain of Custody (COC) Completed chain of custody forms were provided in the report.	Acceptable
Detailed description of field screening protocols *Soil:* Field screening for volatiles was undertaken using a photoionisation detector (PID). Soil sub-samples were placed in sealed plastic bags and the headspace screened for VOCs. *Groundwater:* Field parameters were measured during well sampling. *Indoor air:* Field screening was not undertaken.	Acceptable
Calibration of field equipment The reports indicated that calibration of the PID was undertaken, however details of the methodology and frequency were not provided. Calibration of the groundwater quality meter was not discussed. Calibration certificates from the equipment supplier and field calibration records were not provided.	Although the PID calibration methodology and records were not provided, the PID readings were consistent with the laboratory analytical results and are therefore considered acceptable. Groundwater quality parameters were largely consistent between the two monitoring rounds, and are therefore considered acceptable.
Sampling logs Soil logs are provided within the report, indicating sample depth, PID readings and lithology. The logs do not report coal and bitumen in fill material, however sample descriptions in laboratory reports for asbestos analyses indicate *"bitumen like material"* is present in fill material. Groundwater field sampling records were not provided.	The soil logs appear to lack detail regarding fill material composition. Anthropogenic material may therefore be present at a greater density, and the composition may vary, from that reported. Groundwater parameters and observations were summarised in the reports, which is considered acceptable.

Table 6.2: QA/QC – Field and Lab Quality Assurance and Quality Control	
Field and Lab QA/QC	**Auditor's Opinion**
Field quality control samples Field quality control samples during soil sampling included trip blanks, trip spikes, rinsate blanks, field intra-laboratory and inter-laboratory duplicates. During groundwater sampling one intra-laboratory duplicate was collected, with a rinsate blank collected during the first round, and a trip spike and trip blank during the second round. No intra-laboratory duplicates were collected. An inter-laboratory duplicate was collected during indoor air sampling.	Acceptable
Field quality control results The results of field quality control samples were generally within appropriate limits. The following exceptions were noted: • RPDs for PAHs and TRH in soil intra-laboratory and inter-laboratory duplicates were above the accepted limit. Coffey reported that the elevated RPDs were typically in samples with low concentrations and indicated that soils were heterogeneous. • Zinc was detected in one of three rinsate blanks collected from the hand auger. • Low recovery was reported for one trip spike during the borehole investigation. Trip blank results were less than the PQL.	Overall, in the context of the dataset reported, the elevated RPD results are not considered significant and the field quality control results are acceptable.
NATA registered laboratory and NATA endorsed methods Laboratories used included: Eurofins | mgt (primary), SGS (indoor air primary), ASET (asbestos primary), Envirolab (secondary) and ALS (secondary). Laboratory certificates were NATA stamped.	Acceptable
Analytical methods Analytical methods were included in the laboratory test certificates.	Acceptable
Holding times Review of the COCs and laboratory certificates indicate that the holding times had been met. Coffey also reported that holding times have been met.	Acceptable
Practical Quantitation Limits (PQLs) *Soil:* PQLs were less than the threshold criteria for the contaminants of concern. *Groundwater:* The following trigger values were less than	*Soil:* Overall the soil PQLs are acceptable. *Groundwater*: The elevated PQLs were only marginally elevated above the trigger values and in the

Table 6.2: QA/QC – Field and Lab Quality Assurance and Quality Control	
Field and Lab QA/QC	**Auditor's Opinion**
the PQLs: • Anthracene 1 µg/L, trigger value 0.01 µg/L • Phenanthrene 1 µg/L, trigger value 0.6 µg/L • Benzo(a)pyrene 0.1 µg/L, trigger value 0.1 µg/L *Indoor Air:* PQLs were less than the threshold criteria.	context of the results reported, overall these discrepancies do not materially affect the outcome of the audit. *Indoor Air:* Acceptable
Laboratory quality control samples Laboratory quality control samples including laboratory control samples, matrix spikes, surrogate spikes, blanks, internal standards and duplicates were undertaken. During analysis of indoor air samples, quality control samples included blanks, spikes and duplicate spikes.	Acceptable
Laboratory quality control results The results of laboratory quality control samples were generally within appropriate limits, with the following exceptions: • A slightly elevated spike recovery was reported for copper (1 instance). • RPDs for metals (arsenic, chromium and lead) and PAHs in laboratory duplicates were elevated above control limits in soil analysis.	In the context of the dataset reported, the elevated RPDs are not considered significant and the laboratory quality control results are acceptable. The RPD results indicate that there is variability in metal and PAH concentrations within a sample, indicating that fill material is heterogeneous.
Data Quality Indicators (DQI) and Data Evaluation (completeness, comparability, representativeness, precision, accuracy) Coffey (2016d) did not define DQIs and did not undertake a formal QA/QC data evaluation against the five category areas. They did, however, conclude that *"…the data obtained is generally representative of subsurface conditions at the sampling locations. Overall, it is assessed that the results are acceptable for the purposes of this investigation"*.	An assessment of the data quality with respect to the five category areas has been undertaken by the Auditor and is summarised below.

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

- The data is likely to be representative of the conditions in the areas investigated.
- Given the data gaps noted, the data is not considered complete. Further investigation is proposed in the RAP, which is discussed in Section 11.
- There is a high degree of confidence that data is comparable as consistent sampling protocols were employed by Coffey.
- The primary laboratory provided sufficient information to conclude that data is of sufficient precision. Some of the RPDs for field and laboratory duplicates are above the desirable limit for PAHs and metals. Given the distribution of contamination, this is considered to be due to fill heterogeneity rather than field or laboratory procedures.
- The data is considered to be accurate.

7. ENVIRONMENTAL QUALITY CRITERIA

The Auditor has assessed **soil** data provided by Coffey in reference to criteria from National Environmental Protection Council (NEPC) *National Environmental Protection (Assessment of Site Contamination) Measure 1999*, as Amended 2013 (NEPM, 2013). Based on the proposed development, the Tier 1 (screening) criteria for 'recreational/public open space' and 'commercial/industrial' setting were referred to. The lower value was adopted to be conservative and for simplicity.

- Human Health Assessment
  - Health Based Investigation Levels (HIL C)
  - Soil Health Screening Levels (HSL D) for Vapour Intrusion. The most conservative criteria were adopted i.e. assumed depth to source <1 m and sand.
  - CRC CARE (2011) Direct Contact (HSL C and intrusive maintenance worker)
  - Asbestos criteria adopted was presence/absence.
- Terrestrial Ecological Assessment
  - Ecological Screening Levels (ESL public open space) assuming coarse soil.
  - Ecological Investigation Levels (EIL public open space). Site specific EILs have been derived using site specific pH data and the most conservative generic clay content and cation exchange capacity (CEC) values in the absence of site specific data. Added background concentration (ABC) were referenced from Olszowy et al (1995) (background concentration for high traffic, old suburbs in NSW). The pH value adopted was an average pH of 8.2 (range 7.8 to 8.4).
- Management Limits (ML commercial and industrial) assuming coarse soil.
- Aesthetics
  - The Auditor has considered the need for remediation based on the 'aesthetic' contamination as outlined in the NEPM (2013).

The Auditor has assessed the **groundwater** data provided by Coffey in reference to Tier 1 (screening) criteria for a 'commercial/industrial' setting from the following:

- Human Health Assessment
  - NEPM (2013) Groundwater Health Screening Levels (HSL D) for vapour intrusion (sand, 2 to <4 m)
- Ecological Assessment
  - Groundwater Investigation Levels (GILs) listed in NEPM (2013) for protection of aquatic ecosystems referenced in ANZECC (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. GILs provided are concentrations that, if exceeded, indicate a potential environmental problem at the point of use and 'trigger' further investigation. The marine water 95% level of protection was adopted. Some have been modified based on bioaccumulation or acute-toxicity or potential toxicity to particular species.

Assessment of groundwater has not included potential use as a resource. This is considered unlikely given the site is located in an area with a reticulated water system, the wells were slow to recharge and the closest registered bores are located over the 500 m to the south and east of the site. Assessment of direct contact and consumption of groundwater was therefore not undertaken.

The HSLs are not directly applicable for groundwater encountered at depths less than 2 m below the future development. The depth to groundwater in MW1 was measured at 2.37 mbgl in June 2014 and 1.86 mbgl in April 2016. The groundwater human health screening criteria in Table 7.1 have therefore also been adopted for human health assessment.

Table 7.1: Groundwater Screening Criteria

Chemical of Concern in Groundwater	Screening Criteria (µg/L)	Source
Benzene	1	ADWG (2011)
Toluene	800	ADWG (2011)
Ethylbenzene	300	ADWG (2011)
Total Xylenes	600	ADWG (2011)
Naphthalene	1.7	USEPA RSL (non-threshold) adjusted by a multiple of 10 to allow for the increase in lifetime risk of cancer
Benzo(a)pyrene	0.01	ADWG (2011)
Benzo(a)anthracene	0.18	USEPA RSL (non-threshold) adjusted by a multiple of 10 to allow for the increase in lifetime risk of cancer

The Auditor has assessed the **indoor air** data provided by Coffey to the following criteria for a Tier 1 (screening level) 'commercial/industrial' assessment as follows:

- CRC CARE (2011) Target Air Concentrations corresponding to HSL D

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

- Coffey did not adopt NEPM (2013) HSLs to screen groundwater data.
- Coffey adopted the mineral oil groundwater intervention value from Dutch Soil Remediation Circular (VROM, 2009).

8. EVALUATION OF SOIL ANALYTICAL RESULTS

Soil samples collected during the preliminary site investigation by Coffey (2016d) were analysed for a variety of contaminants including petroleum hydrocarbons, PAHs, asbestos, metals and pesticides. The results have been assessed against the environmental quality criteria discussed in Section 7. Soil sampling locations are shown as Attachment 5, Appendix A.

Table 8.1: Evaluation of Soil Analytical Results – Summary Table (mg/kg)

Analyte	n	Detections	Maximum	n > Human Health Screening Criteria (NEPM, 2013)	n > Terrestrial Ecological Screening Criteria (NEPM, 2013)
Asbestos	6	0	-	-	-
Arsenic	9	4	5.4	0	0
Cadmium	9	2	0.6	0	-
Total Chromium	9	9	41	0	0
Copper	9	9	70	0	0
Lead	9	9	180	0	0
Mercury (inorganic)	9	7	1.1	0	-
Nickel	9	5	31	0	0
Zinc	9	9	190	0	0
F1 (TRH C_6-C_{10} - BTEX)	18	0	<PQL	0	0
F2 (TRH >C_{10}-C_{16} - naphthalene)	18	0	<PQL	NL	0
F3 (TRH >C_{16}-C_{34})	18	6	**3,600**	**1**	**2**
F4 (TRH >C_{34}-C_{40})	18	2	570	0	0
BTEX	18	0	<PQL	0	0
Naphthalene	18	0	<PQL	NL	0
Total PAHs	18	12	**380**	**1**	-
Carcinogenic PAHs	18	10	**82**	**4**	-
Benzo(a)pyrene	18	10	**41**	-	**10**
OCP	9	0	<PQL	0	0
OPP	9	0	<PQL	0	-

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

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

- Impacted fill material was identified in the north of the site, located in a 0.5 m thick layer of fill material containing *"coal-like gravel"* above sandstone bedrock. The material was characterised by a strong hydrocarbon odour and marginally elevated PID readings (4.8 to 10.7 ppm, compared to background of 1.7 to 3.8 ppm), however no sheen or staining was

reported. The impacted material contained elevated PAH concentrations (BH1, BH4 and HA05) and TRH >C_{16}-C_{34} (BH4), with the highest concentrations reported in BH4 at a depth of 1 mbgl. Overlying fill material in BH1 and BH4 did not contain detectable PAH concentrations.

- A hydrocarbon odour was also reported in fill material from BH03, however soil samples were not scheduled for laboratory analysis and no additional investigation was undertaken in the area.
- PAHs were also identified in fill material in other areas of the site at lower concentrations. These detections were not associated with a hydrocarbon odour and were of material containing demolition waste, which the laboratory described as containing *"bitumen like material"*. The PAH concentrations reported were less than the human health criteria, however benzo(a)pyrene concentrations exceeded the ecological criteria.
- Volatile hydrocarbons (BTEXN and TRH C_6-C_{16}) and pesticides were not detected.
- Asbestos was not detected in samples analysed by the laboratory or observed in fill material during intrusive investigations. Fill material contained demolition waste material, such as glass, tile and brick, at investigation locations either side of the land bridge over the Cahill Expressway. In the Auditor's opinion, asbestos may be present in fill material given the low sampling density, the investigation methodology adopted limiting the ability to inspect the fill, the unknown source of the fill, the presence of demolition waste and gaps in site coverage.
- Metals concentrations in fill material were elevated above background concentrations in some instances, however were less than the adopted human health and ecological screening criteria. The highest concentrations were typically detected in fill material from BH6 and BH7, located immediately to the north of the existing Art Gallery building.

8.1 Auditor's Opinion

In the Auditor's opinion, the field observations of hydrocarbon impact in the north of the site are consistent with the analytical results. The results indicate that the impact is characterised by elevated concentrations of PAHs in material overlying sandstone bedrock. A review of the aerial photograph from 1943 indicates that this area was disturbed during construction and/or use of the adjacent fuel bunker and is a potential source of the contamination. The ground disturbance extended to the northeast and southeast of this area towards the fuel bunker. The contamination may therefore extend over this area.

Coffey (2016d) concluded that the contamination identified in the north of the site was *"…likely associated with coal and/or bitumen"*. The Auditor notes that *"coal-like gravel"* was recorded on the borehole logs in these samples. *"Bitumen like material"* was only reported by the laboratory in shallow samples of fill material that reported lower PAH concentrations. The Auditor therefore considers that the source of the contamination in the north of the site is related to the coal like gravel material overlying sandstone bedrock.

The Auditor notes that further investigation of the site is required to address data gaps identified in Section 6. Further site investigation is proposed in the RAP and is discussed further in Section 11.

9. EVALUATION OF INDOOR AIR AND ODOUR

9.1 Indoor Air

Indoor air samples were collected from the northern and southern tank hatches of the fuel bunker. The samples were analysed for BTEXN and TRH C_6-C_{16}, and the analytical results are summarised in Table 9.1.

Table 9.1: Indoor Air Results (µg/m³)

Chemical of Concern	Screening Criteria	Northern Hatch	Southern Hatch
Benzene	18	0.09	<PQL
Toluene	23,000	0.17	0.1
Ethylbenzene	5,900	<PQL	<PQL
Xylene	4000	<PQL	<PQL
Naphthalene	14	<PQL	<PQL
TRH C_6-C_{10}	3,200	<PQL	<PQL
TRH >C_{10}-C_{16}	2,300	0.066	0.052

<PQL Less than the practical quantitation limit

In assessing the analytical results, the Auditor notes that the indoor air concentrations within the fuel bunker were less than the adopted screening criteria, typically by a number of orders of magnitude.

9.2 Odour

A condition of the Woodward-Clyde (1999) audit was that *"odour from remaining oil impregnated within the structure should also be considered with appropriate management incorporated into development"*.

An odour assessment of the fuel bunker was undertaken by Hibbs in 2016. Hibbs (2016) report that the fuel bunker did not present noticeable chemical odours at the time of the inspection. Sampling of accumulated water within the fuel bunker by Hibbs reported TRH, BTEX and PAHs less than the PQL. The analytical results were not provided to the Auditor, which lowers the reliability of the Hibbs conclusion.

Coffey (2016d) concluded that *"air conditioning and ventilation of the proposed Sydney Modern buildings would further reduce the likelihood of odour issues"*.

The Auditor considers that significant contamination and odours are unlikely to be present based on the previous remediation undertaken, the water analytical results, and the ambient air results.

9.3 Auditor's Opinion

Although the ambient air sampling method adopted by Coffey is considered semi-quantitative, the analytical results were two to five orders of magnitude below the screening criteria. The Auditor considers this an adequate margin to account for the semi-quantitative nature of the sampling method. Coffey (2016e) also note that *"air conditioning and ventilation of the proposed Sydney Modern buildings would further reduce the likelihood of odour issues"*.

Based on the ambient air data and Hibbs observations regarding the absence of notable chemical odours, the Auditor considers that aesthetic issues and indoor air do not require further consideration based on future commercial/industrial site use.

10. EVALUATION OF GROUNDWATER ANALYTICAL RESULTS

Groundwater samples were collected from two groundwater monitoring wells located to the east of the fuel bunker (MW1 and MW2) in June 2014 and April 2016 (Attachment 5, Appendix A). Water within the pump room sump located to the north of the fuel bunker was also sampled during the June 2014 and April 2016 monitoring events. The analytical results are summarised below in Table 10.1.

Table 10.1: Evaluation of Water Analytical Results – Summary Table (µg/L)

Analyte	June 2014				April 2016			
	n	Detections	Maximum	n > Criteria	n	Detections	Maximum	n > Criteria
TRH C_6-C_{10}	3	1	20	0	3	0	<PQL	0
TRH >C_{10}-C_{16}	3	2	2,000	NL	3	3	2,200	NL
TRH >C_{16}-C_{34}	3	1	1,800	-	3	2	4,300	-
TRH >C_{34}-C_{40}	3	1	400	-	3	1	800	-
BTEX	0	-	-	-	3	0	<PQL	0
Benzo(a)pyrene	3	0	<PQL	0	3	0	<PQL	0
Benzo(a) anthracene	3	0	<PQL	0	3	0	<PQL	0
Naphthalene	3	2	32	0	3	1	7	0
Anthracene	3	1	**1**	**1**	3	1	**5**	**1**
Fluoranthene	3	0	<PQL	0	3	0	<PQL	0
Phenanthrene	3	1	**26**	**1**	3	1	**27**	**1**

n	number of samples
-	No criteria available/used
<PQL	Less than the practical quantitation limit
Criteria	Tier 1 criteria adopted are discussed in Section 7
NL	Non-limiting
Bold	Exceeds the criteria

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

- Monitoring well MW2 had a sheen in the form of oil globules and a hydrocarbon odour during the 2014 and 2016 monitoring rounds. The well also had the highest TRH and PAH concentrations, with concentrations of anthracene and phenanthrene exceeding the ecological criteria (0.01 µg/L and 0.6 µg/L, respectively).
- Concentrations of volatile hydrocarbons (BTEX and TRH C_6-C_{14}) were typically not detected above the PQL. The exception was naphthalene in MW2, which was below the NEPM (2013) HSL (non-limiting) and ANZECC (2000) GIL (50 µg/L). The naphthalene concentration exceeded the USEPA RSL (1.7 µg/L) for groundwater less than 2 mbgl, however this does not apply to MW2 which had a standing water level (SWL) of 3.5-4.8 mbgl.
- Samples collected from the pump room sump and within the fuel bunker were typically low or less than the PQL.

Hibbs (2016) sampled approximately 7 megalitres of water that had accumulated within the fuel bunker in 2016. Hibbs report that samples were analysed for TRH, BTEX and PAHs and concentrations were less than the PQL. Further details were not provided.

10.1 Auditor's Opinion

In the Auditor's opinion, the groundwater monitoring undertaken was adequate to assess potential impacts from the former fuel bunker. The groundwater monitoring indicates that oil from the fuel bunker has impacted downgradient groundwater. Groundwater beneath the oil bunker has not been assessed, however is also likely to be impacted. The source of the contamination was removed when the fuel bunker was drained in 1993 and remediated in 1999, however the Woodward-Clyde (1999) audit concluded *"…that minor oil seeps from joints and boltholes may occur in the future"*.

The risk to future occupants of the fuel bunker following development from vapour intrusion is considered low. Naphthalene concentrations detected in MW2 were less than the HSL and concentrations in MW1 were less than the PQL. Ambient air in the fuel bunker was assessed by Coffey and did not identify a vapour inhalation risk (discussed in Section 9).

Groundwater in the remainder of the site has not been investigated. A potential source of contamination to groundwater was identified in fill material containing elevated TRH and PAH concentrations in the north of the site. Further investigation and remediation of the impacted fill material is proposed in the RAP, which is discussed in Section 11.

11. EVALUATION OF REMEDIATION

11.1 Previous Remediation of the Fuel Bunker

Previous investigations and remediation/validation of the fuel bunker was undertaken between 1995 and 1999. The consultant reports detailing the fuel bunker investigations and remediation/validation were mostly not provided to the Auditor, however a summary was included in the Woodward-Clyde (1999) SAR. The Auditor has relied on the summary and conclusions of the Woodward-Clyde (1999) audit.

Woodward-Clyde (1999) report that investigations were undertaken within the bunker and in immediately surrounding areas to the north, east and south. Residual oil was identified in the sub-floor drainage system and within the fabric of the structure, such as joints and bolt holes, which presented a potential risk to future occupants. Contamination was also identified in an isolated area beneath the concrete slab (identified in 1 of 95 locations) and beneath the footpath on the western side of Lincoln Crescent.

Remediation was undertaken to remove residual oil from the sub-floor drainage system, floor slab joints, bolt holes and walls. Residual oil was sealed into the structure with grout, and two groundwater monitoring wells were installed on the eastern boundary of the fuel bunker to assess the potential for offsite migration. An oil/water separation system was to be installed in the pump room to treat water from the drainage system prior to disposal.

The investigation and validation of the fuel bunker were undertaken in accordance with guidelines in force at the time. Since this time, the DEC (2006) *Guidelines for the NSW Site Auditor Scheme* and NEPM (2013) have been released. Validation of remediation undertaken in the fuel bunker was qualitative and based on aesthetic issues, such as oil seepage from the structure. Woodward-Clyde (1999) reported that *"The criteria to show that clean-up of the structure has been successful are qualitative and based upon visual inspection of results outlining the removal of oil, such that it does not enter the interior of the bunker and come into contact with potential occupiers"*. The conclusion of the Woodward-Clyde (1999) audit that the fuel bunker was suitable for commercial/industrial use is therefore considered to remain valid, with the exception of indoor air which was assessed by Coffey and is discussed in Section 9.

Woodward-Clyde (1999) report that investigation of conditions beneath the fuel bunker found limited fuel oil contamination. Woodward-Clyde (1999) concluded that *"the land beneath the bunkers requires the ongoing monitoring of groundwater to confirm that the source of oil has substantially been removed and will not continue to provide a source of off-site migration"*. Groundwater monitoring undertaken by Coffey in 2014 and 2016 is discussed in Section 10.

Soil surrounding the fuel bunker was assessed by EES in 1995, including twelve boreholes (BH1-BH12) to the north, east and south of the bunker (Attachment 6, Appendix A). The report was not provided to the Auditor for review, however a summary of the analytical results was provided by GHD (1997). The summarised results indicate that hydrocarbon contamination was present in BH4 and BH12 associated with a pipe in the footpath adjacent to Lincoln Crescent. The area was subsequently remediated and validated by EES (1996). The footpath area was excavated to sandstone at a depth of 2-2.5 mbgl and validation samples were collected from the walls and floor of the excavation. Residual hydrocarbon contamination was identified in the eastern wall of the excavation adjacent to electrical services, however further excavation of the contamination was not considered feasible. The maximum TPH concentrations reported in samples from boreholes and validation samples from remedial excavations were less than the CRC CARE (2010) HSL for direct contact by intrusive maintenance workers.

Other investigation locations by EES to the north (BH7 and BH8) and south (BH11) of the fuel bunker had low TPH concentrations, marginally above the laboratory detection limit. Further investigation or remediation of these areas does not appear to have been undertaken by Coffey or others.

11.2 Conceptual Site Model

A conceptual site model (CSM) is a representation of the source, pathway and receptor linkages at a site. The RAP includes a CSM, which is summarised in Table 11.1 and provides the Auditor's review. An illustrated CSM is provided as Attachment 7 in Appendix A.

Table 11.1: Review of the Conceptual Site Model

Element of CSM	Consultant	Auditor Opinion
Contaminant source and mechanism	Pesticide application during garden maintenance Placement of uncontrolled fill material during previous site development Storage of oil within fuel bunker Potential leaks from electrical equipment in the naval substation Degradation of hazardous building materials	The potential contaminant sources have been adequately identified. Contaminants of concern are discussed in Section 4 of this SAR.
Affected media	Soil, groundwater and surface water in Woolloomooloo Bay	Indoor air within the fuel bunker may also be affected and has been assessed by Coffey (discussed in Section 9 of this SAR). Soil and groundwater on the site have been assessed, however further investigation of soil is required during remediation (discussed in Table 11.2). Assessment of groundwater will be required if a potential source is identified. Surface water assessment of Woolloomooloo Bay has not been undertaken and is not proposed. This is considered acceptable based on the groundwater concentrations reported (Section 10 of this SAR).
Receptor identification	Site users, construction workers, maintenance workers, and surface water ecosystems	Considered adequate
Exposure pathways	Direct dermal contact, ingestion and vapour inhalation	Considered adequate. Groundwater extraction for beneficial use is not considered.

Table 11.1: Review of the Conceptual Site Model		
Element of CSM	**Consultant**	**Auditor Opinion**
Presence of preferential pathways for contaminant movement	Not discussed in the RAP, however stormwater drains on the site were identified as a pathway by which contaminated groundwater could reach Woolloomooloo Bay.	Services in Lincoln Crescent may also act as preferential pathways for groundwater migration. There is a low potential for preferential pathways for vapour inhalation within the fuel bunker given that residual oil is isolated within the concrete structure.
Evaluation of data gaps	Not discussed in the RAP	Data gaps have been identified and will be addressed during remediation and validation of the site. This is discussed further in Table 11.2.

11.3 Remediation Required

Based on the investigations completed by Coffey and previous investigation and remediation summarised in Woodward-Clyde (1999), the RAP (Coffey, 2016e) identified one area of the site requiring remediation. The remedial area is shown in Attachment 5 in Appendix A and targets elevated TRH and PAH concentrations and hydrocarbon odours in soil. Given the low sampling density in other areas of the site, validation is required in areas not previously assessed.

The Auditor has assessed the RAP (Coffey, 2016e) by comparison with the checklist included in OEH (2011) *Guidelines for Consultants Reporting on Contaminated Sites*, as detailed in Table 11.2.

Table 11.2: Evaluation of Remedial Action Plan	
Remedial Action Plan	**Auditor Comments**
Remedial Goal The RAP defines the goal as *"...to manage identified and discovered contamination so that the site is suitable for the proposed project (comprising both open space and commercial land uses)…"*.	In the Auditor's opinion, this goal is considered appropriate.
Discussion of the extent of remediation required The remedial area is centred on boreholes BH2 and BH4 in the north of the site (Attachment 5, Appendix A). The RAP estimated the remedial area to be 12 m by 25 m, and extending to the top of sandstone at 1.1-2.2 mbgl. The RAP noted that *"the odorous soils may... be present in discrete pockets"*. Further investigation of other areas of the site, and potentially remediation, is required. These	The Auditor notes that the contaminated material may extend outside of the remedial area defined by Coffey. The contamination (if identified) should be remediated and validated in accordance with the RAP. The areas requiring further investigation are considered appropriate.

Table 11.2: Evaluation of Remedial Action Plan	
Remedial Action Plan	**Auditor Comments**
are considered to include: • BH3 where odorous soils were observed. • Areas of the site around the fuel bunker. • Area between the remedial area and fuel bunker that was disturbed during quarrying of the fuel bunker area. • The former naval electrical substation located to the north of the fuel bunker pump house. • The seawater heat exchange area. Assessment of soil present on the land bridge over the Cahill Expressway and above the fuel bunker is not proposed in the RAP as this material will be removed to underlying concrete prior to development.	
Additional Investigations Re-sampling the area at and around **BH3** will be undertaken to assess hydrocarbon odours noted on the borehole log. Boreholes or test pits will be excavated at 2-5 m distance from BH3. Proposed locations are shown on Attachment 5 in Appendix A. Samples will be collected at approximately 0.5 to 1 m depth intervals and analysed for metals, TRH, BTEX and PAHs. The **former disturbed area** between the remedial area and fuel bunker (orange area on Attachment 5, Appendix A) is estimated to be 800 m^2. Samples will be collected on a 10 m grid, which equates to 8 samples. **General site areas** that have not previously been assessed are estimated to comprise approximately 1.05 ha. A minimum of 22 sampling locations is proposed, with 1-2 samples analysed per location depending on the fill thickness and composition. The proposed sample locations are shown on Attachment 5 in Appendix A. Samples are to be analysed for TRH, PAHs, BTEXN and metals, with 50% of samples additionally analysed for phenols, OCPs, OPPs and PCBs. Asbestos is to be analysed if evidence of building rubble or ACM is present in fill material. The former naval **electrical substation** located adjacent to the pump room (as opposed to the one abutting the northern site boundary) will be sampled following demolition, with two shallow	The additional investigations are considered to address the data gaps identified in the CSM.

Table 11.2: Evaluation of Remedial Action Plan	
Remedial Action Plan	**Auditor Comments**
samples collected beneath the floor slab (<0.5 mbgl) and analysed for TRH and PCBs.	
Remedial Options Remedial options assessed were based on the hierarchy in NEPM (2013) preferred hierarchy and included: • Onsite treatment. • Offsite treatment and re-use onsite. • Consolidation and isolation on site. • Offsite disposal. Where remediation would have no net environmental benefit or would have a net adverse effect, implementation of a management strategy can be considered.	The Auditor considers that an appropriate range of options were considered.
Selected Preferred Option and Rationale The selected preferred option was excavation and offsite disposal. The option was selected given that the majority of the site will require removal of fill material and soil to allow construction of new buildings and infrastructure.	The Auditor considers the preferred option is appropriate and compatible with the proposed development and site use.
Proposed Validation Validation samples will be collected from the **remedial excavation** at a density of 1/100 m^2 from the base and 1/10 m laterally (2/10 m if the excavation is >1.5 m deep). Validation samples will be analysed for TRH, PAHs and lead. Field observations and screening with a PID will be undertaken to confirm validation. The **fuel bunker** will be visually assessed for evidence of oil seeps, as required by Woodward-Clyde (1999). Soil excavated and re-used within the **seawater heat exchange** area will be assessed at a rate of 1/100 m^3 and analysed for TRH, PAHs, BTEXN and metals, with 50% of samples additionally analysed for phenols, OCPs, OPPs and PCBs. Asbestos is to be analysed if evidence of building rubble or ACM is present in fill material. Other remediation areas identified during site validation will be sampled as per the remedial excavation targeting the northern area of the site (BH2 and BH4). The analytes are will be determined based on the source of the contamination, however would include TRH,	The Auditor notes that the sampling density proposed for general site areas is the minimum required based on the NSW EPA (1995) *Sampling Design Guidelines*. This is acceptable if field and laboratory results are consistent across the site. A higher sampling density will be required where contamination and/or differing site conditions are observed. Imported material must either be VENM, ENM or be classified under a Resource Recovery Exemption. The density of testing would need to be commensurate with the documentation provided and the consistency of the results. ENM should additionally be analysed for asbestos.

Table 11.2: Evaluation of Remedial Action Plan	
Remedial Action Plan	**Auditor Comments**
PAHs and lead as a minimum. **Excavated material re-used on the site** is to be sampled at a rate of 1/25 m^3 for small volumes (<250 m^3), and minimum of 10 samples collected from larger volumes of material assuming low heterogeneity (>250 m^3). Samples are to be analysed for TRH, BTEX, PAHs and metals. If material contains evidence of building rubble or ACM it will be disposed offsite. **Imported material** will be inspected by the environmental consultant at the source site and upon delivery to site to confirm consistency. Excavated natural material (ENM) will be assessed as per the ENM Order 2014. Virgin excavated natural material (VENM) material will be sampled at the source site, with two samples collected and analysed for metals, TPH, BTEX and PAHs.	
Interim Site Management Plan (before remediation) Not discussed in the RAP.	The Auditor considers that interim site management is not required. Contaminated material requiring remediation is located at a depth of approximately 1-1.5 mbgl and does not present a risk to site users under current conditions.
Unexpected Finds Appendix A of the RAP includes the Coffey '*Unexpected Finds Procedure, Sydney Modern Project, Art Gallery Road, Sydney, NSW'*, dated 1 August 2016 (the UFP). The UFP includes a summary of expected subsurface conditions, examples of unexpected finds and procedures to follow to manage the unexpected find.	In the Auditor's opinion, the procedure for handling unexpected finds, which includes stopping work and assessing the risk is appropriate and practical and can be implemented within the proposed remediation strategy.
Site Management Plan (operation phase) Section 11 of the RAP includes an outline of the environmental management plan for the remediation phase. The plan discusses air emissions, dust, noise, soil management, residual oil in the fuel bunker, water management, traffic and occupation health and safety (OH&S). The RAP reports that a separate construction management plan (CMP), acid sulfate soil management plan and site safety plan (SSP) are to be (or have been) prepared for the site.	Considered adequate. A CMP prepared by TPP (2016) includes further details regarding site management during remediation and development. The acid sulfate soil management plan prepared by Coffey (2016c) provides guidance on the assessment and management of ASS during construction. An air quality assessment report (Wilkinson Murray, 2016) was prepared for the site, which recommended that an Air Quality & Odour Management Plan (AQOMP) be prepared.

Table 11.2: Evaluation of Remedial Action Plan	
Remedial Action Plan	**Auditor Comments**
Contingency Plan if Selected Remedial Strategy Fails The RAP identifies two scenarios where contingency planning would be required, including: • Contamination is identified extending outside of the planned remedial excavation. • Material has a higher waste classification than general solid waste (i.e. restricted solid waste or hazardous waste). An addendum to the RAP would be provided in the event an unexpected occurrence results in the remediation objectives not being met. The UFP presents a procedure to follow in the event of an unexpected find of contamination.	Strategies to address the identified contingency planning scenarios where were not included in the RAP. With respect to the first point, the remedial strategy has a low risk of failure as validation failure would lead to further excavation. As for the second point, a higher waste classification has the potential to add significantly to project cost and timing.
Contingency Plans to Respond to site Incidents Not discussed in the RAP.	The Auditor notes that the RAP includes an UFP as Appendix A. The UFP provides examples of unexpected finds and procedures to follow to manage the unexpected find. The UFP has been reviewed and is considered acceptable. Contingency plans to respond to other site incidents were not provided in the RAP.
Remediation Schedule and Hours of Operation The hours of operation were provided and were reported to be in accordance with the Department of Planning and EPA requirements. An indicative project duration was not provided.	The CMP (TPP, 2016) reports that the construction duration is expected to be 40 months. Considered acceptable.
Licence and Approvals The RAP lists the following: • Remediation is category 1 in accordance with Clause 9(e)(ix) of SEPP 55 given that the site is situated within a "scenic area" or "scenic protection area" by virtue of Clauses 58A and 58B of Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005 which nominates the site as within the "Sydney Opera House buffer zone". • Remediation is part of site redevelopment of which approval is sought through a State Significant Development Application (SSDA 6471 Sydney Modern). • Waste disposal must be undertaken at an	Considered acceptable.

Table 11.2: Evaluation of Remedial Action Plan	
Remedial Action Plan	**Auditor Comments**
appropriately licenced waste facility. • Water accumulated in excavations may require disposal to the sewerage system via a trade waste approval or stormwater system with Council approval. The RAP considered the proposed remediation was not classified as designated development in accordance with Schedule 3 of the NSW Environmental Planning and Assessment Regulation 2000.	
Contacts/Community Relations Contact details for the Art Gallery of NSW project manager, remediation contractor, construction contractor and environmental contractor were not included in the RAP. Community consultation is not proposed, however the RAP notes that the management measures will ensure the impact on the surrounding community is controlled.	The CMP includes further information regarding community and stakeholder management, and notes that a strategy will be developed. Considered acceptable.
Staged Progress Reporting Staged progress reporting is not proposed in the RAP.	Considered acceptable.
Long-term environmental management plan (EMP) A long-term EMP was not proposed by the RAP.	Long-term management of the site is unlikely to be required based on the contamination identified, the remediation proposed and the end land use.

11.4 Auditor's Opinion

In the Auditors' opinion, the proposed remediation works should be able to ensure that the site is suitable for the proposed land uses through the removal of impacted fill. Successful validation will be required to confirm this.

12. CONTAMINATION MIGRATION POTENTIAL

Fill material containing hydrocarbon odours and elevated concentrations of TRH and PAHs has been identified in the north of the site. The contamination was identified at a depth of approximately 1-1.5 mbgl in material described as *"coal-like gravel"*. Remediation to remove the contaminated material is proposed. Successful remediation and validation will limit the potential for future migration of contamination.

Fill material in other areas of the site was found to contain anthropogenic material and TRH and PAH concentrations less than the adopted criteria. The site is currently largely sealed with grass and vegetation, limiting the potential for migration of the low level contamination identified. The site investigations to date have been undertaken at a low density, however further investigation is proposed in the RAP. Development of the site will result in removal of large areas of fill material for construction of buildings and surrounding landscaped areas. The proposed development will further limit the low potential for contamination migration from fill material via dust or surface water.

The potential for migration of contamination from the fuel bunker was assessed in the Woodward-Clyde (1999) audit, which concluded *"…that impacts on the Harbour are likely to be minimal based on the concentrations identified…"* and *"this assessment would be confirmed by the proposed ongoing groundwater monitoring program"*. Results of ongoing monitoring were not provided to the Auditor, however groundwater monitoring was subsequently undertaken by Coffey (discussed in Section 10).

Assessment of groundwater conditions downgradient of the fuel bunker was undertaken by Coffey in 2014 and 2016. They identified elevated concentrations of TRH and PAHs, with concentrations of anthracene and phenanthrene exceeding the adopted ecological criteria. Coffey (2016a) concluded that *"based on the concentrations reported in MW2 … and the distance to the receiving water body, it is considered unlikely that the hydrocarbon impact detected during the current investigation would cause environmental impact to Woolloomooloo Bay"*.

In the Auditor's opinion, the groundwater contamination identified downgradient of the fuel bunker is considered unlikely to migrate to the downgradient receptor given that: previous remediation of the fuel bunker has removed the source of contamination; contaminant concentrations were related to oil globules identified in MW2 that would have a low potential to migrate; and dissolved phase contamination is likely to attenuate given the distance to the receptor.

There is little potential for future migration given the historical remedial works undertaken and the proposed remediation and redevelopment of the site.

13. ASSESSMENT OF RISK

Based on assessment of results against relevant guidelines and consideration of the overall investigation and proposed remediation, it is the Auditor's opinion that implementation of the RAP should result in a site that presents a low risk to site users. This is to be confirmed by successful validation.

Contaminants within the groundwater are not likely to pose a risk to human health as the impacts are mostly localised and abstraction and use on-site is not expected.

The Auditor considers that there is a risk of undetected contamination given the low sampling density achieved to date, however further investigation is proposed in the RAP. Contamination identified during redevelopment will be managed by the RAP and UFP.

14. COMPLIANCE WITH REGULATORY GUIDELINES AND DIRECTIONS

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

The investigation was generally conducted in accordance with SEPP 55 Guidelines and reported in accordance with the OEH (2011) *Guidelines for Consultants Reporting on Contaminated Sites*. The EPA's *Checklist for Site Auditors using the EPA Guidelines for the NSW Site Auditor Scheme 1998* (December 1999) has also been referred to.

The Audit is a requirement of the SEARs, application number SSD 6471, issued 21 May 2014 and last modified 8 June 2016. Key Issue 8 of the SEARs relates to contamination and requires a SAS and accompanying SAR as follows:

> *"The RAP* [remedial action plan] *must be accompanied by a Site Audit Statement prepared by a NSW EPA accredited site auditor certifying that the site can be made suitable for the proposed use(s)".*

This SAR and SAS were prepared to comply with the Key Issue.

The Woodward-Clyde (1999) audit concluded that the site was suitable for commercial/industrial use, subject to ongoing groundwater monitoring to *"…confirm that the source of oil has substantially been removed and will not continue to provide a source for off-site migration"*. The results of ongoing groundwater monitoring were not provided to the Auditor and it is not known if the monitoring was undertaken. Coffey undertook groundwater monitoring in 2014 and 2016 to assess groundwater contamination in relation to the former bunker.

15. CONCLUSIONS AND RECOMMENDATIONS

The RAP (Coffey, 2016e) was prepared with the objective to *"describe appropriate measures by which site contamination can be managed so that the site is suitable for the proposed project (comprising both open space and commercial land uses), in accordance with planning guidelines and guidelines endorsed by NSW EPA"*.

Based on the information presented in the reports reviewed (as listed in Section 1) and observations made on site, and following the Decision-Making Process for Assessing Urban Redevelopment Sites in DEC (2006) *Guidelines for the NSW Site Auditor Scheme*, the Auditor concludes that the site can be made suitable for the proposed use, that is 'commercial/industrial' and 'open space', if the site is remediated in accordance with the following remedial action plan:

- 'Art Gallery of NSW, Remedial Action Plan, Art Gallery of NSW Expansion - Sydney Modern Project, Art Gallery Road, Sydney, NSW', 14 November 2016, Coffey Geotechnics Pty Ltd.

And subject to compliance with the following conditions:

1. Groundwater is not abstracted from the site for beneficial use.
2. A Section A site audit statement is prepared at the completion of remediation and validation certifying suitability for the proposed use.

16. OTHER RELEVANT INFORMATION

This Audit was conducted on the behalf of the Art Gallery of New South Wales for the purpose of assessing the suitability and appropriateness of a remedial action plan (RAP), i.e. a "Site Audit" as defined in Section 4 (1) (b) (v) of the CLM Act.

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

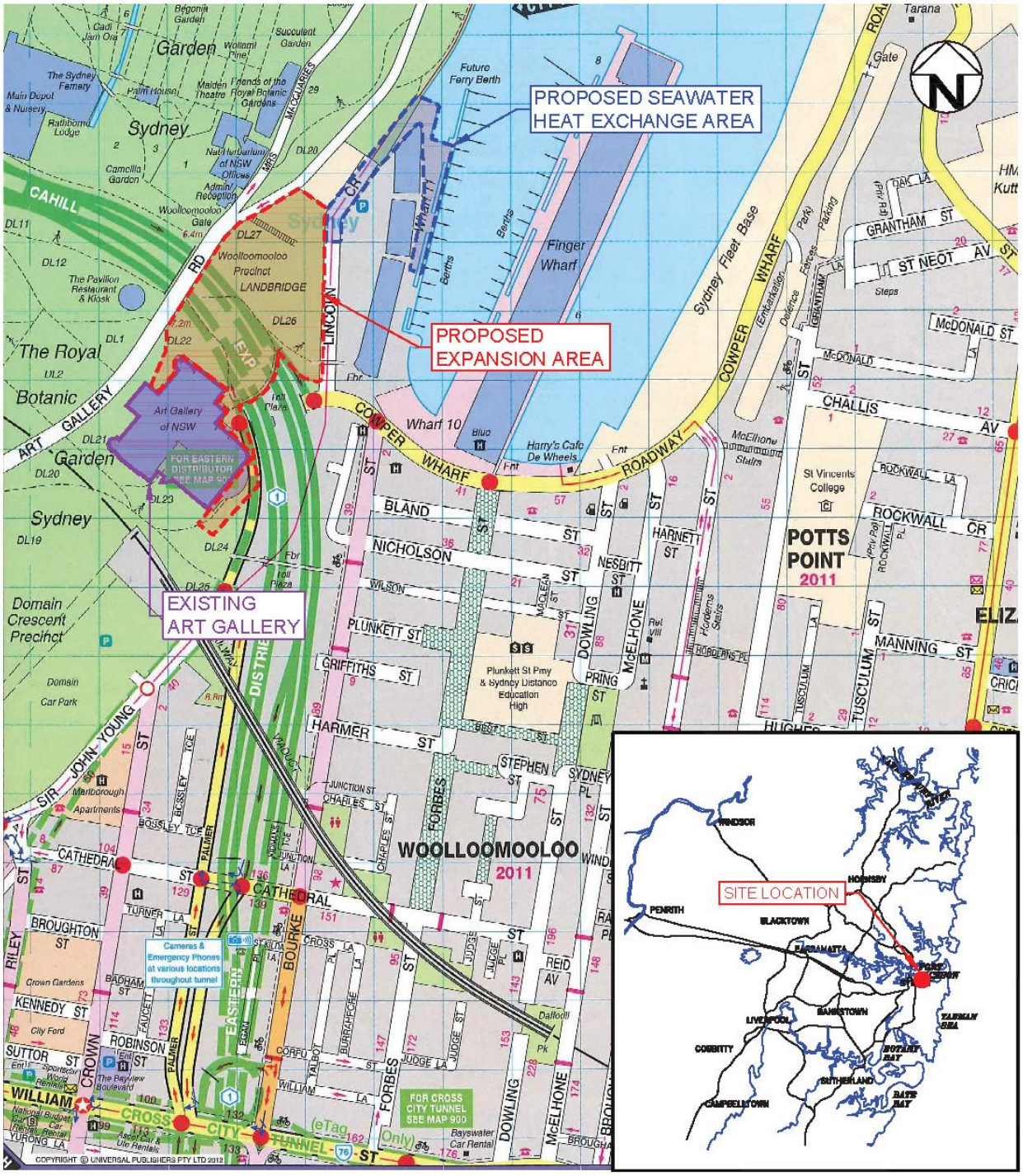
The Auditor has relied on the documents referenced in Section 1 of the Site Audit Report in preparing the Auditors' opinion. If the Auditor is unable to rely on any of those documents, the conclusions of the audit could change.

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

APPENDIX A
ATTACHMENTS

Attachment 1: Site Location
Attachment 2: Site Survey
Attachment 3: Proposed Development
Attachment 4: Seawater Heat Exchange
Attachment 5: Site Investigation and Remediation Locations
Attachment 6: EES Investigation Locations
Attachment 7: Conceptual Site Model

Attachment 1: Site Location



GENERAL AREA MAP

SOURCE:UBD STREET DIRECTORY GREGORYS SYDNEY, NEW SOUTH WALES 48TH EDITION, 2013, MAP:J

50 0 50 100 150 200 250

Scale (metres) 1:5000

drawn	DH / AW
approved	-
date	27 / 07 / 16
scale	AS SHOWN
original size	A4

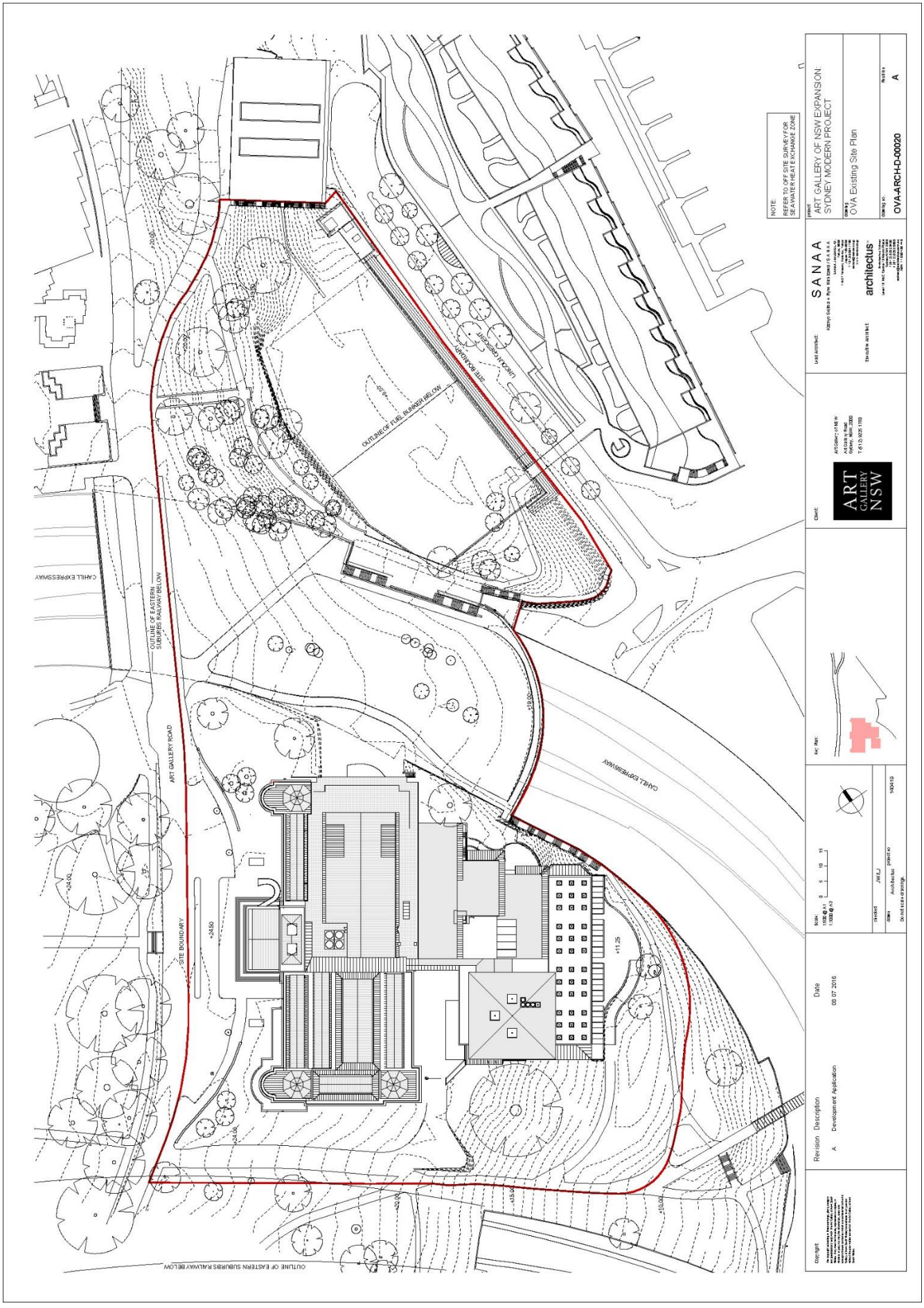
coffey
A TETRA TECH COMPANY

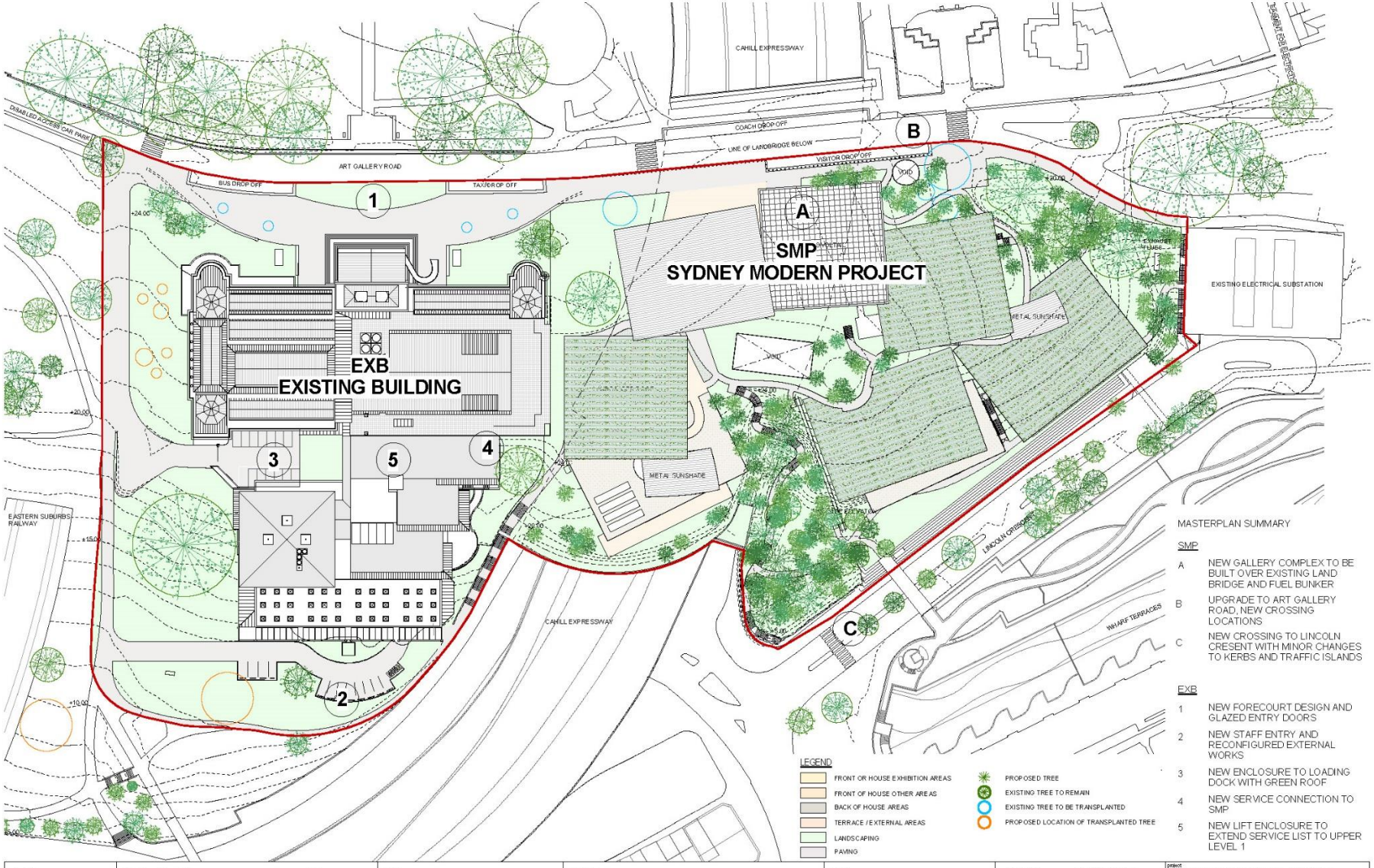
client:	ART GALLERY OF NSW
project:	REMEDIAL ACTION PLAN SYDNEY MODERN PROJECT ART GALLERY ROAD, SYDNEY, NSW
title:	SITE LOCATION PLAN

project no:	figure no:	rev:
GEOTLCOV25037AC-R03B	FIGURE 1	A

PLOT DATE: 27/07/2016 9:29:57 AM DWG FILE: F:\GEOTECH\NCS\1.PROJECTS\GEOTLCOV\25037AC ART GALLERY NSW CONTAMINATION ASSESSMENT\DRAWINGS\GEOTLCOV25037AC-R03B.DWG

Attachment 2: Site Survey





MASTERPLAN SUMMARY

SMP

- A — NEW GALLERY COMPLEX TO BE BUILT OVER EXISTING LAND BRIDGE AND FUEL BUNKER
- B — UPGRADE TO ART GALLERY ROAD, NEW CROSSING LOCATIONS
- C — NEW CROSSING TO LINCOLN CRESENT WITH MINOR CHANGES TO KERBS AND TRAFFIC ISLANDS

EXB

1. NEW FORECOURT DESIGN AND GLAZED ENTRY DOORS
2. NEW STAFF ENTRY AND RECONFIGURED EXTERNAL WORKS
3. NEW ENCLOSURE TO LOADING DOCK WITH GREEN ROOF
4. NEW SERVICE CONNECTION TO SMP
5. NEW LIFT ENCLOSURE TO EXTEND SERVICE LIST TO UPPER LEVEL 1

LEGEND

- FRONT OR HOUSE EXHIBITION AREAS
- FRONT OF HOUSE OTHER AREAS
- BACK OF HOUSE AREAS
- TERRACE / EXTERNAL AREAS
- LANDSCAPING
- PAVING
- PROPOSED TREE
- EXISTING TREE TO REMAIN
- EXISTING TREE TO BE TRANSPLANTED
- PROPOSED LOCATION OF TRANSPLANTED TREE

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Revision	Description	Date
A	Development Application	06 07 2016

Scale: 1500 @ A1, 1:1000 @ A3 (0 5 10 15)

checked JW/LJ

drawn Architectus project no 140419

Do not scale drawings.

Key Plan:

Client: ART GALLERY NSW
Art Gallery of NSW
Art Gallery Road
Sydney, NSW, 2000
T (61 2) 9225 1788

Lead Architect: SANAA
Kazuyo Sejima + Ryue Nishizawa / S A N A A
SANAA Architects Co.
1-6-27 Yanaka, Taito-ku, Tokyo
Japan 110-0001
T (81 3) 3821 1181
F (81 3) 3821 1182
sanaa@sanaa.co.jp
www.sanaa.co.jp

Executive Architect: architectus
Architectus Sydney
Level 18 MLC Centre 19 Martin Place
Sydney NSW 2000 Australia
T (61 2) 8252 8400
F (61 2) 8252 8600
sydney@architectus.com.au
ABN 11 000 012 847

project: ART GALLERY OF NSW EXPANSION: SYDNEY MODERN PROJECT

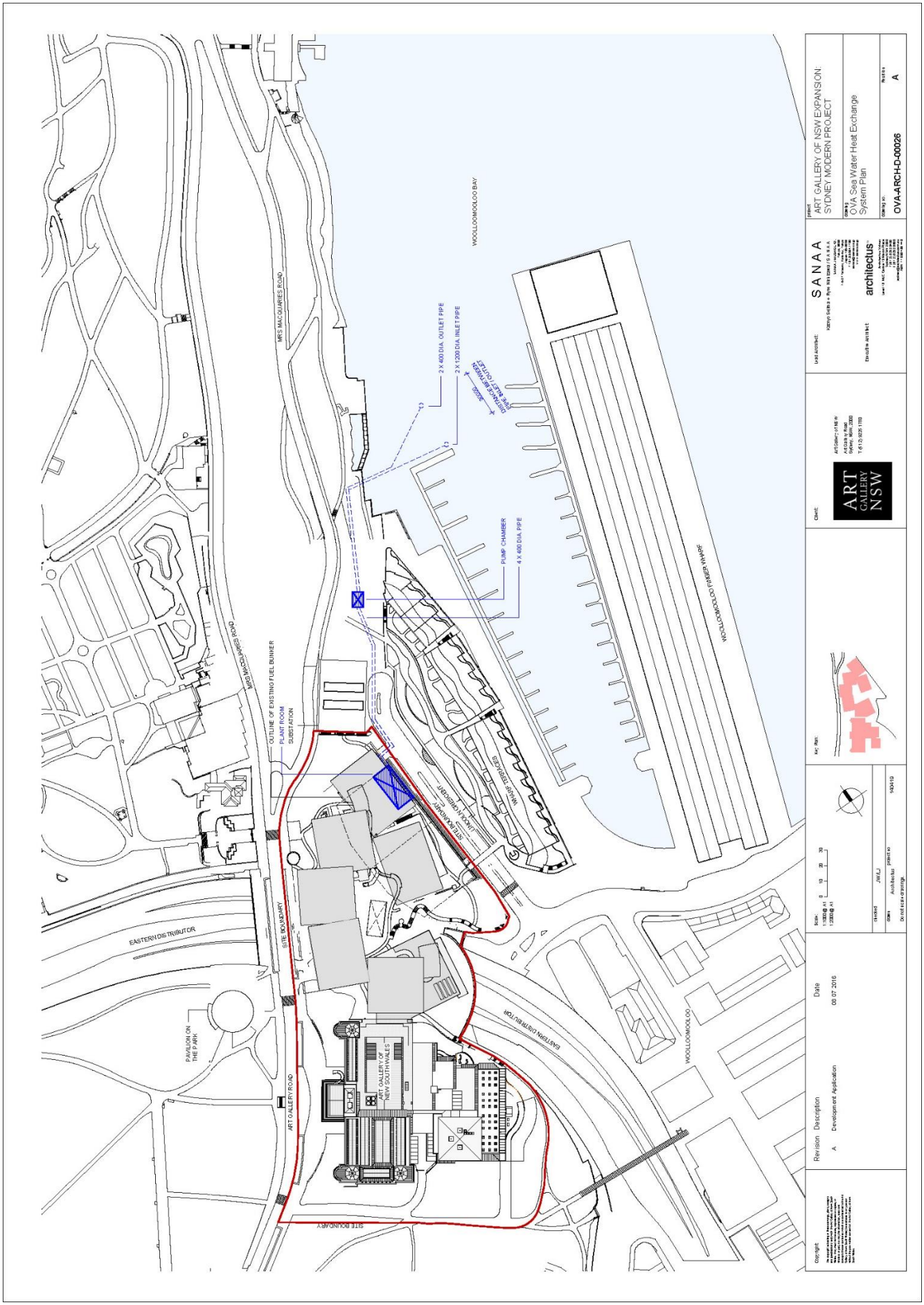
drawing: OVA Master Plan Summary

drawing no.: OVA-ARCH-D-00100

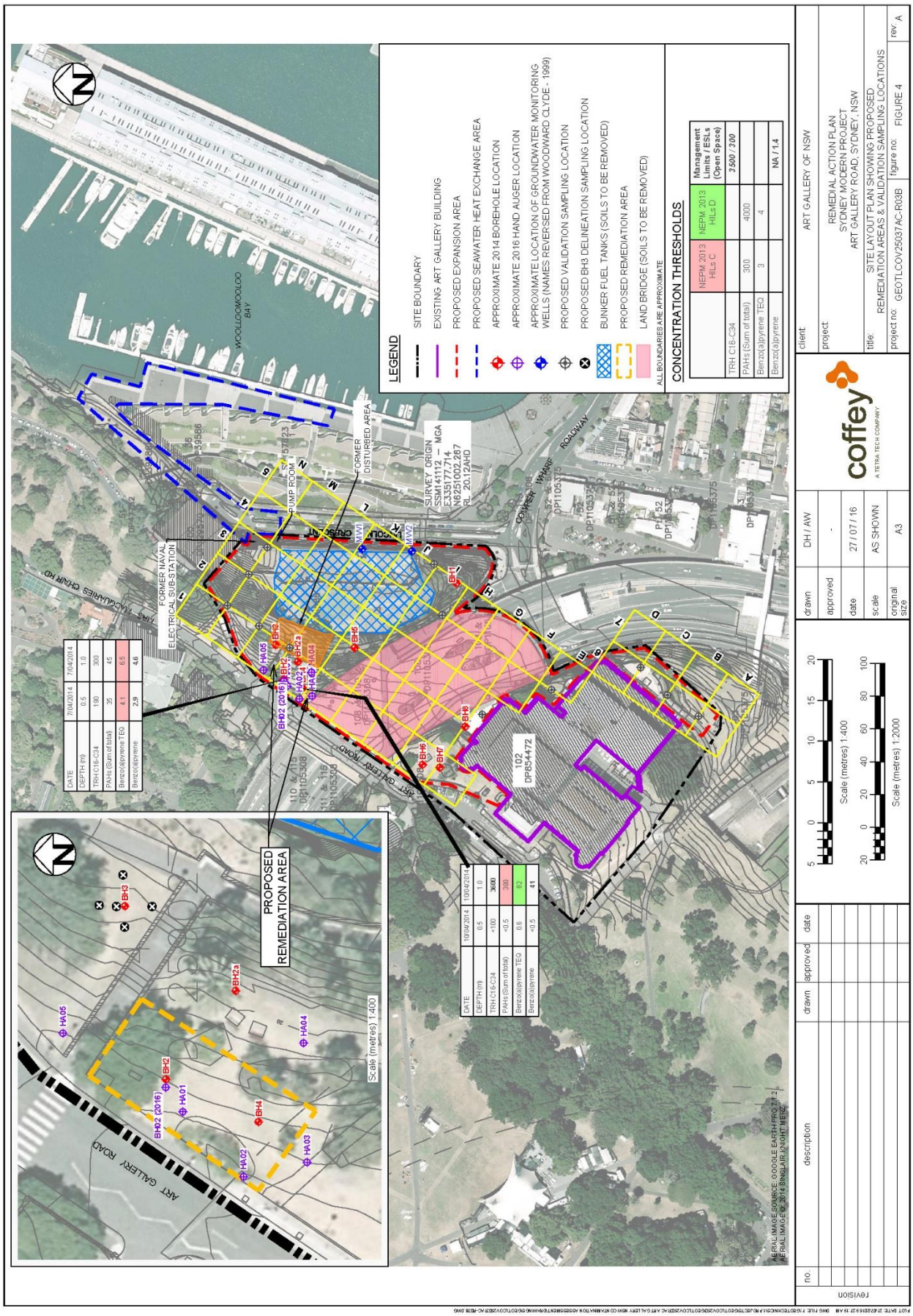
Revision: A

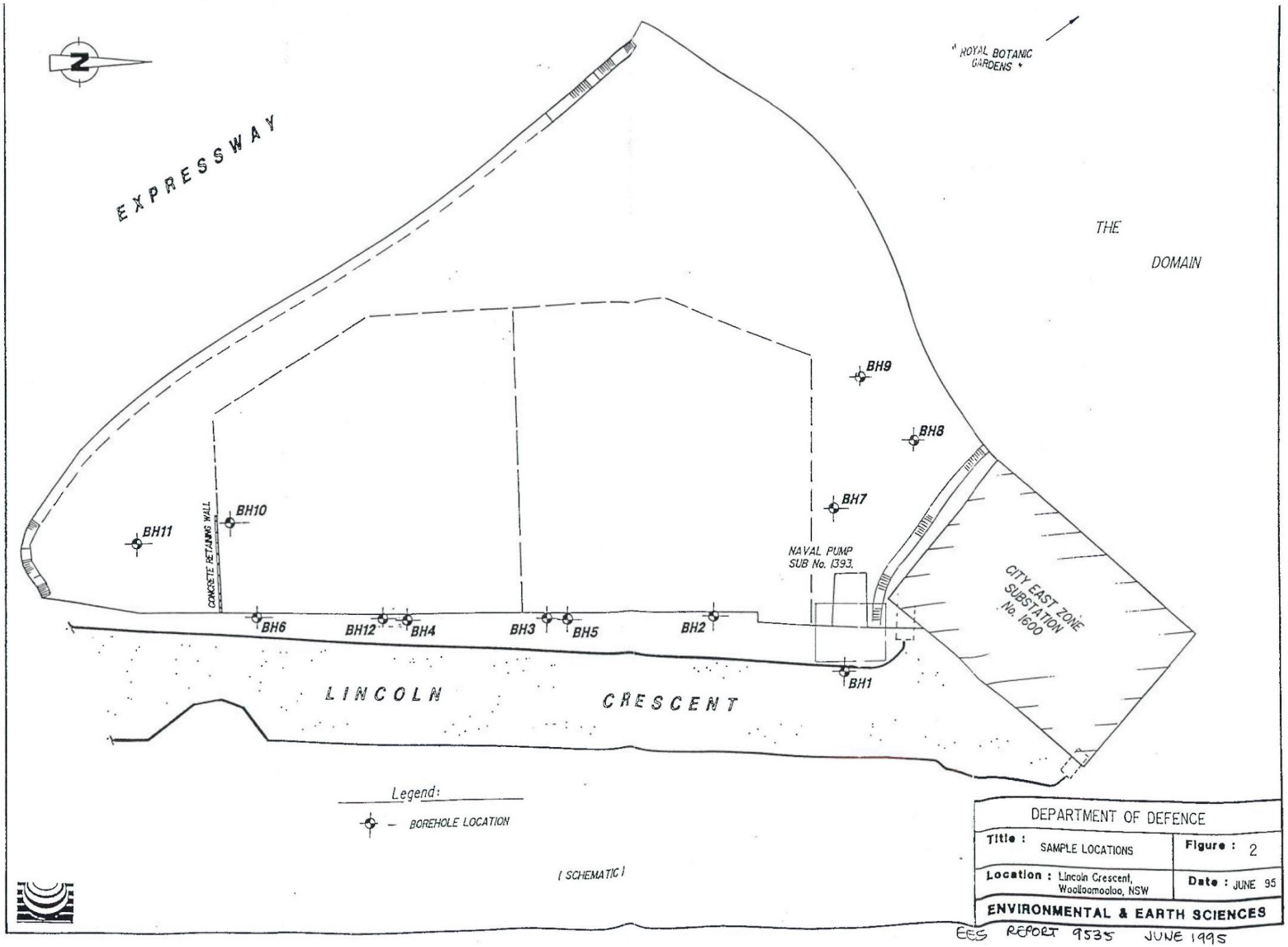
Attachment 3: Proposed Development

Attachment 4: Seawater Heat Exchange



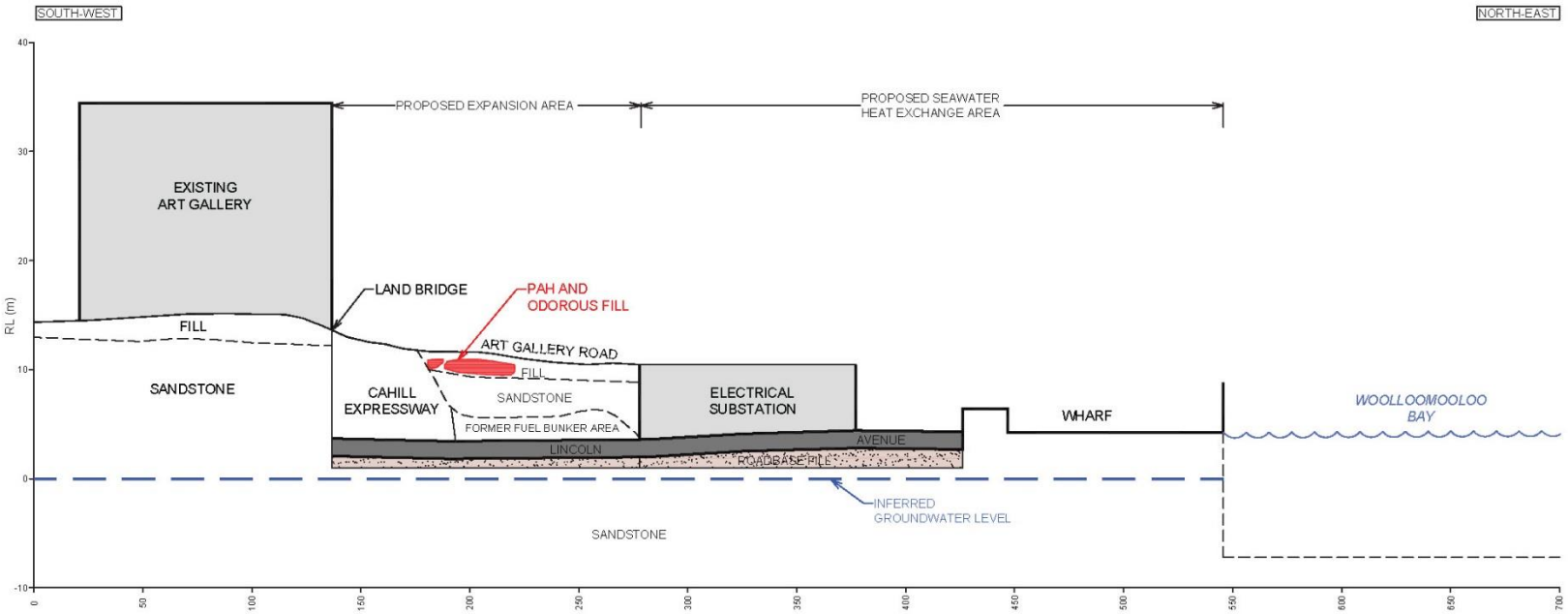
Attachment 5: Site Investigation and Remediation Locations





EES REPORT 9535 JUNE 1995

Attachment 6: EES Investigation Locations



revision	no.	description	drawn	approved	date

Scale (metres) 1:400

5 0 5 10 15 20

Scale (metres) 1:2000

20 0 20 40 60 80 100

drawn	DH / AW
approved	-
date	27 / 07 / 16
scale	AS SHOWN
original size	A3

coffey
A TETRA TECH COMPANY

client:	ART GALLERY OF NSW
project:	REMEDIAL ACTION PLAN SYDNEY MODERN PROJECT ART GALLERY ROAD, SYDNEY, NSW
title:	CONCEPTUAL SITE MODEL
project no:	GEOTLCOV25037AC-R03B
figure no:	FIGURE 5
rev:	A

Attachment 7: Conceptual Site Model

APPENDIX B
EPA GUIDELINES

Guidelines made or approved by the EPA under section 105 of the *Contaminated Land Management Act 1997*

(as of: 13 October 2015)

Section 105 of the *Contaminated Land Management Act 1997* (CLM Act) allows the Environment Protection Authority (EPA) to make or approve guidelines for purposes connected with the objects of the Act. These guidelines must be taken into consideration by the EPA whenever they are relevant and by accredited site auditors when conducting a site audit. They are also used by contaminated land consultants in undertaking investigation, remediation, validation and reporting on contaminated sites.

A current list of guidelines made or approved by the EPA under the CLM Act appears below. To obtain hard copies of the guidelines, contact Environment Line on 131 555.

Guidelines made by the EPA

- Guidelines for the Vertical Mixing of Soil on Former Broad-acre Agricultural Land (2003028VerticalMixGuidelines.pdf, 148KB) (January 1995)
- Sampling Design Guidelines (9559sampgdlne.pdf, 2MB) (September 1995)
- Guidelines for Assessing Banana Plantation Sites (bananaplantsite.pdf; 586KB) (October 1997)
- Guidelines for Consultants Reporting on Contaminated Sites (20110650consultantsglines.pdf; 428KB) (reprinted August 2011)
- Guidelines for Assessing Former Orchards and Market Gardens (orchardgdlne.pdf; 172KB) (June 2005)
- Guidelines for the NSW Site Auditor Scheme, 2nd edition (auditorglines06121.pdf; 510KB) (April 2006)
- Guidelines for the Assessment and Management of Groundwater Contamination (groundwaterguidelines07144.pdf; 604KB) (March 2007)
    - Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997 (150164-report-land-contamination-guidelines.pdf; 412KB) (September 2015)

Note: All references in the EPA's contaminated sites guidelines to:

- the Australian Water Quality Guidelines for Fresh and Marine Waters (ANZECC, November 1992) are replaced as of 6 September 2001 by references to the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ, October 2000)
- the National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPC 1999) are replaced as of 16 May 2013 by references to the National Environment Protection (Assessment of Site Contamination) Measure 1999 (April 2013)

subject to the same terms.

Guidelines approved by the EPA

ANZECC publications

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality, published by ANZECC and the Agriculture and Resource Management Council of Australia and New Zealand, Paper No. 4 (October 2000)

EnHealth publications (formerly National Environmental Health Forum monographs)

- Composite Sampling, Lock, W. H., National Environmental Health Forum Monographs, Soil Series No.3, 1996, SA Health Commission, Adelaide
- Environmental Health Risk Assessment: Guidelines for assessing human health risks from environmental hazards, Department of Health and Ageing and EnHealth Council, Commonwealth of Australia (2012)

National Environment Protection Council publications

- National Environment Protection (Assessment of Site Contamination) Measure 1999 (April 2013)

The NEPM consists of a policy framework for the assessment of site contamination, Schedule A (Recommended General Process for the Assessment of Site Contamination) and Schedule B (Guidelines).

Schedule B guidelines include:

Guideline on Investigation Levels for Soil and Groundwater
Guideline on Site Characterisation
Guideline on Laboratory Analysis of Potentially Contaminated Soils
Guideline on Site-specific Health Risk Assessment Methodology
Guideline on Ecological Risk Assessment
Guideline on Methodology to Derive Ecological Investigation Levels in Contaminated Soils
Guideline on Ecological Investigation Levels for Arsenic, Chromium(III), Copper, DDT, Lead, Naphthalene, Nickel and Zinc
Guideline on the Framework for Risk-based Assessment of Groundwater Contamination
Guideline on Derivation of Health-based Investigation Levels
Guideline on Community Engagement and Risk Communication
Guideline on Competencies and Acceptance of Environmental Auditors and Related Professionals

More details on the amended NEPM and the transitional arrangements for its implementation

Other documents

- Guidelines for the Assessment and Clean Up of Cattle Tick Dip Sites for Residential Purposes, NSW Agriculture and CMPS&F Environmental (February 1996)
- Australian Drinking Water Guidelines, NHMRC and Natural Resource Management Ministerial Council of Australia and New Zealand (2011)
- Further guidance webpage