ACOUSTICS AND AIR

SYDNEY MODERN PROJECT
ART GALLERY OF NSW EXTENSION

AIR QUALITY ASSESSMENT

REPORT NO. 16121
VERSION C

NOVEMBER 2017

PREPARED FOR

ARCHITECTUS SYDNEY
LEVEL 18 MLC CENTRE 19 MARTIN PLACE
SYDNEY NSW 2000
B/O
ART GALLERY OF NSW TRUST

WILKINSON MURRAY

DOCUMENT CONTROL

Version	Status	Date	Prepared By	Reviewed By
A	Draft	24 June 2016	John Wassermann	Nic Hall
A	Final	31 July 2016	John Wassermann	Nic Hall
B	Draft	27 September 2017	John Wassermann	Nic Hall
B	Final	6 October 2017	John Wassermann	Nic Hall
B	Final	25 October 2017	John Wassermann	Nic Hall
C	Final	31 October 2017	John Wassermann	Nic Hall
C	Final	1 November 2017	John Wassermann	Nic Hall

Note

All materials specified by Wilkinson Murray Pty Limited have been selected solely on the basis of acoustic performance. Any other properties of these materials, such as fire rating, chemical properties etc. should be checked with the suppliers or other specialised bodies for fitness for a given purpose. The information contained in this document produced by Wilkinson Murray is solely for the use of the client identified on the front page of this report. Our client becomes the owner of this document upon full payment of our **Tax Invoice** for its provision. This document must not be used for any purposes other than those of the document's owner. Wilkinson Murray undertakes no duty to or accepts any responsibility to any third party who may rely upon this document.

Quality Assurance

We are committed to and have implemented AS/NZS ISO 9001:2008 "Quality Management Systems – Requirements". This management system has been externally certified and Licence No. QEC 13457 has been issued.

CASANZ

This firm is a member firm of the Clean Air Society of Australia and New Zealand and the work here reported has been carried out in accordance with the terms of that membership.

Celebrating 50 Years in 2012

Wilkinson Murray is an independent firm established in 1962, originally as Carr & Wilkinson. In 1976 Barry Murray joined founding partner Roger Wilkinson and the firm adopted the name which remains today. From a successful operation in Australia, Wilkinson Murray expanded its reach into Asia by opening a Hong Kong office early in 2006. 2010 saw the introduction of our Queensland office and 2011 the introduction of our Orange office to service a growing client base in these regions. From these offices, Wilkinson Murray services the entire Asia-Pacific region.

TABLE OF CONTENTS

GLOSSARY OF AIR QUALITY TERMS

Air Pollution – The presence of contaminants or pollutant substances in the air that interfere with human health or welfare, or produce other harmful environmental effects.

Air Quality Standards – The level of pollutants prescribed by regulations that are not to be exceeded during a given time in a defined area.

Air Toxics – Any air pollutant for which a national ambient air quality standard (NAAQS) does not exist (i.e. excluding ozone, carbon monoxide, PM-10, sulphur dioxide, nitrogen oxide) that may reasonably be anticipated to cause cancer; respiratory, cardiovascular, or developmental effects; reproductive dysfunctions, neurological disorders, heritable gene mutations, or other serious or irreversible chronic or acute health effects in humans.

Airborne Particulates – Total suspended particulate matter found in the atmosphere as solid particles or liquid droplets. Chemical composition of particulates varies widely, depending on location and time of year. Sources of airborne particulates include dust, emissions from industrial processes, combustion products from the burning of wood and coal, combustion products associated with motor vehicle or non-road engine exhausts, and reactions to gases in the atmosphere.

Area Source – Any source of air pollution that is released over a relatively small area, but which cannot be classified as a point source. Such sources may include vehicles and other small engines, small businesses and household activities, or biogenic sources, such as a forest that releases hydrocarbons, may be referred to as nonpoint source.

Concentration – The relative amount of a substance mixed with another substance. Examples are 5 ppm of carbon monoxide in air and 1 mg/l of iron in water.

Emission – Release of pollutants into the air from a source. We say sources emit pollutants.

Emission Factor – The relationship between the amount of pollution produced and the amount of raw material processed. For example, an emission factor for a blast furnace making iron would be the number of pounds of particulates per ton of raw materials.

Emission Inventory – A listing, by source, of the amount of air pollutants discharged into the atmosphere of a community; used to establish emission standards.

Flow Rate – The rate, expressed in gallons -or litres-per-hour, at which a fluid escapes from a hole or fissure in a tank. Such measurements are also made of liquid waste, effluent, and surface water movement.

Fugitive Emissions – Emissions not caught by a capture system.

Hydrocarbons (HC) – Chemical compounds that consist entirely of carbon and hydrogen.

Hydrogen Sulphide (H_2S) – Gas emitted during organic decomposition. Also, a by-product of oil refining and burning. Smells like rotten eggs and, in heavy concentration, can kill or cause illness.

Inhalable Particles – All dust capable of entering the human respiratory tract.

Nitric Oxide (NO) – A gas formed by combustion under high temperature and high pressure in an internal combustion engine. NO is converted by sunlight and photochemical processes in ambient air to nitrogen oxide. NO is a precursor of ground-level ozone pollution, or smog.

Nitrogen Dioxide (NO_2) – The result of nitric oxide combining with oxygen in the atmosphere; major component of photochemical smog.

Nitrogen Oxides (NO_x) – A criterion air polluant. Nitrogen oxides are produced from burning fuels, including gasoline and coal. Nitrogen oxides are smog formers, which react with volatile organic compounds to form smog. Nitrogen oxides are also major components of acid rain.

Mobile Sources – Moving objects that release pollution; mobile sources include cars, trucks, buses, planes, trains, motorcycles and gasoline-powered lawn mowers.

Particulates; Particulate Matter (PM-10) – A criteria air pollutant. Particulate matter includes dust, soot and other tiny bits of solid materials that are released into and move around in the air. Particulates are produced by many sources, including burning of diesel fuels by trucks and buses, incineration of garbage, mixing and application of fertilizers and pesticides, road construction, industrial processes such as steel making, mining operations, agricultural burning (field and slash burning), and operation of fireplaces and woodstoves. Particulate pollution can cause eye, nose and throat irritation and other health problems.

Parts Per Billion (ppb)/Parts per Million (ppm) – Units commonly used to express contamination ratios, as in establishing the maximum permissible amount of a contaminant in water, land, or air.

PM10/PM2.5 – PM10 is measure of particles in the atmosphere with a diameter of less than 10 or equal to a nominal 10 micrometers. PM2.5 is a measure of smaller particles in the air.

Point Source – A stationary location or fixed facility from which pollutants are discharged; any single identifiable source of pollution; e.g. a pipe, ditch, ship, ore pit, factory smokestack.

Scrubber – An air pollution device that uses a spray of water or reactant or a dry process to trap pollutants in emissions.

Source – Any place or object from which pollutants are released.

Stack – A chimney, smokestack, or vertical pipe that discharges used air.

Stationary Source – A place or object from which pollutants are released and which does not move around. Stationary sources include power plants, gas stations, incinerators, houses etc.

Temperature Inversion – One of the weather conditions that are often associated with serious smog episodes in some portions of the country. In a temperature inversion, air does not rise because it is trapped near the ground by a layer of warmer air above it. Pollutants, especially smog and smog-forming chemicals, including volatile organic compounds, are trapped close to the ground. As people continue driving and sources other than motor vehicles continue to release smog-forming pollutants into the air, the smog level keeps getting worse.

1 INTRODUCTION

This report has been prepared by Wilkinson Murray Pty Ltd (WMPL) on behalf of Art Gallery of NSW Trust to accompany a State Significant Development Application (SSDA) for the Art Gallery of NSW Extension referred to as the Sydney Modern Project.

The Art Gallery of NSW proposes to undertake a major expansion of the existing art gallery adjacent to the Phillip Precinct of the Domain. The expansion, proposed as a separate, stand-alone building, is located north of the existing gallery, partly extending over the Eastern Distributor land bridge and includes a disused Navy fuel bunker located to the north east of this land bridge.

The new 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.

Secretary's Environmental Assessment Requirements (SEARs) has requested that the EIS address air quality and odour issues, specifically:

11. Air, Noise Vibration and Odour

- *Address potential air quality, noise and odour impacts, in particular during the construction and operation of the development and appropriate mitigation measures.*

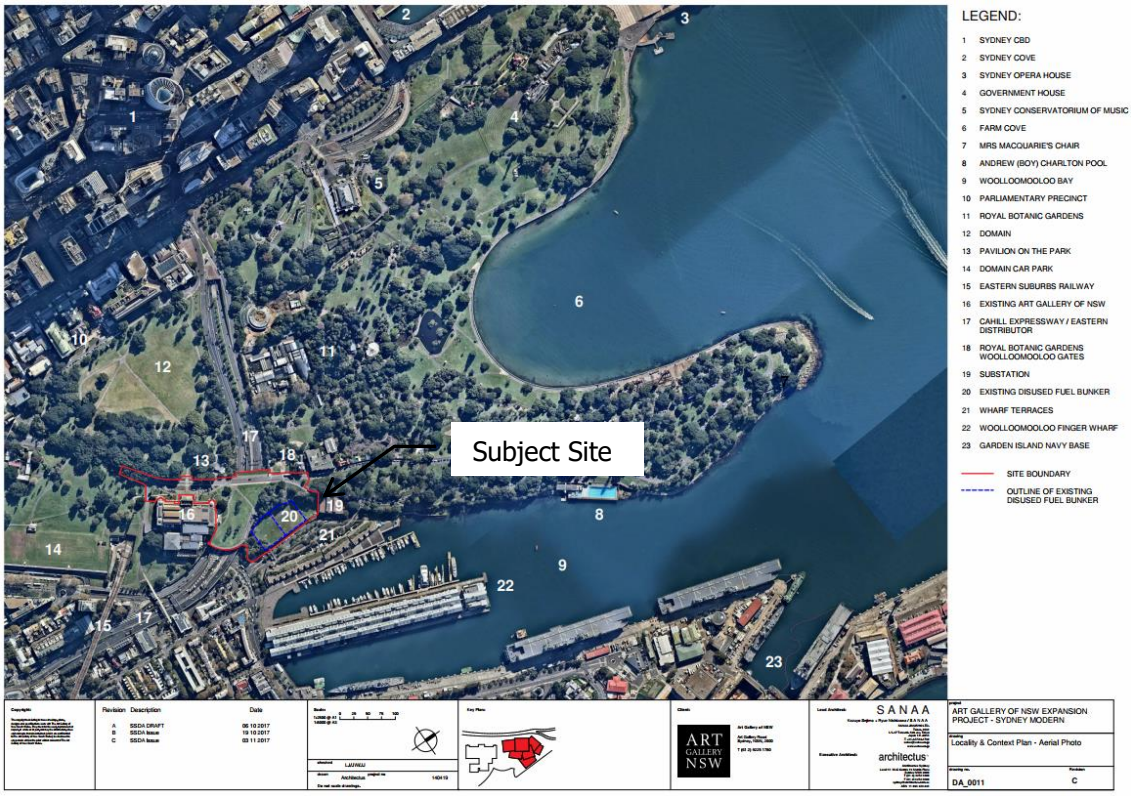
Wilkinson Murray Pty Limited has been commissioned to undertake a qualitative air quality assessment associated with the proposed development. This assessment has been prepared to form part of the EIS to be submitted to Department of Planning and Environment (DPE) in response to the SEARs.

2 SITE DESCRIPTION

The site comprises the existing Gallery, the land bridge above the Cahill Expressway, and the land to the immediate north east of the Cahill Expressway.

The majority of the land proposed to be developed lies on either the Cahill Expressway land bridge, or on Royal Botanic Gardens and Domain Trust land. The site's context and boundary is shown in Figure 2-1. The site is bounded by the Cahill Expressway (other than where the land bridge lies), Cowper Wharf Roadway and Lincoln Crescent (a local road). To the west, the site is bounded by the land bridge and Art Gallery Road (Figure 2-2).

Figure 2-1 Project Site Plan and Context

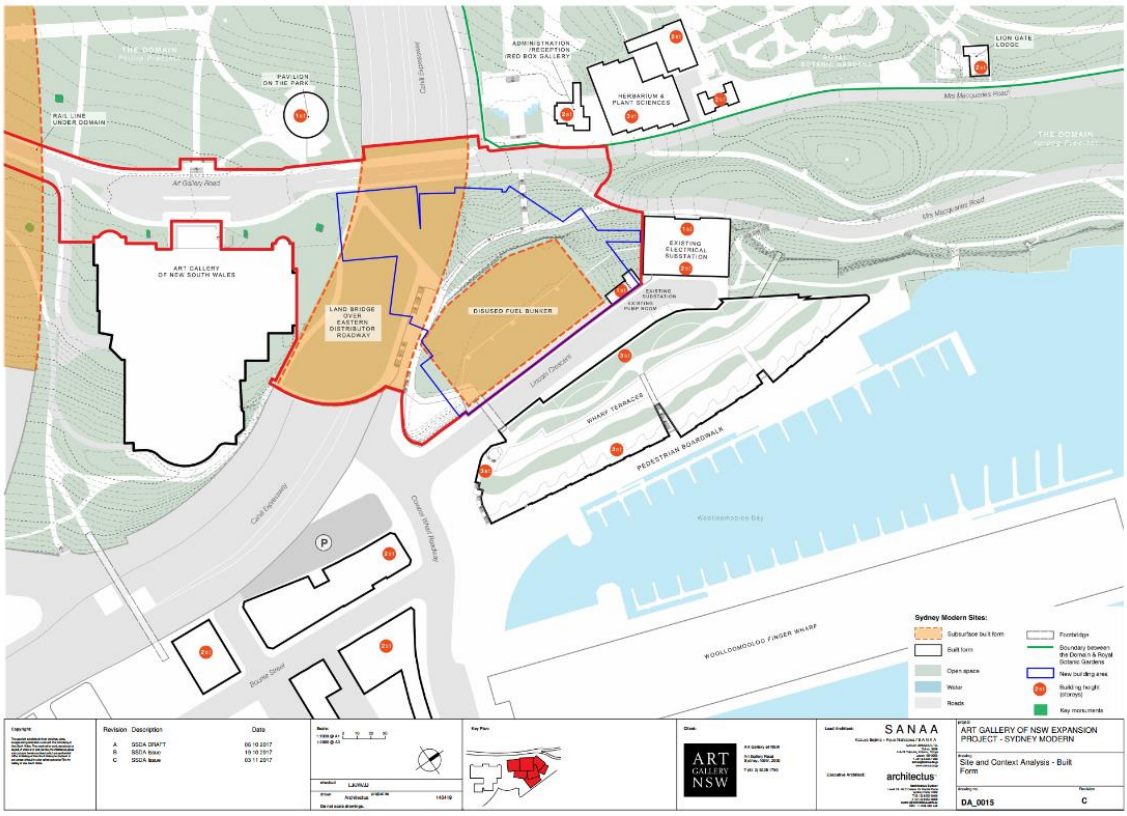


The site has a varied topography, generally sloping from the existing Gallery building down to the north east. The site drops sharply when transitioning from the land bridge and Art Gallery Road to the naval fuel tank area. The site drops sharply again on the boundary between the site and Lincoln Crescent to the east (Figure 2-2).

The area of the site directly adjacent to Lincoln Crescent contains a number of remediated naval Fuel bunkers. The bunkers were constructed 1938, and were used as emergency fuel tanks for military vessels. The bunkers ceased to be used for refuelling circa 1984, at which time the tanks were emptied and cleaned to remove the majority of the residual oil.

A Remedial Action Plan (RAP) has been prepared for the Project by Coffey Geotechnics, dated September 2017 (Coffey, 2017).

Figure 2-2 Project Site Plan

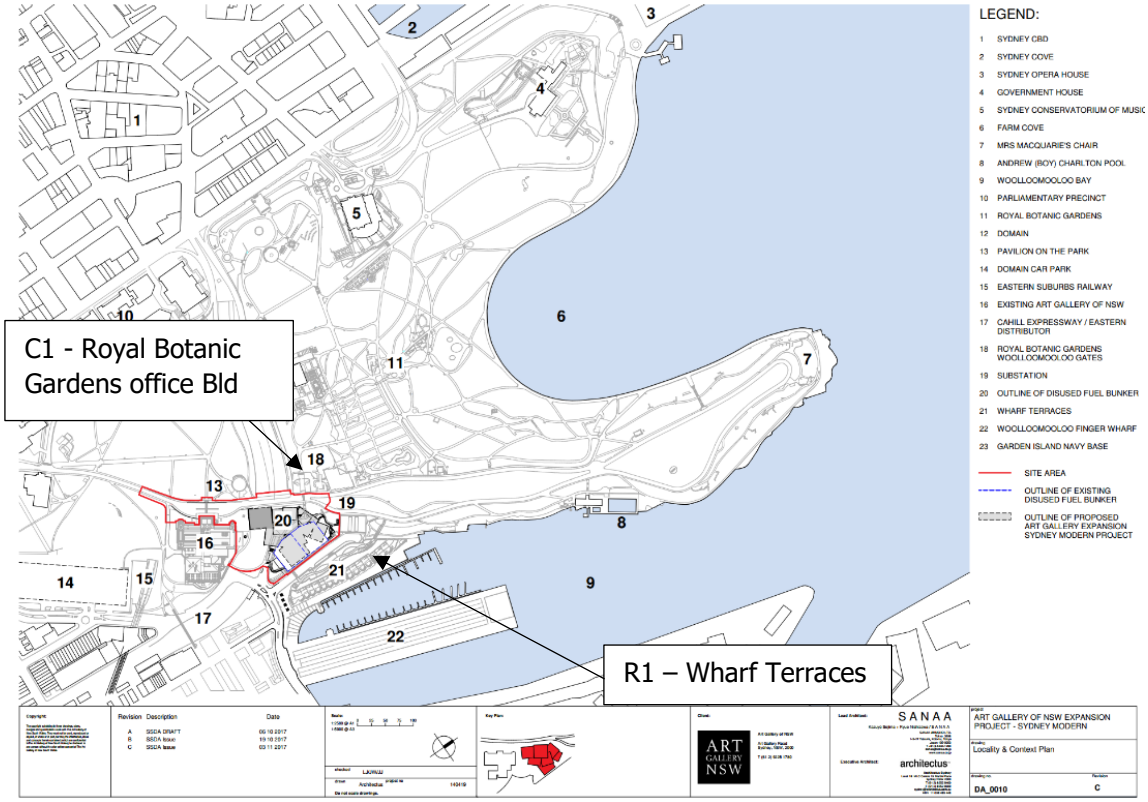


2.1 Surrounding Land Use and Sensitive Receptors

The site is bounded to the north and west by Royal Botanic Gardens and Domain Trust land, to the east by Lincoln Crescent and to the south by Cahill Expressway. The nearest sensitive receptors to the development are located immediately to the east of the site, along Lincoln Crescent. This receptor is an apartment building called the Wharf Apartments (R1). The Royal Botanic Gardens have an office building to the north (C1).

The receptors are shown in Figure 2-3.

Figure 2-3 Nearby Sensitive Receptors



3 PROJECT DESCRIPTION

3.1 Project Overview

The Art Gallery of NSW proposes to undertake a major expansion of the existing art gallery adjacent to the Phillip Precinct of the Domain. The expansion, proposed as a separate, stand-alone building, is located north of the existing gallery, partly extending over the Eastern Distributor land bridge and includes a disused Navy fuel bunker located to the north east of this land bridge.

The new 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.

Development consent is sought for:

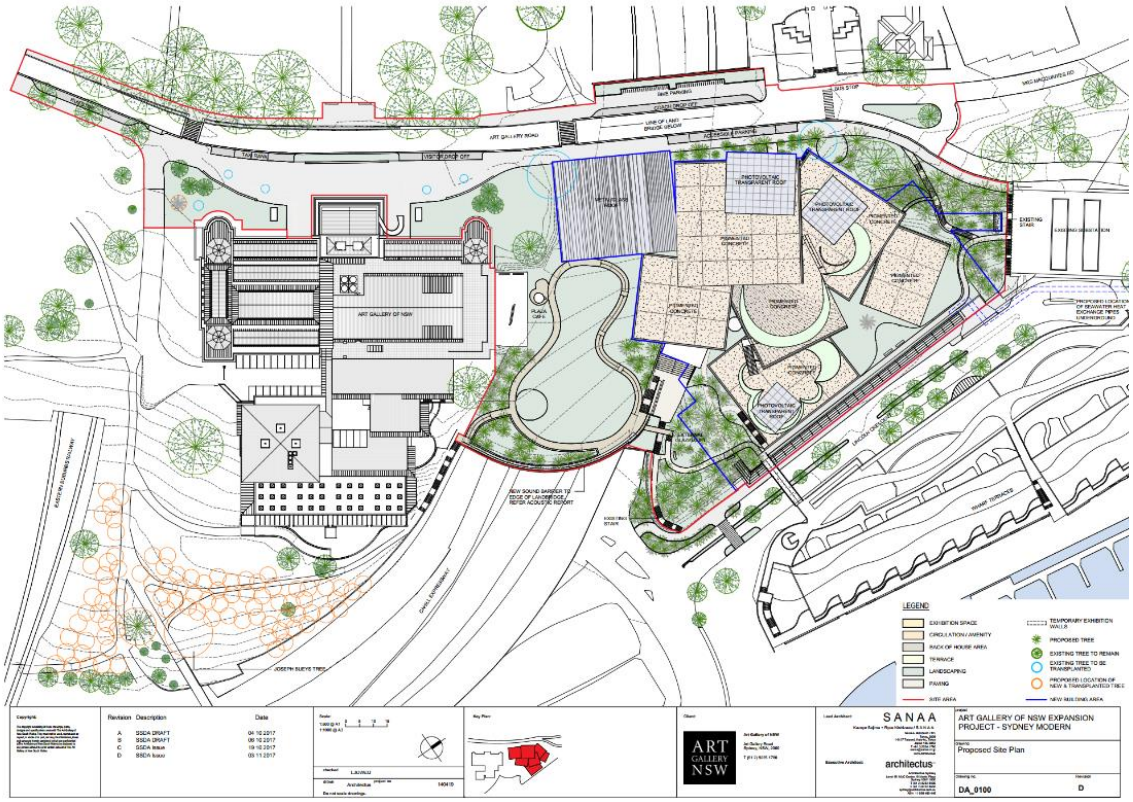
- Site preparation works, including:
  - Site clearing, including demolition of former substation, part of road surfaces, kerbs and traffic islands, pedestrian crossings, foot paths, retaining walls, stairs, and part of disused underground former Navy fuel bunkers;
  - Tree removal;
  - Excavation and site earthworks;
  - Remediation works;
- Construction of the new building comprising:
  - Covered public entry plaza;
  - Five building levels, including entry pavilion following the site topography down to Lincoln Crescent;
  - Retention of part of existing former underground Navy fuel bunker for use as gallery space and support spaces;
  - Art exhibition spaces;
  - Outdoor publicly accessible terraces;
  - Shop and cafe;
  - Multipurpose space;
  - Education spaces;
  - Ground level loading dock (accessed via Lincoln Crescent) with associated art handling facilities, workshops, service parking, plant, and storage areas.
- Landscaping and public domain improvements including:
  - Continuation of the east-west pedestrian link over the land bridge between the Domain and Woolloomooloo Bay, including dedicated lift structure for universal access;
  - Improved public access of the north south pedestrian link
  - Enhancement of the public open space on the land bridge to create a landscape and art connection between the two buildings

- Hard and soft landscaping to roofs and terraces;
- Plantings and new pathways;
- Increased landscaped area to forecourt of existing Art Gallery building and removal of car parking
- Relocation of selected trees to the south-eastern corner of the site;
- Sound barrier to edge of land bridge;

- Upgrade works to part of Art Gallery Road, Cowper Wharf Road, Mrs Macquaries Road, and Lincoln Crescent, including new pedestrian crossings;
- Provision of vehicle drop off points including a taxi stand, private vehicle drop off and bus/coach drop off, at Art Gallery Road;
- Installation of an ancillary seawater heat exchange system to act as the new building's cooling system, adjacent to and within Woolloomooloo Bay;
- Diversion, extension and augmentation of physical infrastructure and utilities as required.

Figure 3-1 shows the proposed location of the Sydney Modern Project.

Figure 3-1 Proposed Development



Specifically, approval is sought for the following:

- carrying out of remediation and validation within fuel bunker earthworks area to ensure it is suitable for the intended future uses of the land;
- bulk excavation within the perimeter of the site; and
- construction of Sydney Modern buildings.

3.2 Remediation Works

The RAP identifies one area requiring remediation. The area is estimated to be 12m by 25m in area, with a depth up to 2.2m. The remediation area is shown in Figure 3-2.

Within the remediation area, measured concentrations of polycyclic aromatic hydrocarbons (PAH) exceed human health criteria. Additionally, strong hydrocarbon odours were identified in soil samples taken within the remediation area. The source of the soil contamination is considered most likely to be bituminous material within fill, and not the disused fuel bunkers.

The proposed remediation comprises excavation of the contaminated soils, offsite disposal to a licensed facility, and validation sampling and laboratory analysis of soils from the remedial excavation.

The remediation requires the removal of approximately fifty truckloads of excavated material, and is expected to take less than one week to complete. During the works, the following air quality controls are proposed:

- Application of odour suppressants; and,
- Covering all stockpiles and truck loads.

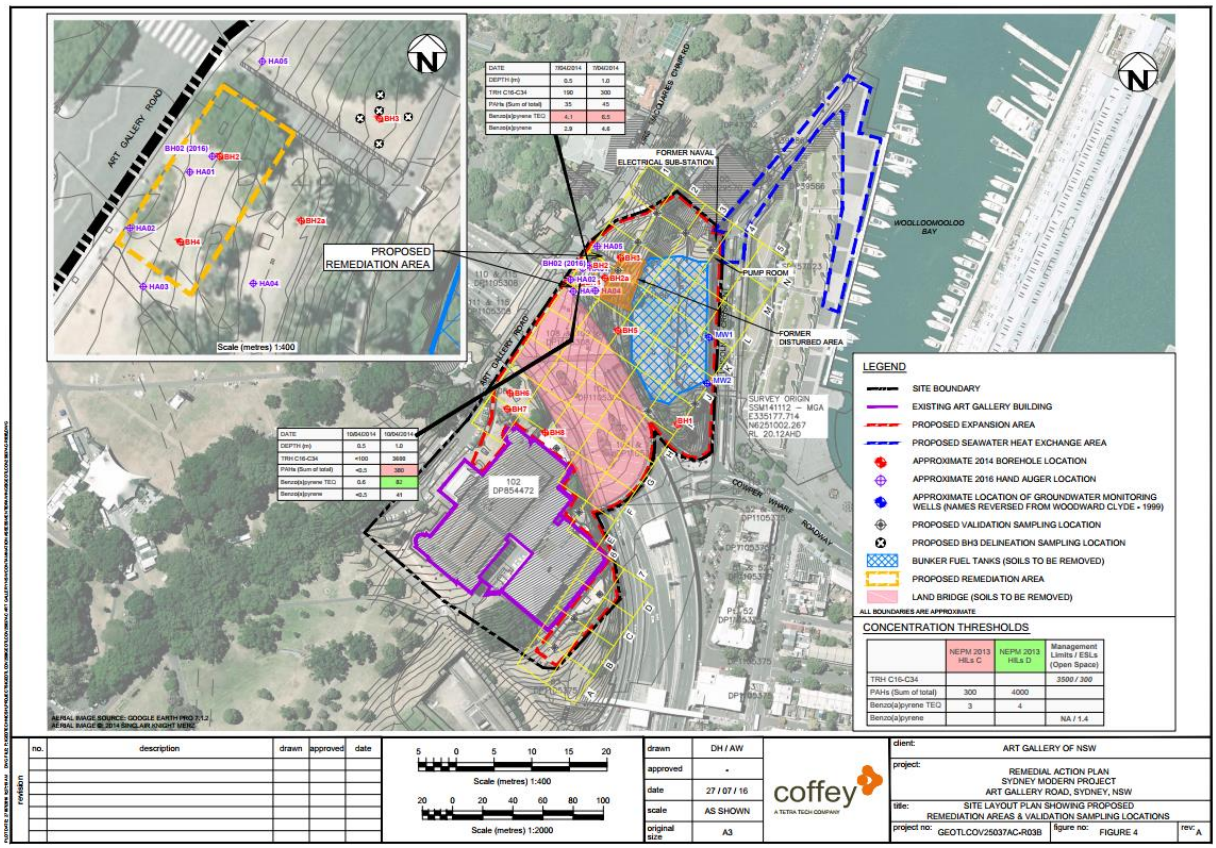
Additionally, if odours are apparent during the remediation works, VOC monitoring would be conducted.

3.3 Timing and Work Hours

Construction and remediation works are expected to be conducted within standard construction hours. The proposed construction hours for the works are between 7.00am and 6.00pm Monday – Friday and between 8.00am and 1.00pm on Saturdays.

No construction and remediation work is proposed to be undertaken on Sundays or Public Holidays.

Figure 3-2 Remediation Area



4 AIR QUALITY ASSESSMENT CRITERIA

4.1 Introduction

The NSW EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC, 2005) sets out applicable impact assessment criteria for a number of air pollutants.

Air quality criteria are benchmarks set to protect the general health and amenity of the community in relation to air quality. The sections below identify the pollutants of interest in this study and the application air quality criteria for each pollutant.

4.2 Pollutants of Interest

The major potential for air quality impacts would be associated with particulates or dust from excavation and constructions works, and soil contaminants and/or odour in the remediation area.

The pollutants off concern are:

- Particulate matter;
- Heavy Metals in the form of Lead;
- VOCs (specifically BTEX); and
- Odour.

4.3 Assessment Criteria

The ambient air quality criteria for the pollutants considered in this assessment are shown in Table 4-1.

Table 4-1 Impact Assessment Criteria - Criteria Pollutants

Pollutant	Averaging Period	Criteria (µg/m^3)
Combustion Products and Dust		
Total suspended particulates (TSP)	Annual	90
Fine particulate matter (PM_{10})	24 hours	50
	Annual	30
Soil Contaminants		
Benzene	1 hour	29
Ethylbenzene	1 hour	8,000
Toluene	1 hour	360
Xylenes	1 hour	190
Lead	Annual	0.5

A number of soil contaminants identified within the site have the potential to cause nuisance odours. Odour in a regulatory context needs to be considered in two similar, but different ways depending on the situation.

NSW legislation prohibits emissions that cause offensive odour to occur at any off-site receptor. Offensive odour is evaluated in the field by authorised officers, who are obliged to consider the odour in the context of its receiving environment, frequency, duration, character and so on and to determine whether the odour would unreasonably interfere with the comfort and repose of the normal person. In this context, the concept of offensive odour is applied to operational facilities and relates to actual emissions in the air.

However, in the approval and planning process for proposed new operations or modifications to existing projects, no actual odour exists and it is necessary to consider hypothetical odour. In this context, odour concentrations are used and are defined in odour units. The number of odour units represents the number of times that the odour would need to be diluted to reach a level that is just detectable to the human nose. Thus by definition, odour less than odour unit (1 OU), would not be detectable to most people.

The range of a person's ability to detect odour varies greatly in the population, as does their sensitivity to the type of odour. Therefore there can be a wide range of variability in the way odour response is interpreted. As a result the assessment of odour impacts and the application of specific air quality goals related to odour is a challenging aspect of air science.

It should be noted that odour refers to complex mixtures of odours, and not 'pure' odour arising from a single chemical. Odour from a single, known chemical very rarely occurs (when it does, it is best to consider that specific chemical in terms of its concentration in the air). In most situations, odour will be comprised of a cocktail of many substances that is referred to as a complex mixture of odorous pollutants, or more simply odour.

For developments with potential for odour it may be necessary to predict the likely odour impact that may arise. This is done by using air dispersion modelling which can calculate the level of dilution of odours emitted from the source at the point that it reaches surrounding receptors. This approach allows the air dispersion model to produce results in terms of odour units.

The NSW criteria for acceptable levels of odour range from 2 to 7 OU, with the more stringent 2 OU criteria applicable to densely populated urban areas and the 7 OU criteria applicable to sparsely populated rural areas, as outlined below.

Table 4-2 presents the relevant impact assessment criteria for complex mixtures of odorous pollutants.

Table 4-2 Impact Assessment Criteria –Complex Mixtures of Odorous Pollutants

Population of Affected Community	Impact Assessment Criteria (OU)*
Urban (≥~2000) and/or schools and hospitals	2.0
~500	3.0
~125	4.0
~30	5.0
~10	6.0
Single rural residence (≤~2)	7.0

*99th percentile nose-response time

The area surrounding the site is highly populated, and therefore; the applicable impact assessment criteria for odour is 2.0 OU/m^3.

5 EXISTING ENVIRONMENT

5.1 Local Climate

Long-term meteorological data for the surrounding area is available from the Bureau of Meteorology (BoM) operated Automatic Weather Stations (AWS) at Observatory Hill and Fort Denison. The Observatory Hill AWS is located approximately 1,500 m north west of the site and records observations of a number of meteorological data including temperature, humidity and rainfall. There is no anemometer at Observatory Hill, and therefore; observations of wind speed and direction are taken from the Fort Denison AWS, located approximately 1,600 m north of the site.

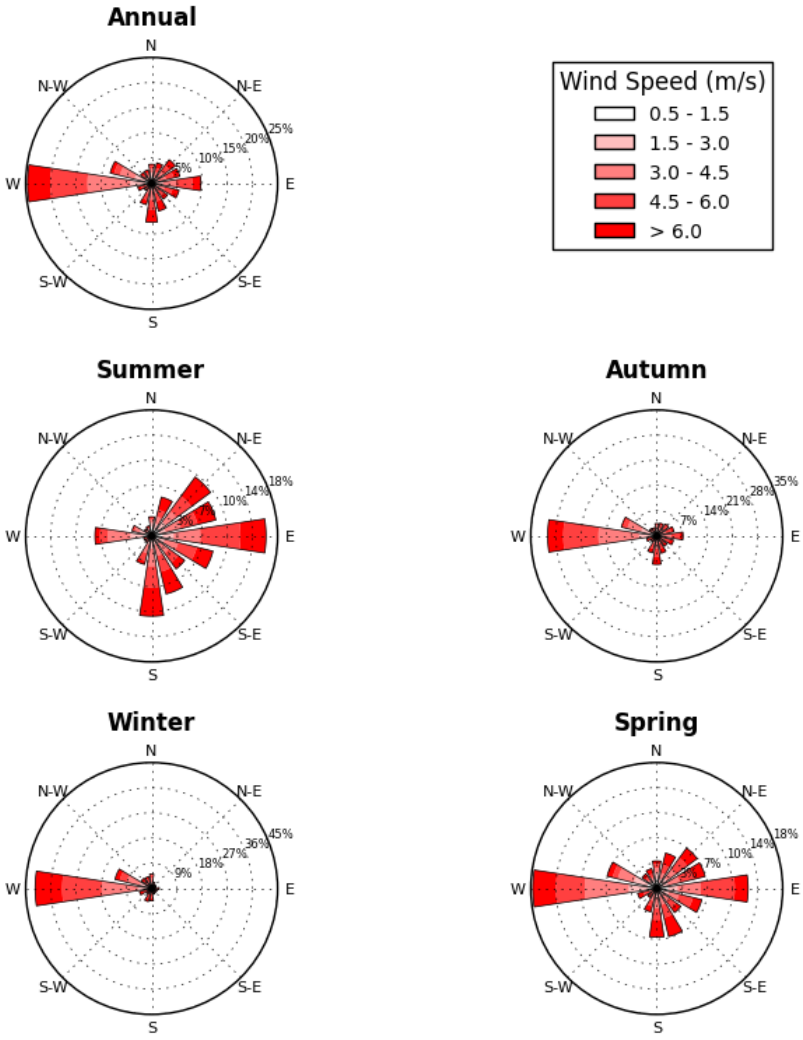
Long-term climate statistics are presented in Table 5-1. Temperature data recorded at the Observatory Hill AWS indicates that January is the hottest month of the year, with a mean daily maximum temperature of 25.9°C. July is the coolest month with a mean daily minimum temperature of 8.1°C. June is the wettest month with an average rainfall of 132 mm falling over almost 9 days. There are on average 100 rain days per year, yielding 1213 mm of rain.

Table 5-1 Long-term Climate Averages for Observatory Hill

Observation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
9am Mean Observations													
Temperature (°C)	22.5	22.3	21.1	18.2	14.6	11.9	10.9	12.5	15.7	18.5	19.9	21.6	17.5
Humidity (%)	71	74	74	72	74	74	71	66	62	61	66	67	69
3pm Mean Observations													
Temperature (°C)	24.8	24.9	24.0	22.0	19.4	16.9	16.4	17.5	19.2	20.7	22.1	23.8	21.0
Humidity (%)	62	64	62	59	57	57	51	49	51	56	58	59	57
Daily Minimum and Maximum Temperatures													
Minimum (°C)	18.7	18.8	17.6	14.7	11.6	9.3	8.1	9.0	11.1	13.6	15.6	17.5	13.8
Maximum (°C)	25.9	25.8	24.8	22.4	19.5	17.0	16.3	17.8	20.0	22.1	23.6	25.2	21.7
Rainfall													
Rainfall (mm)	101.1	118.0	129.7	127.1	119.9	132.0	97.4	80.7	68.4	76.9	84.3	77.3	1212.6
Rain days	8.6	9.0	9.8	9.0	8.7	8.7	7.5	7.2	7.2	7.9	8.4	8.0	100.0

Windrose plots showing the distribution of wind direction and wind speed at the Fort Denison BoM AWS between 2008 and 2013 and presented in Figure 5-1.

Figure 5-1 Windrose Plots – Fort Denison BoM AWS, 2008 – 2013



5.2 Local Air Quality

The NSW Office of Environment and Heritage (OEH) operates a network of air quality monitoring sites across the state. The nearest OEH air quality monitoring station to the Gallery site is located at Rozelle, approximately 5 km to the west.

Ambient pollution concentrations recorded at the Rozelle site between 1 July 2013 and 30 June 2014 have been used to establish the existing local air quality for this assessment and are summarised in Table 5-2.

Table 5-2 Existing Ambient Pollutant Concentrations – Rozelle Monitoring Station

Pollutant	Averaging Period	Background Concentration (µg/m³)	Impact Assessment Criteria (µg/m³)
PM_{10}	24 hour Maximum	59	50
	Annual Average	19	30
TSP [1]	Annual Average	39	90

1 Scaled from PM_{10} concentrations
2 Not assessed. Used to calculate NO_2 transformation

Detailed plots of PM_{10} concentrations from the Rozelle monitoring station are included in Appendix B. The detailed plot of PM_{10} concentrations indicate that the existing 24 hour PM_{10} levels measured by the Rozelle monitoring station exceed the goal of 50 µg/m^3 on three occasions during the period 1 July 2013 to 30 June 2014.

6 AIR QUALITY ASSESSMENT

6.1 Ambient Air Quality

The following section presents a qualitative assessment of potential air quality impacts from the proposed development and relevant best practices to reduce the likelihood of these impacts.

Dust can be generated from construction activities involving soil, including excavation, handling, loading, stockpiling and wind erosion of exposed areas.

The major potential for air quality impacts would be associated with particulates or dust from excavation and construction works, and odour impacts from remediation works.

The remediation works are expected to take less than one week to complete, and would be conducted during standard construction hours only. Due to the short duration of the remediation works, and that the works will occur during the daytime where thermal mixing provides more favourable dispersion, air quality impacts from the works are considered low risk.

Therefore, measures to manage potential air quality impacts from dust, contaminants, and odour are recommended to be implemented through an Air Quality & Odour Management Plan (AQOMP).

The AQOMP would detail prevention and management measures for air quality and odour issues associated with remediation, excavation and construction. It would define mitigation measures to be implemented during relevant construction activities, a monitoring program that enables assessment of the impacts of construction activities on potentially affected areas, and contingency measures that may be implemented if complaints are received or exceedances are measured.

The AQOMP should consider the following:

Ref.	Air Quality Mitigation Measure
MINIMISE COMBUSTION EMISSIONS	
AQ1.	Turn engines off while parked on site.
AQ2.	Regularly maintain equipment, plant and machinery to minimise visible smoke / emissions.
AQ3.	Use mains power where available and suitable.
DUST AND MATERIAL MANAGEMENT	
AQ4.	Limit exposed / excavation areas outside of the excavation enclosures, where feasible.
AQ5.	Seal haul roads outside the remediation areas. Limit accessibility to roads for construction vehicles, and implement site speed limits.
AQ6.	Cover all loads coming onto the site and departing site to prevent spillage / dust emissions. Immediately clean up any spills.

Ref.	Air Quality Mitigation Measure
AQ7.	Ensure all vehicles leaving site (or moving from unsealed to sealed roads) pass through a truck wash prior to exiting, with physical removal of dirt / mud using a pressure washer if required.
AQ8.	Use dust sealants or hydromulch on exposed areas vulnerable to wind erosion.
AQ9.	Where feasible, reduce handling / stockpiling of excavated materials through pre-testing and validation, allowing direct transport off-site.
AQ10.	Use solid 2.4m or 3m high hoardings at the site perimeter, and wind barriers at internal excavation boundaries where possible.
AQ11.	Sweep and water haul routes, materials handling areas (outside excavation enclosures), site entry points and other areas as needed. Water at a rate of 2L per m^2 per hour or greater.
AQ12.	Adjust work practices based on wind and weather conditions, and real time dust monitoring.
AQ13.	Undertake emergency dust suppression if needed during dust generating conditions (e.g. dry and windy weather) during longer non-working periods (e.g. long weekends, holidays).
STOCKPILE MANAGEMENT	
AQ14.	Maintain all stockpiles at manageable sizes to allow covering or spraying. Locate stockpiles to minimise wind erosion.
AQ15.	Cover any stockpiled spoil material identified as being restricted, hazardous or special waste whilst not active, including overnight.
AQ16.	Use water sprays to suppress dust emissions from spoil stockpiles, loading and unloading activities, unless spoil is damp.
AQ17.	Cover or coat with sealant stockpiled material that is to remain inactive for a period greater than two weeks to prevent odour / dust generation.
AQ18.	Apply covers, odour sealant or odour suppressant to control odours generated at the point of excavation or at stockpiles, where required outside excavation enclosures. Where odorous contaminated spoil is encountered, implement contingency measures.
CONTROL ODOURS DURING EXCAVATION & STOCKPILING OF VOC CONTAINING CONTAMINATED SOILS	
AQ19.	Ensure an Air Quality Manager is on site during work hours to undertake monitoring, managing odour suppressants and controls, reporting and implementing contingency measures if required.
AQ20.	Undertaking the excavation works in a staged manner to limit the surface area of odorous material exposed.
AQ21.	Application of odour suppressants (such as Biosolve or Killsmell) via spray applicator.
AQ22.	Covering of the stockpiled soil, to suppress the release of the odours.

Ref.	Air Quality Mitigation Measure
MONITORING	
AQ23.	Implement a reactive monitoring regime to allow early detection of air quality issues associated with remedial works, and allow real-time assessment of various remedial work activities. Monitoring would be conducted at the Wharf Apartments (R1) and Royal Botanic Gardens Offices (C1). Refer to Table 6-1

Table 6-1 Proposed Air Quality Monitoring

Parameter	Equipment	Frequency	Method	EPA Criteria
TSP	HVAS	24 hours every 6 days	AM-15 AS 3580.9.3:2015	90 µg/m^3 as an annual average
PM_{10}	Aeroqual Dust Sentry	Continuous	Aeroqual method	50 µg/m^3 24 hour average[1] 30 µg/m^3 annual average
Lead	HVAS	24 hours every 6 days	AM-15 AS 3580.9.3:2015	DEC (2005)[3]
VOCs (total)	PID	Daily	PID method	N/A
Odour	Field Olfactometer	Morning, followed by afternoon if odour exceeds trigger level	Nasal Ranger Operational Manual V6.2	≥ 2 D/T associated with works on two consecutive events

6.2 Fuel Bunker Air Quality

The fuel bunkers are proposed to form part of the Sydney Modern Building and further assessment of seepage water within the bunkers as well as odour and volatile hydrocarbon vapour considerations was undertaken and reported in Coffey (2016).

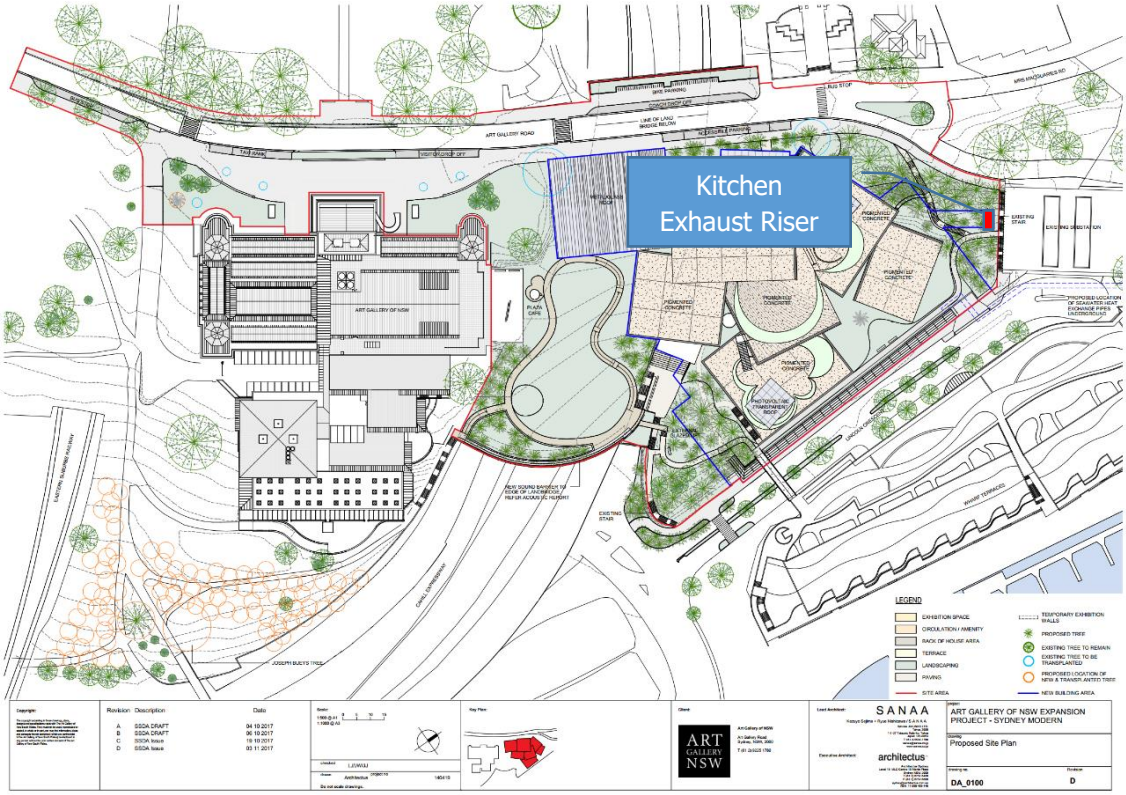
Ambient air within the former fuel bunker (from a contamination perspective) has been previously tested. The results of the internal air quality monitoring within the former fuel bunker indicated concentrations of BTEX, naphthalene, TRH C6-C10 and TRH >C10-C16 were well below the limit of reporting and below the Health screening levels (HSLs) for commercial use.

Air conditioning and ventilation of the proposed Sydney Modern buildings would further reduce the likelihood of internal odour issues. The potential for residual petroleum hydrocarbon vapours within the fuel bunker is considered minor.

6.3 Kitchen Exhaust Riser

Odour from the project's kitchen exhaust riser has been considered in the design to minimise odour impacts. The kitchen exhaust riser has been located in the landscaped area adjacent to the existing Substation (Figure 6-1). When considering the predominant winds in the area, the location would minimise odour to the closest neighbours and the public accessible Roof Terraces.

Figure 6-1 Location of the Kitchen Exhaust Riser



7 CONCLUSION

Wilkinson Murray Pty Limited has been commissioned to undertake a qualitative air quality assessment associated with the proposed development. This assessment has been prepared to form part of the EIS to be submitted to Department of Planning and Environment (DPE) in response to the SEARs.

The major potential for air quality impacts would be associated with particulates or dust from excavation and construction works, and odour impacts from remediation works.

Therefore, measures to manage potential air quality impacts from dust, contaminants, odours and combustion gases are recommended to be implemented through an Air Quality & Odour Management Plan (AQOMP).

The AQOMP would detail prevention and management measures for air quality and odour issues associated with remediation, excavation and construction. It would define mitigation measures to be implemented during relevant construction activities, a monitoring program that enables assessment of the impacts of construction activities on potentially affected areas, and contingency measures that may be implemented if complaints are received or exceedances are measured.

A range of best practice measures have been recommended to manage potential emissions of air pollutants.

8 REFERENCES

Coffey 2016, *Sydney Modern Project – Groundwater monitoring adjacent to former fuel bunkers.* GEOTLCOV25037AC-L01 Rev 1. 30 May 2016.

Coffey 2017, *Remedial Action Plan – Sydney Modern Project*, Coffey Geotechnics Pty Ltd, Chatswood, Australia

DEC 2005, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales,* Department of Energy and Conservation NSW, Sydney, Australia

JBA 2014, *Request for Director-General's Requirements – Sydney Modern Project*, JBA Urban Planning, North Sydney, Australia

APPENDIX A

LOCAL AIR QUALITY

Figure A-1 Background 24 hour PM10 Concentration – Rozelle OEH Monitoring Station