REPORT TO

CATHOLIC ARCHDIOCESE OF SYDNEY

ON

REMEDIATION ACTION PLAN (RAP)

FOR

PROPOSED RESIDENTIAL DEVELOPMENT

AT

95 BOWER STREET & 29-35 REDDALL STREET, MANLY, NSW

Date: 1 May 2019

Ref: E30375Krpt-RAP

JKEnvironments

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Executive Summary

Catholic Archdiocese of Sydney ('the client') commissioned Environmental Investigation Services (EIS)1 to prepare a Remediation Action Plan (RAP) for the proposed residential development at 95 Bower Street and 29-35 Reddall Street, Manly, NSW. The site location is shown on Figure 1 and the RAP is applicable to 'the site' boundaries as shown on Figure 2.

EIS have previously undertaken a *Preliminary Environmental Site Assessment (ESA)* at the site (EIS Ref: E30375Krpt[2]) dated 8 June 2017. The findings of the EIS 2017 report are summarised in Section 2.

Based on the supplied conceptual plan prepared by Squillace Architects. The proposed development will involve the demolition of the existing structures on the site and the construction of three multiple storey residential buildings, over one to two and a half levels of basement.

The goal of this RAP is to provide technical recommendations for further contamination investigations, remediation works, validation works and unexpected finds protocols during the development works.

The objectives of the RAP are to:

- Provide a methodology to manage contamination, remediate and validate the site;
- Provide a contingency plan for the remediation works;
- Outline site management procedures to be implemented during remediation work; and
- Provide an unexpected finds protocol to be implemented during the development works.

The contaminants of concern are the Benzo(a)Pyrene (BaP) identified within the fill material at BH3 (0-0.3) during the previous assessment, as well as a range of other contaminants associated will imported fill material at the site, and hazardous building materials.

This RAP outlines the following procedures:

- Removal of the contaminated fill; and
- Validation sampling to ensure remediation has been successful.

EIS are of the opinion that the site can be made suitable for the proposed residential development provided this RAP is implemented accordingly. A site validation report should be prepared on completion of remediation activities and should be submitted to the consent authority.

The conclusions and recommendations should be read in conjunction with the limitations presented in the body of this report.

[1] Environmental consulting division of Jeffery & Katauskas Pty Ltd (J&K)

[2] Titled *"Report to Peloton Group on Preliminary Stage 2 Environmental Site Assessment for Proposed Warehouse Extension and Car Park Development at Sunshine Sugar Warehouse, 322 Parramatta Road, Clyde, NSW"* referred to as EIS Stage 2 Report

Table of Contents

List of Tables

Attachments

Abbreviations

Asbestos Fines/Fibrous Asbestos	AF/FA
Ambient Background Concentrations	ABC
Added Contaminant Limits	ACL
Asbestos Containing Material	ACM
Australian Drinking Water Guidelines	ADWG
Area of Environmental Concern	AEC
Australian Height Datum	AHD
Acid Sulfate Soil	ASS
Above-Ground Storage Tank	AST
Below Ground Level	BGL
Benzo(a)pyrene Toxicity Equivalent Factor	BaP TEQ
Bureau of Meteorology	BOM
Benzene, Toluene, Ethylbenzene, Xylene	BTEX
Cation Exchange Capacity	CEC
Contaminated Land Management	CLM
Contaminant(s) of Potential Concern	CoPC
Chain of Custody	COC
Conceptual Site Model	CSM
Development Application	DA
Data Quality Indicator	DQI
Data Quality Objective	DQO
Detailed Site Investigation	DSI
Ecological Investigation Level	EIL
Environmental Investigation Services	EIS
Ecological Screening Level	ESL
Environmental Management Plan	EMP
Excavated Natural Material	ENM
Environment Protection Authority	EPA
Environmental Site Assessment	ESA
Ecological Screening Level	ESL
Fibre Cement Fragment(s)	FCF
General Approval of Immobilisation	GAI
Health Investigation Level	HILs
Hardness Modified Trigger Values	HMTV
Health Screening Level	HSLs
International Organisation of Standardisation	ISO
Lab Control Spike	LCS
Light Non-Aqueous Phase Liquid	LNAPL
Map Grid of Australia	MGA
National Association of Testing Authorities	NATA
National Environmental Protection Measure	NEPM
Organochlorine Pesticides	OCP
Organophosphate Pesticides	OPP
Polycyclic Aromatic Hydrocarbons	PAH
Potential ASS	PASS
Polychlorinated Biphenyls	PCBs
Photo-ionisation Detector	PID
Protection of the Environment Operations	POEO
Practical Quantitation Limit	PQL
Quality Assurance	QA
Quality Control	QC
Remediation Action Plan	RAP
Relative Percentage Difference	RPD

Site Assessment Criteria	**SAC**
Sampling, Analysis and Quality Plan	**SAQP**
Site Audit Statement	**SAS**
Site Audit Report	**SAR**
Site Specific Assessment	**SSA**
Source, Pathway, Receptor	**SPR**
Specific Contamination Concentration	**SCC**
Standard Penetration Test	**SPT**
Standard Sampling Procedure	**SSP**
Standing Water Level	**SWL**
Trip Blank	**TB**
Toxicity Characteristic Leaching Procedure	**TCLP**
Total Recoverable Hydrocarbons	**TRH**
Trip Spike	**TS**
Upper Confidence Limit	**UCL**
United States Environmental Protection Agency	**USEPA**
Underground Storage Tank	**UST**
Virgin Excavated Natural Material	**VENM**
Volatile Organic Compounds	**VOC**
World Health Organisation	**WHO**
Work Health and Safety	**WHS**

Units

Litres	**L**
Metres BGL	**mBGL**
Metres	**m**
Millivolts	**mV**
Millilitres	**ml or mL**
Milliequivalents	**meq**
micro Siemens per Centimetre	**µS/cm**
Micrograms per Litre	**µg/L**
Milligrams per Kilogram	**mg/kg**
Milligrams per Litre	**mg/L**
Parts Per Million	**ppm**
Percentage	**%**

1 INTRODUCTION

Catholic Archdiocese of Sydney ('the client') commissioned Environmental Investigation Services (EIS)[3] to prepare a Remediation Action Plan (RAP) for the proposed residential development at 95 Bower Street and 29-35 Reddall Street, Manly, NSW. The site location is shown on Figure 1 and the RAP is applicable to 'the site' boundaries as shown on Figure 2.

EIS have previously undertaken a *Preliminary Environmental Site Assessment (ESA)* at the site (EIS Ref: E30375Krpt[4]) dated 8 June 2017. The findings of the EIS 2017 report are summarised in Section 2.

EIS are currently in a transitional phase of re-branding and will commence trading as JK Environments in 2019. JK Environments, like EIS, will function as the environmental division of Jeffery and Katauskas Pty Ltd and will continue to operate alongside JK Geotechnics.

1.1 Proposed Development Details

Based on the supplied conceptual plan prepared by Squillace Architects. The proposed development will involve the demolition of the existing structures on the site and the construction of three multiple storey residential buildings, over one to two and a half levels of basement.

1.2 Goals, Aims and Objectives

The goal of this RAP is to provide technical recommendations for further contamination investigations, remediation works, validation works and unexpected finds protocols during the development works.

The objectives of the RAP are to:

- Provide a methodology to manage contamination, remediate and validate the site;
- Provide a contingency plan for the remediation works;
- Outline site management procedures to be implemented during remediation work; and
- Provide an unexpected finds protocol to be implemented during the development works.

1.3 Scope of Work

The plan was prepared in accordance with an EIS proposal (Ref: EP49193PL) of 21 March 2019 and written acceptance from the client's representative of 21 March 2019. The scope of work included:

- Review of the previous report prepared by EIS; and
- Preparation of a final report.

[3] Environmental consulting division of Jeffery & Katauskas Pty Ltd (J&K)

[4] Titled *"Report to Archdiocese of Sydney on Preliminary Environmental Site Assessment for Proposed Residential Development at 95 Bower Street, 29, 31 and 35 Reddall Street, Manly, NSW*" referred to as EIS 2017 Report.

The scope of work was undertaken with reference to the regulations and guidelines outlined in the table below. Individual guidelines are also referenced within the text of the report.

Table 1-1: Guidelines

Guidelines/Regulations/Documents
Contaminated Land Management Act (1997)[5]
State Environmental Planning Policy No.55 – Remediation of Land (1998)[6]
Managing Land Contamination, Planning Guidelines SEPP55 – Remediation of Land (1998)[7]
Guidelines for Consultants Reporting on Contaminated Sites (2011)[8]
Guidelines for the NSW Site Auditor Scheme, 3rd Edition (2017)[9]
National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013)[10]

[5] Contaminated Land Management Act 1997 (NSW). (referred to as CLM Act 1997)

[6] State Environmental Planning Policy No. 55 – Remediation of Land 1998 (NSW). (referred to as SEPP55)

[7] Department of Urban Affairs and Planning, and Environment Protection Authority, (1998). *Managing Land Contamination, Planning Guidelines SEPP55 – Remediation of Land*. (SEPP55 Planning Guidelines)

[8] NSW Office of Environment and Heritage (OEH), (2011). *Guidelines for Consultants Reporting on Contaminated Sites.* (referred to as Reporting Guidelines 2011)

[9] NSW EPA, (2017). *Guidelines for the NSW Site Auditor Scheme, 3rd ed.* (referred to as Site Auditor Guidelines 2017)

[10] National Environment Protection Council, (2013). *National Environmental Protection (Assessment of Site Contamination) Amendment Measure 1999* (as amended 2013). (referred to as NEPM 2013)

2 SITE INFORMATION

2.1 Site Identification

Table 2-1: Site Identification

Current Site Owner:	Catholic Archdiocese of Sydney
Site Address:	95 Bower Street and 29-35 Reddall Street, Manly, NSW
Lot & Deposited Plan:	Lot 81, 82, 83 and 84 within DP8076
Current Land Use:	Residential
Proposed Land Use:	Residential
Local Government Authority (LGA):	Northern Beaches Council
Current Zoning:	R1 – General Residential
Site Area (m^2):	2,512m^2
Geographical Location (decimal degrees) (approx.):	Latitude: -33.80159205 Longitude: 151.2928998

2.2 Site Location and Regional Setting

The site is located in a predominantly residential area of Manly. The site is bounded by Bower Street to the east, College Street to the south and Reddall Street to the west and a public reserve to the north. The site is located approximately 450m to the south-west of Shelly Beach, Tasman Sea.

2.3 Topography

The regional topography is characterised by a north facing hillside that falls eastwards towards the ocean. The site had a slope which fell towards the east at approximately 2-8°. Parts of the site appear to have been levelled to account for the slope and accommodate the existing structures.

2.4 EIS Site Inspection (2018)

A walkover inspection of the site was undertaken by EIS on 15/5/2017. The inspection was limited to accessible areas of the site and immediate surrounds. An internal inspection of buildings was not undertaken. EIS were informed by Squillace during the site inspection that 29 Reddall Street (Lot 84) is to be included into the report when referring to the 'site.' However, an inspection of this property was not undertaken. During the inspection various sandstone outcrops were observed on the site and on the neighbouring properties.

A summary of the findings are outlined in the following subsections:

2.4.1 Buildings, Structures and Roads

The site consisted of four residential lots. The buildings were generally constructed of brick with tiled roofs. The car port at 29 Reddall Street and the eves at 35 Reddall Street appeared to contain fibre cement sheeting.

2.4.2 Visible or Olfactory Indicators of Contamination

No obvious materials such as asbestos containing materials were observed on the surface of the soil.

2.4.3 Drainage and Services

Surface water would generally infiltrate the landscaped areas on the site.

2.4.4 Sensitive Environments

Sensitive environments such as wetlands, ponds, creeks or extensive areas of natural vegetation were not identified on site.

2.4.5 Landscaped Areas and Visible Signs of Plant Stress

Medium to large trees and shrubs were observed in planted and grassed areas across the site. The vegetation appeared to be in reasonable condition based on a cursory inspection, with no obvious or extensive dieback observed.

2.5 Surrounding Land Use

During the site inspection, EIS observed the following land uses in the immediate surrounds:

- North – Bower Street beyond which were residential properties.
- South – Reddall Street beyond which were residential properties.
- East – College Street beyond which were residential properties.
- West – public walkway beyond which were residential properties.

EIS did not observe any land uses in the immediate surrounds that were identified as potential contamination sources for the site.

2.6 Previous Investigation (EIS 2017)

EIS have previously undertaken a *Preliminary Environmental Site Assessment (ESA)* at the site (EIS Ref: E30375Krpt, dated 8 June 2017).

The EIS 2017 report involved a preliminary site history assessment and soil sampling from three locations as shown on the attached Figure 2. Sampling was undertaken using hand equipment due to access restrictions.

The site history assessment identified that St Patricks College (located approximately 50m to the south-east of the site) was notified on an EPA list of contaminated sites. The contamination was listed as Category F and G. Category F is defined as: *"The contamination of this site is managed by a planning approval process. The consent authority is either the local council or government agency, such as the department of planning"*.

Category G is defined as: *"Based on the information made available to the EPA to date, the contamination of the site is considered by the EPA to be not significant enough to warrant regulatory intervention under the Contaminated Management Act 1997"*.

The site history assessment identified that the site has been used for residential purposes since at least 1943.

The soils sampling results identified one elevation of Benzo(a)pyrene (B(a)P) above the human health based site assessment criteria (SAC) in the fill material sampled from BH3 (0-0.3m) with a concentration of 3.7mg/kg (SAC of 3.0mg/kg). The B(a)P was considered to be associated with ash and slag inclusions within the fill material. EIS were of the opinion that the soil contamination was confined to the fill material at the site. The horizontal extent of the contamination was unknown due to the limited sampling locations across the site.

Soil sampling for potential acid sulfate soil (PASS) and analysis was undertaken. Mildly acidic soils were identified, however this is indicative of soils associated with organic/humic material rather than ASS. The EIS 2017 report concluded that potential acid sulfate soil conditions were unlikely to be generated at the site for the following reasons:

- EIS observed sandstone bedrock outcrops on the surface of the site;
- The geological maps illustrated that the majority of the site was underlain by Hawkesbury Sandstone. This was confirmed by site observations;
- The sub-surface conditions encountered in the boreholes consisted of sandy fill over very shallow inferred bedrock. ASS are associated with alluvial soil profiles not shallow bedrock; and
- The site is located at approximately 9-24m AHD, with excavations to extend to a minimum elevation of approximately 7m AHD. ASS are not usually associated with soil horizons above 5m AHD.

The EIS 2017 report identified the following data gaps:

- 29 Reddall Street and areas beneath the existing buildings were not included in the assessment;
- An assessment of the groundwater has not been undertaken;
- A waste classification of the natural soil/rock has not been undertaken; and
- The NSW sampling density was not met.

Therefore the EIS 2017 report concluded that the site can be made suitable for the proposed development provided that a Stage 2 Environmental Site Assessment be undertaken and a Remediation Action Plan (RAP) be implemented (if required).

2.7 Summary of Geology and Hydrogeology

2.7.1 Regional Geology

The 1:100 000 Sydney geological map shows the site to be underlain by Hawkesbury Sandstone, which is described as medium to coarse grained quartz sandstone with minor shale and laminite lenses.

2.7.2 EIS Stage 2 Report

Boreholes drilled at the site for the EIS 2017 report generally encountered fill material at the surface and extended to depths of approximately 0.4m to 1.0m. BH2 and BH3 were terminated in the fill at a maximum depth of 1.0m. The fill material typically comprised of silty sand and contained inclusions of ash, slag, sandstone gravel and clay nodules. The fill was underlain by inferred sandstone bedrock in BH1 at a depth of 0.5m.

2.7.3 Acid Sulfate Soil Risk

A review of the acid sulfate soil (ASS) risk map prepared by Department of Land and Water Conservation (1997[11]) indicated that the site is located within an area of no known occurrence of acid sulfate soil. ASS information presented in the Lotsearch report (attached in the appendices) indicated that the site is located within a Class 5 area. Works in Class 5 areas that could pose an environmental risk in terms of ASS include works within 500m of adjacent Class 1,2,3,4 land which are likely to lower the water table below 1m AHD on the adjacent land.

2.7.4 Hydrogeology

Hydrogeological information presented in the Lotsearch report indicated the regional aquifer includes porous, extensive aquifers of low to moderate productivity. There were numerous registered bores within 2km of the site. The nearest registered bore was 362m from the site and the majority of bores were used for domestic or recreational purposes. Use of groundwater is not proposed as part of the development.

2.7.5 Receiving Water Bodies

The site location and regional topography indicates that excess surface water flows have the potential to enter the Tasman Sea. This water body could be a potential receptor.

2.8 Summary of Site History

The EIS 2017 report included a preliminary site history assessment comprising a review of a Lotsearch Pty Ltd Environmental Risk and Planning Report, historical aerial photographs, historical land titles and statutory notices by the NSW EPA. From this information, the site history indicated the site has been privately owned for residential purposes since at least 1943.

[11] Department of Land and Water Conservation, (1997). *1:25,000 Acid Sulfate Soil Risk Map (Series 9130N3, Ed 2).*

3 CONCEPTUAL SITE MODEL

NEPM (2013) defines a CSM as a representation of site related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM for the site is presented in the following sub-sections and is based on the site information (including the site inspection information) and the review of site history information. Reference should also be made to the figures attached in the appendices.

3.1 Potential Contamination Sources/AEC and CoPC

The potential contamination sources/AEC and CoPC identified in the previous investigation are presented in the following table:

Table 3-1: Potential (and/or known) Contamination Sources/AEC and Contaminants of Potential Concern

Source / AEC	CoPC
Fill material – The site has been historically filled to achieve the existing levels. The previous investigation identified fill to depths ranging from 0.4m to 1.0m. Benzo(a)pyrene above the SAC for human health receptors was identified at one location in fill.	Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), petroleum hydrocarbons (referred to as total recoverable hydrocarbons – TRHs), benzene, toluene, ethylbenzene and xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides (OCPs), organophosphate pesticides (OPPs), polychlorinated biphenyls (PCBs) and asbestos.
Hazardous Building Material – Hazardous building materials may be present as a result of former building and demolition activities. These materials may also be present in the existing buildings/ structures on site. A hazardous building materials assessment is being undertaken by EIS at the time of this report.	Asbestos, lead and PCBs
Off-site area – St Patricks College has been notified by the EPA's list of contaminated sites with the notified activity listed as 'unclassified'. The college is located up-gradient of the site and is considered to be a potential source of contamination.	Unknown (detailed information not available)

3.2 Mechanism for Contamination, Affected Media, Receptors and Exposure Pathways

The mechanisms for contamination, affected media, receptors and exposure pathways relevant to the potential contamination sources/AEC are outlined in the following CSM table:

Table 3-2: CSM

Potential mechanism for contamination	Potential mechanisms for contamination include: • Fill material – importation of impacted material, 'top-down' impacts (e.g. placement of fill, leaching from surficial material etc.), or sub-surface release (e.g. impacts from buried material); • Hazardous building materials – 'top-down' (e.g. demolition resulting in surficial impacts in unpaved areas); • Off-site land uses – 'top-down', spill or sub-surface release. Impacts to the site could occur via migration of contaminated groundwater.
Affected media	Soil/soil vapour and groundwater have been identified as potentially affected media.
Receptor identification	Human receptors include site occupants/users, construction workers and intrusive maintenance workers. Off-site human receptors include adjacent land users, groundwater users and recreational water users within Shelly Beach. Ecological receptors include terrestrial organisms and plants within unpaved areas (including the proposed landscaped areas), and marine ecology in Shelly Beach.
Potential exposure pathways	Potential exposure pathways relevant to the human receptors include ingestion, dermal absorption and inhalation of dust (all contaminants) and vapours (volatile TRH, naphthalene and BTEX). The potential for exposure would typically be associated with the construction and excavation works, and use of unpaved areas (i.e. the gardens) and basement (i.e. vapour inhalation or incidental contact with groundwater seepage). Potential exposure pathways for ecological receptors include primary contact and ingestion.

4 REMEDIATION EXTENT

A discussion of the anticipated extent of remediation based on the current data is provided below.

Table 4-1: Remediation Extent

AEC	Extent
Fill material	The EIS 2017 report identified one elevated concentration of B(a)P in the fill material. Based on the available data, the contamination is likely to be limited to the depth and extent of fill material on the site. The full extent of remediation of fill material will be confirmed by the Stage 2 ESA. An outline of remediation management requirements to address this AEC is included in Section 7.

The remediation strategy outlined in the RAP is based on the limited data available from the EIS 2017 report and it is assumed that the fill across the entire site is contaminated.

The full extent of the contaminated fill material at the site should be confirmed by completing a Stage 2 ESA. This will address the data gaps outlined in the EIS 2017 report as well as characterise the contamination at the site and properly define the scope and extent of remediation required. Should additional contaminants be identified during the Stage 2 ESA, this RAP will be amended to reflect the additional information and update the remediation strategies as required.

5 REMEDIATION OPTIONS

5.1 Soil Remediation

The NSW EPA follows the hierarchy set out in NEPM 2013. The preferred order for soil remediation and management is as follows:

1) On-site treatment of soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level;
2) Off-site treatment of excavated material so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the site; or

If the above are not practicable:

3) Consolidation and isolation of the soil on-site by containment with a properly designed barrier;
4) Removal of contaminated material to an approved site or facility, followed where necessary by replacement with clean material; or
5) Where the assessment indicates that remediation would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate management strategy.

The above hierarchy items (1 to 5 inclusive) have been referred to as Option 1, Option 2 etc herein.

5.2 Consideration of Remediation Options

The tables below discusses a range of remediation options:

Table 5-1: Consideration of Remediation Options

Option	Discussion	Applicability
Option 1 On-site treatment of contaminated soil	Various on-site treatment technologies exist such as bio-remediation, air sparging and soil vapour extraction, and thermal desorption.	Bioremediation of hydrocarbon impacted soils associated with the remediation areas may be possible, however this option is unlikely to be practical in terms of the limited volumes of material potentially to be remediated, the limitations associated with treatment technologies, and the regulatory implications.
Option 2 Off-site treatment of contaminated soil	Contaminated soils are excavated, transported to an approved/ licensed treatment facility, treated to remove/stabilise the contaminants then returned to the subject site, transported to an alternative site or disposed to an approved landfill facility. This option provides for a relatively short program of on-site works, however there may be some delays if the material is to be returned to the site following treatment and regulatory requirements would need to be carefully considered. The cost per tonne for transport to and from the site and for treatment is considered to be relatively high. The material would also have to be assessed in terms of suitability for reuse as part of the proposed development works.	Not applicable for this project considering the limited volumes of material potentially to be remediated, the limitations associated with treatment technologies, and the regulatory implications.
Option 3 Capping and containment of contaminated soils	This would include the placement of a warning layer (such as geo-grid or geofabric) and pavement over the surface of the contaminated soil to isolate the material and thereby reduce the health risk to future site users. The capping and/or containment must be appropriate for the specific contaminants of concern. An ongoing Environmental Management Plan (EMP) would be required and site identification	Not applicable for this project, considering the requirement for extensive excavation of the site for the proposed development. This option would also require notation of the site on various planning and site identification documentation. This may impact upon

Option	Discussion	Applicability
	documentation, including the Section 10.7 Council planning certificate (or other appropriate notification mechanism), would be modified to note the presence of the contamination/EMP in the event that contamination remains at concentrations that exceed the Validation Assessment Criteria (VAC). This may impact upon development approval conditions, place restrictions on the use of the land and limit the future potential land value.	development approval conditions and place restrictions on the use of the land and limit potential land value.
Option 4 Removal of contaminated material to an appropriate facility and reinstatement with clean material	Contaminated soils would be classified in accordance with NSW EPA guidelines for waste disposal, excavated and disposed of off-site to an appropriately licensed facility. The material would have to meet the requirements for landfill disposal. Landfill gate fees (which may be significant) would apply in addition to transport costs.	Removal is considered the most viable option for this project considering the relatively low volume of soil that is to be excavated for the proposed development.

6 REMEDIATION DETAILS

6.1 Sequence of Works

Prior to commencement of any site preparation or remediation work, a suitably qualified contaminated land consultant[12] should be engaged as the validation consultant to undertake the Stage 2 ESA and validate the implementation of the RAP. The site management plan for remediation works (see Section 9) should be reviewed and implemented by the remediation contractor. Subsequently, remediation can occur within the nominated remediation areas.

Geotechnical advice should be sought with regards to the stability of any proposed excavations and adjacent structures/features. Geotechnical advice should also be sought regarding the requirements of any backfill material used for the reinstatement (temporary or otherwise) of the remediation areas.

6.2 Remediation of the Contaminated Fill

6.2.1 Rationale for Selection of Remedial Strategy

The most viable option for remediation of the contaminated fill soil is removal and disposal off-site to an appropriate facility (Option 4).

6.2.2 Remediation Details

The specific remediation details for the separator pit are described below:

Table 6-1: Remediation Details – Contaminated Fill

Step	Procedure
1.	Address Stability Issues and Underground Services: Geotechnical advice should be sought regarding the stability of the adjacent structures and/or adjacent areas prior to commencing the excavation (as required). Stability issues should be addressed to the satisfaction of a qualified geotechnical engineer.
2.	PPE and WHS: Check PPE and WHS requirements prior to commencement of remediation works. The minimum PPE required for the remediation includes the following: • Disposable gloves; • P2 dust mask; • Eye protection; and • Hard hat, covered clothing and steel toed boots.

[12] EIS recommend that the consultancy engaged for the work be a member of the Australian Contaminated Land Consultants Associated (ACLCA), and/or the individual managing the works (and writing the validation report) be certified under one of the NSW EPA endorsed certified practitioner schemes

Step	Procedure
3.	Site Preparation: All existing vegetation, buildings, pavement and infrastructure should be removed from the site with care by the demolition/earth works contractor.
4.	Removal of the contaminated fill material: Following removal of the buildings, vegetation and pavement, remediation of the area will be undertaken as follows: • The remediation area should be marked out with signage and physical barriers (i.e. fencing or bollards); • Submit an application to dispose of the soil (in accordance with the assigned waste classification) to a landfill that is appropriately licensed to receive the waste, and obtain authorisation to dispose; • Load the soil onto trucks and dispose in accordance with the assigned waste classification; • The validation consultant should be present during the excavation to provide advice on the extent based on visual and olfactory indicators; • Any excavated material that is to be stockpiled, should be covered until such time as it can be loaded onto trucks and disposed of; • Obtain validation samples from the walls and base of the excavation (see the Validation Plan in Section 7 of the RAP). Groundwater is unlikely to be encountered at the base of the remedial excavation, however in the event that groundwater is encountered, this should also be validated in accordance with Section 7; • All documents including landfill dockets, liquid waste disposal etc. should be retained and forwarded to the client for inclusion into the validation report to be prepared by the validation consultant.

6.3 Remediation Documentation

The remediation contractor must retain all documentation associated with the remediation, including but not limited to:

- Liquid waste disposal (if undertaken);
- Soil disposal dockets (and dockets for disposal of asbestos containing materials where relevant);
- Imported materials information;
- Photographs of remediation works;
- Waste tracking documentation.

Copies of the above documentation must be forwarded to the validation consultant on completion of the remediation for inclusion in the final validation report.

6.4 Waste Volume and Disposal Assessment

A soil volume analysis should be undertaken on completion of the works and reconciled with the quantities shown on the soil disposal dockets. A review of the disposal facility's licence issued under the Protection of the Environment Operations (POEO) Act (1997)[13] should also be undertaken to confirm whether or not each facility is appropriately licensed to receive the waste.

[13] NSW Government, (1997)). *Protection of Environment Operations Act.* (referred to as POEO Act 1997)

7 VALIDATION PLAN

Validation is necessary to demonstrate that remedial measures described in this RAP have been successful and that the site is suitable for the intended land use. The sampling program for the validation is outlined in Section 7.1. This is the minimum requirement based on the remedial strategies provided. Additional validation sampling may be required based on site observations made during remediation.

Site observations will also be used as a validation tool to assess the extent of site contamination. In particular visual and olfactory indicators such as petroleum odours and staining should be recorded.

7.1 Validation Sampling and Documentation

The table below outlines the validation requirements for the site.

Table 7-1: Validation Requirements

Aspect	Sampling	Analysis	Observations and Documentation
Remediation of Contaminated Fill			
Remediation Area – excavation base	One surficial soil sample to be collected per 25m^2.	TRH/BTEX and PAHs	Samples to be screened using PID Observations of staining and odour to be recorded Photographs to be taken
Remediation Area – excavation walls	One sample per 10 lineal metre and per vertical metre (of fill). Sampling to target obvious indicators of contamination and changes in soil profile.	TRH/BTEX and PAHs	Samples to be screened using PID Observations of staining and odour to be recorded Photographs to be taken
Groundwater (if encountered in excavation)	One 'grab' sample to be collected using a bailer.	TRH/BTEX and PAHs (other contaminants have been excluded as volatile compounds pose the greatest risk in the context of the proposed site use).	Observations of sheen and odour to be recorded.

Imported Materials – relevant to all site works			
Imported VENM backfill	Minimum of three samples per source	Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), TRH, BTEX PAHs, OCP/OPP, PCBs and asbestos. Additional analysis may be required depending on source site history.	VENM documentation/ report required (should include source site history to demonstrate analytes are appropriate) confirming material meets the definition for VENM. Material to be inspected upon importation to confirm it is free of visible/olfactory indicators of contamination and is consistent with documentation.
Imported engineering materials such as recycled aggregate, road base etc	Minimum of three samples per source/material type.	Heavy metals (as above), TRHs, BTEX, PAHs, OCP/OPP, PCBs and asbestos.	Documentation required to confirm material has been classified with reference to a relevant exemption. Material to be inspected upon importation to confirm it is free of visible/olfactory indicators of contamination and is consistent with documentation. Dockets for imported material to be provided.
Imported engineering materials comprising only natural quarried products such as blue metal etc	At the validation consultant's discretion based on supplier documentation.	At the validation consultant's discretion based on supplier documentation.	Documentation to be provided from the supplier confirming the material is a product comprising only VENM (i.e. quarried product). Review of quarry POEO licence. Material to be inspected upon importation to confirm it is free of anthropogenic materials, visible and olfactory indicators of contamination, and is consistent with documentation. Dockets for imported material to be provided.

Imported landscaping materials	Minimum of three samples per source/material type.	Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), TRHs, BTEX, PAHs, OCPs, OPPs, PCBs and asbestos.	Documentation required to confirm material has been produced under an appropriate standard. Material to be inspected upon importation to confirm it is free of visible/olfactory indicators of contamination and is consistent with documentation. Dockets for imported material to be provided.

7.2 Validation Assessment Criteria (VAC) and Data Assessment

The VAC to be adopted for the validation assessment (and data gap investigation) are outlined in the table below:

Table 7-2: VAC

Validation Aspect	Criteria
Waste classification (soil disposal)	In accordance with the procedures and criteria outlined in Part 1 of the Waste Classification Guidelines 2014.
Soil validation	Soil VAC will include the HIL-B and HSL-B criteria for 'residential with minimal soil access' land use, based on NEPM (2013). Asbestos is to be considered as present/absent (use of asbestos HSLs is not considered relevant in the context of the proposed development). Aesthetics: soils to be free of staining and odours
Groundwater	VAC for volatile compounds in groundwater will be based on drinking water guidelines presented in Australian Drinking Water Guidelines (2011)[14] and the World Health Organisation (WHO) document titled Petroleum Products in Drinking-water, Background document for the development of WHO Guidelines for Drinking Water Quality (2008)[15]. The VAC for naphthalene will include the threshold value for tap water based on the USEPA Region 9 screening levels.
Imported materials	Heavy metal concentrations are to be less than the most conservative Added Contaminant Limit (ACL) concentrations for URPOS exposure setting presented in Schedule B1 of NPEM (2013). Organic compounds are to be less than the laboratory PQLs and asbestos to be absent. Results for VENM and other imported materials will need to be consistent with expectations for those materials. Aesthetics: soils to be free of staining and odours

Data should initially be assessed as above or below the VAC. Statistical analysis may be applied if deemed appropriate by the consultant and undertaken in accordance with the NEPM (2013).

[14] National Health and Medical Research Council (NHMRC), (2011). *National Water Quality Management Strategy, Australian Drinking Water Guidelines* (referred to as ADWG 2011)

[15] World Health Organisation (WHO), (2008). *Petroleum Products in Drinking-water, Background document for the development of WHO Guidelines for Drinking Water Quality* (referred to as WHO 2008)

7.3 Validation Report

As part of the validation process, a site validation report will be prepared by the validation consultant. The report will outline the remediation work undertaken at the site and any deviations to the remediation strategy. The report will summarise the results of the validation assessment and will be prepared in accordance with the Reporting Guidelines 2011. The report should draw conclusions regarding the success of the remediation/validation and the suitability of the site for the proposed development (from a contamination viewpoint).

7.4 Data Quality

Appropriate QA/QC samples should be obtained during the validation and analysed for the contaminants of concern. As a minimum, QA/QC sampling should include duplicates (5% inter-laboratory and 5% intra-laboratory), trip spikes, trip blanks and rinsate samples (one spike, rinsate and blank per sampling event).

DQOs should be established for the validation with regards to the seven-step process outlined in Section **Error! Reference source not found.**. DQIs are to be assessed based on field and laboratory considerations for precision, accuracy, representativeness, completeness and comparability.

8 CONTINGENCY PLAN

A review of the proposed remediation works has indicated that the greatest risk that may affect the success of the remediation is an unexpected find. A contingency plan for unexpected finds is outlined below, in conjunction with a selection of other contingencies that may apply to this project.

8.1 Unexpected Finds

Residual hazards that may exist at the site would generally be expected to be detectable through visual or olfactory means. At this site, these types of hazards may include: USTs, asbestos in soil, and odorous or stained hydrocarbon impacted soils outside those identified.

The procedure to be followed in the event of an unexpected find is presented below:

- In the event of an unexpected find, all work in the immediate vicinity should cease and the client should be contacted immediately;
- Temporary barricades should be erected to isolate the area from access to the public and workers;
- In the event potential asbestos material is encountered, a qualified occupational hygienist and/or asbestos consultant should be contacted (preferably the validation consultant will have an in-house hygienist or asbestos assessor);
- The client should engage a qualified environmental consultant to attend the site and assess the extent of remediation that may be required and/or adequately characterise the contamination in order to allow for cap and containment of the material;
- In the event remediation is required, the procedures outlined within this report should be adopted where appropriate, alternatively an addendum to this RAP should be prepared;
- An additional sampling and analytical rationale should be established by the consultant and should be implemented with reference to the relevant guideline documents; and
- Appropriate validation sampling should be undertaken and the results should be included in the validation report.

8.2 Continual Soil Validation Failure

In the event of a soil validation failure, the excavation should be extended in the direction of the failure (in consultation with the validation consultant) and the area re-validated.

8.3 Importation Failure for VENM or other Imported Materials

Where material to be imported onto the site does not meet the importation acceptance criteria detailed in Section 7, the only option is to not accept the material. Alternative material must be sourced that meets the importation requirements.

8.4 Disposal of Hazardous Waste

Material classed as 'Hazardous Waste' under the Waste Classification Guidelines 2014 may require further assessment and stabilisation prior to off-site disposal. Disposal approval may also be required from the NSW EPA and licensed landfill facility. The presence of Hazardous Waste may result in significant delays and additional cost to the project.

9 SITE MANAGEMENT PLAN FOR REMEDIATION WORKS

The information outlined in this section of the RAP is for the remediation work only. The client should contact the local consent authority (council or certifier) for specific site management requirements for the overall development of the site.

9.1 Interim Site Management

The site is secure and is currently sealed, therefore interim management is not considered to be required.

9.2 Project Contacts

Emergency procedures and contact telephone numbers should be displayed in a prominent position at the site entrance gate and within the main site working areas. The contact details of key project personnel are summarised below.

Table 9-1: Project Contacts

Task	Company	Contact Details
Project Manager	Peloton Group	Vincent Orrock 9357 5288
Remediation Contractor	To be appointed	-
Environmental Consultant	EIS (at the time of the RAP preparation)	9888 5000
Certifier	To be appointed	-
NSW EPA	Pollution Line	131 555
Emergency Services	Ambulance, Police, Fire	000

9.3 Security

Prior to the commencement of site works, fencing should be installed as required to secure the remediation areas. Warning signs should be erected, which outline the PPE required for remediation work. All excavations should be clearly marked and secured to reduce the risk to site personnel from injury by falling into open excavations.

9.4 Timing and Sequencing of Remediation Works

In general, all remedial works should be completed prior to the commencement of construction works for the proposed development. In the event that remedial works are undertaken in conjunction with the

development, all remediation areas should be clearly marked and covered with builder's plastic (or similar) in order to reduce the dust generation, surface water run-off and/or exposure to receptors.

In the event of unexpected delays, builder's plastic (or similar) should be used to cover the remediation areas in order to reduce the dust generation, surface water run-off and/or exposure to receptors.

9.5 Site Soil and Water Management Plan

The contractor should prepare a detailed soil and water management plan prior to the commencement of site works. Silt fences should be used to control the surface water runoff at all appropriate locations of the site. Reference should be made to the development consent conditions for further details.

All stockpiled materials should be placed within an erosion containment boundary with silt fences and sandbags employed to limit sediment movement. The containment area should be located away from drainage lines, gutters, stormwater pits and inlets and the site boundary. No liquid waste or runoff should be discharged to the stormwater or sewerage system without the approval of the appropriate authorities.

9.6 Noise and Vibration Control Plan

The guidelines for minimisation of noise on construction sites outlined in AS-2460 (2002)[16] should be adopted. Other measures specified in the consent conditions should also be complied with. Noise producing machinery and equipment should only be operated between the hours approved by Council (refer to consent documents).

All practicable measures should be taken to reduce the generation of noise and vibration to within acceptable limits. In the event that short-term noisy operations are necessary, and where these are likely to affect residences, notifications should be provided to the relevant authorities and the residents by the project manager, specifying the expected duration of the noisy works.

9.7 Dust Control Plan

All practicable measures should be taken to reduce dust emanating from the site. Factors that contribute to dust production are:

- Wind over a cleared surface;
- Wind over stockpiled material; and
- Movement of machinery in unpaved areas.

Visible dust should not be present at the site boundary. Measures to minimise the potential for dust generation include:

- Use of water sprays on unsealed or exposed soil surfaces;

[16] Australian Standard, (2002). *AS2460: Acoustics - Measurement of the Reverberation Time in Rooms.*

- Covering of stockpiled materials and excavation faces (particularly during periods of site inactivity and/or during windy conditions) or alternatively the erection of hessian fences around stockpiled soil or large exposed areas of soil;
- Establishment of dust screens consisting of a 2m high shade cloth or similar material secured to a chain wire fence;
- Maintenance of dust control measures to keep the facilities in good operating condition;
- Concrete surfaces brushed or washed to remove dust;
- Stopping work during strong winds;
- Loading or unloading of dry soil as close as possible to stockpiles to prevent spreading of loose material around the site; and
- The expanse of cleared land should be kept to a minimum to achieve a clean and economical working environment.

If stockpiles are to remain on-site or an excavation remains open for a period of longer than several days, dust monitoring should be undertaken at the site. If excessive dust is generated all site activities should cease until either wind conditions are more acceptable or a revised method of excavation/remediation is developed.

Dust is also produced during the transfer of material to and from the site. All material should be covered during transport and should be properly disposed of on delivery. No material is to be left in an exposed, un-monitored condition.

All equipment and machinery should be brushed or washed down before leaving the site to limit dust and sediment movement off-site. In the event of prolonged rain and lack of paved areas all vehicles should be washed down prior to exit from the site, and any soil or dirt on the wheels of the vehicles removed. Water used to clean the vehicles should be collected and tested prior to appropriate disposal under the Waste Classification Guidelines.

9.8 Odour Control Plan

All activities undertaken at the site should be completed in a manner that minimises emissions of smoke, fumes and vapour into the atmosphere and any odours arising from the works or stockpiled material should be controlled. Control measures may include:

- Maintenance of construction equipment so that exhaust emissions comply with the Clean Air Regulations issued under the POEO Act;
- Demolition materials and other combustible waste should not be burnt on site;
- The spraying of a suitable proprietary product to suppress any odours that may be generated by excavated materials; and
- Use of protective covers (e.g. tarpaulins or builder's plastic).

All practicable measures should be taken to reduce fugitive emissions emanating from the site so that associated odours do not constitute a nuisance and that the ambient air quality is not adversely impacted.

Disturbance of hydrocarbon contaminated soils associated with the USTs and separator pit may result in odorous conditions. The following odour management plan should be implemented to limit the exposure of site personnel and surrounding residents to unpleasant odours:

- Excavation and stockpiling of material should be scheduled during periods with low winds if possible;
- A suitable proprietary product could be sprayed on material during excavation and following stockpiling to reduce odours;
- All complaints from workers and neighbours should be logged and a response provided. Work should be rescheduled as necessary to minimise odour problems;
- The site foreman should consider the following odour control measures:
  - reduce the exposed surface of the odorous materials;
  - time excavation activities to reduce off-site nuisance (particularly during strong winds); and
  - cover exposed excavation faces overnight or during periods of low excavation activity.
- If continued complaints are received, alternative odour management strategies should be considered and implemented.

9.9 Health and Safety Plan

A site specific WHS plan should be prepared by the contractor for all work to be undertaken at the site. The WHS plan should meet all the requirements outlined in SafeWork NSW WHS regulations.

As a minimum requirement, personnel must wear appropriate protective clothing, including long sleeve shirts, long trousers and steel cap boots. Gloves and dust masks should be worn when working on remediation activities (additional asbestos-related PPE may also be required for asbestos remediation work). Washroom and lunchroom facilities should also be provided to allow workers to remove potential contamination from their hands and clothing prior to eating or drinking.

9.10 Waste Management

Prior to commencement of remedial works and excavation for the proposed development, the contractor should develop a waste management plan. A Waste Data File is also to be maintained to assist with addressing the requirements for assessing and tracking waste disposal under this RAP.

9.11 Incident Management Contingency

The validation consultant should be contacted if any unexpected conditions are encountered at the site. This should enable the scope of remedial/validation works to be adjusted as required. Similarly if any incident occurs on site, the environmental consultant should be advised to assess potential impacts on site contamination conditions and the remediation/validation timetable. Any new information that comes to light

that has the potential to alter the prior conclusions regarding site contamination should be notified to Council in accordance with Condition 103 of the development consent.

9.12 Dewatering

Dewatering is unlikely to be required to facilitate the remediation. Reference should be made to the development consent for specific details regarding temporary construction dewatering.

9.13 Hours of Operation

Hours of operation should be between those approved by Council under the development approval process. Reference should also be made to any specific conditions imposed by other consent authority/regulatory bodies.

10 CONCLUSION

EIS are of the opinion that the site can be made suitable for the proposed residential development provided this RAP is implemented accordingly. A site validation report should be prepared on completion of remediation activities and should be submitted to the consent authority.

10.1 Remediation Category

Site remediation can fall under the following two categories outlined in SEPP55:

Table 10-1: Remediation Category

Category	Details
Category 1	Category 1 remediation works are those undertaken in the following areas specified under Clause 9 of SEPP55: A designated development; • Carried out on land declared to be a critical habitat; • Development for which another SEPP or REP requires a development consent; or • Carried out in an area or zone classified as: ➢ Coastal Protection; ➢ Conservation or heritage conservation; ➢ Habitat protection, or habitat or wildlife corridor; ➢ Environmental protection; ➢ Escarpment, escarpment protection or preservation; ➢ Floodway or wetland; ➢ Nature reserve, scenic area or scenic protection; etc. • Work that is not carried out in accordance with the site management provisions contained in the consent authority Development Control Plan (DCP)/Local Environmental Plan (LEP) etc. Approval is required from the consent authority for Category 1 remediation work. The RAP needs to be assessed and determined either as part of the existing DA or as a new and separate DA. Category 1 remediation work is identified as advertised development work unless the remediation work is a designated development or a state significant development (Part 6 of EPAA Regulation 1994).
Category 2	Remediation works which do not fall under the above category are classed as Category 2. Development consent is not required for Category 2 remediation works, however the consent authority should be given 30 days' notice prior to commencement of works.

From the information reviewed in the Manly Local Environmental Plan 2013, EIS understand that the site remediation work may fall under Category 2 remediation. This should be confirmed with the client's planning expert.

10.2 Regulatory Requirements

The regulatory requirements applicable for the site are outlined in the following table:

Table 10-2: Regulatory Requirement

Guideline	Applicability
Duty to Report Contamination (2015)[17]	At this stage, EIS consider that there is no requirement to notify the NSW EPA regarding site contamination. This requirement should be reassessed following review of the validation results.
POEO Act 1997	Section 143 of the POEO Act 1997 states that if waste is transported to a place that cannot lawfully be used as a waste facility for that waste, then the transporter and owner of the waste are each guilty of an offence. The transporter and owner of the waste have a duty to ensure that the waste is disposed of in an appropriate manner. Appropriate waste tracking is required for all relevant waste that is disposed off-site. Asbestos waste must be tracked using WasteLocate.

[17] NSW EPA, (2015). *Guidelines on the Duty to Report Contamination under the Contamination Land Management Act 1997.* (referred to as Duty to Report Contamination 2015)

11 LIMITATIONS

The following limitation apply to this assessment:

- EIS accepts no responsibility for any unidentified contamination issues at the site. Any unexpected problems/subsurface features that may be encountered during development works should be inspected by an environmental consultant as soon as possible;
- Previous use of this site may have involved excavation for the foundations of buildings, services, and similar facilities. In addition, unrecorded excavation and burial of material may have occurred on the site. Backfilling of excavations could have been undertaken with potentially contaminated material that may be discovered in discrete, isolated locations across the site during construction work;
- This report has been prepared based on site conditions which existed at the time of the assessment; scope of work and limitation outlined in the EIS proposal; and terms of contract between EIS and the client (as applicable);
- The conclusions presented in this report are based on investigation of conditions at specific locations, chosen to be as representative as possible under the given circumstances, visual observations of the site and immediate surrounds and documents reviewed as described in the report;
- The preparation of this report have been undertaken in accordance with accepted practice for environmental consultants, with reference to applicable environmental regulatory authority and industry standards, guidelines and the assessment criteria outlined in the report;
- Where information has been provided by third parties, EIS has not undertaken any verification process, except where specifically stated in the report;
- EIS has not undertaken any assessment of off-site areas that may be potential contamination sources or may have been impacted by site contamination, except where specifically stated in the report;
- EIS accept no responsibility for potentially asbestos containing materials that may exist at the site. These materials may be associated with demolition of pre-1990 constructed buildings or fill material at the site;
- EIS have not and will not make any determination regarding finances associated with the site;
- Additional investigation work may be required in the event of changes to the proposed development or landuse. EIS should be contacted immediately in such circumstances;
- Material considered to be suitable from a geotechnical point of view may be unsatisfactory from a soil contamination viewpoint, and vice versa; and
- This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose.

Important Information About This Rrport

These notes have been prepared by EIS to assist with the assessment and interpretation of this report.

The Report is based on a Unique Set of Project Specific Factors:
This report has been prepared in response to specific project requirements as stated in the EIS proposal document which may have been limited by instructions from the client. This report should be reviewed, and if necessary, revised if any of the following occur:

- The proposed land use is altered;
- The defined subject site is increased or sub-divided;
- The proposed development details including size, configuration, location, orientation of the structures or landscaped areas are modified;
- The proposed development levels are altered, eg addition of basement levels; or
- Ownership of the site changes.

EIS/J&K will not accept any responsibility whatsoever for situations where one or more of the above factors have changed since completion of the assessment. If the subject site is sold, ownership of the assessment report should be transferred by EIS to the new site owners who will be informed of the conditions and limitations under which the assessment was undertaken. No person should apply an assessment for any purpose other than that originally intended without first conferring with the consultant.

Changes in Subsurface Conditions:
Subsurface conditions are influenced by natural geological and hydrogeological process and human activities. Groundwater conditions are likely to vary over time with changes in climatic conditions and human activities within the catchment (e.g. water extraction for irrigation or industrial uses, subsurface waste water disposal, construction related dewatering). Soil and groundwater contaminant concentrations may also vary over time through contaminant migration, natural attenuation of organic contaminants, ongoing contaminating activities and placement or removal of fill material. The conclusions of an assessment report may have been affected by the above factors if a significant period of time has elapsed prior to commencement of the proposed development.

This Report is based on Professional Interpretations of Factual Data:
Site assessments identify actual subsurface conditions at the actual sampling locations at the time of the investigation. Data obtained from the sampling and subsequent laboratory analyses, available site history information and published regional information is interpreted by geologists, engineers or environmental scientists and opinions are drawn about the overall subsurface conditions, the nature and extent of contamination, the likely impact on the proposed development and appropriate remediation measures.

Actual conditions may differ from those inferred, because no professional, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to prevent the unanticipated, but steps can be taken to help minimise the impact. For this reason, site owners should retain the services of their consultants throughout the development stage of the project, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

Assessment Limitations:
Although information provided by a site assessment can reduce exposure to the risk of the presence of contamination, no environmental site assessment can eliminate the risk. Even a rigorous professional assessment may not detect all contamination on a site. Contaminants may be present in areas that were not surveyed or sampled, or may migrate

to areas which showed no signs of contamination when sampled. Contaminant analysis cannot possibly cover every type of contaminant which may occur; only the most likely contaminants are screened.

Misinterpretation of Site Assessments by Design Professionals:
Costly problems can occur when other design professionals develop plans based on misinterpretation of an assessment report. To minimise problems associated with misinterpretations, the environmental consultant should be retained to work with appropriate professionals to explain relevant findings and to review the adequacy of plans and specifications relevant to contamination issues.

Logs Should not be Separated from the Assessment Report:
Borehole and test pit logs are prepared by environmental scientists, engineers or geologists based upon interpretation of field conditions and laboratory evaluation of field samples. Logs are normally provided in our reports and these should not be re-drawn for inclusion in site remediation or other design drawings, as subtle but significant drafting errors or omissions may occur in the transfer process. Photographic reproduction can eliminate this problem, however contractors can still misinterpret the logs during bid preparation if separated from the text of the assessment. If this occurs, delays, disputes and unanticipated costs may result. In all cases it is necessary to refer to the rest of the report to obtain a proper understanding of the assessment. Please note that logs with the 'Environmental Log' header are not suitable for geotechnical purposes as they have not been peer reviewed by a Senior Geotechnical Engineer.

To reduce the likelihood of borehole and test pit log misinterpretation, the complete assessment should be available to persons or organisations involved in the project, such as contractors, for their use. Denial of such access and disclaiming responsibility for the accuracy of subsurface information does not insulate an owner from the attendant liability. It is critical that the site owner provides all available site information to persons and organisations such as contractors.

Read Responsibility Clauses Closely:
Because an environmental site assessment is based extensively on judgement and opinion, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, model clauses have been developed for use in written transmittals. These are definitive clauses designed to indicate consultant responsibility. Their use helps all parties involved recognise individual responsibilities and formulate appropriate action. Some of these definitive clauses are likely to appear in the environmental site assessment, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to any questions.

Appendix A: Report Figures

AERIAL IMAGE SOURCE: GOOGLE EARTH PRO 7.1.5.1557
AERIAL IMAGE ©: 2015 GOOGLE INC.

This plan should be read in conjunction with the EIS report.

Title: **SITE LOCATION PLAN**

Location: 31-35 & 95 REDDALL STREET & BOWER STREET MANLY, NSW

Report No: E30375K

Figure No: 1

ENVIRONMENTAL INVESTIGATION SERVICES

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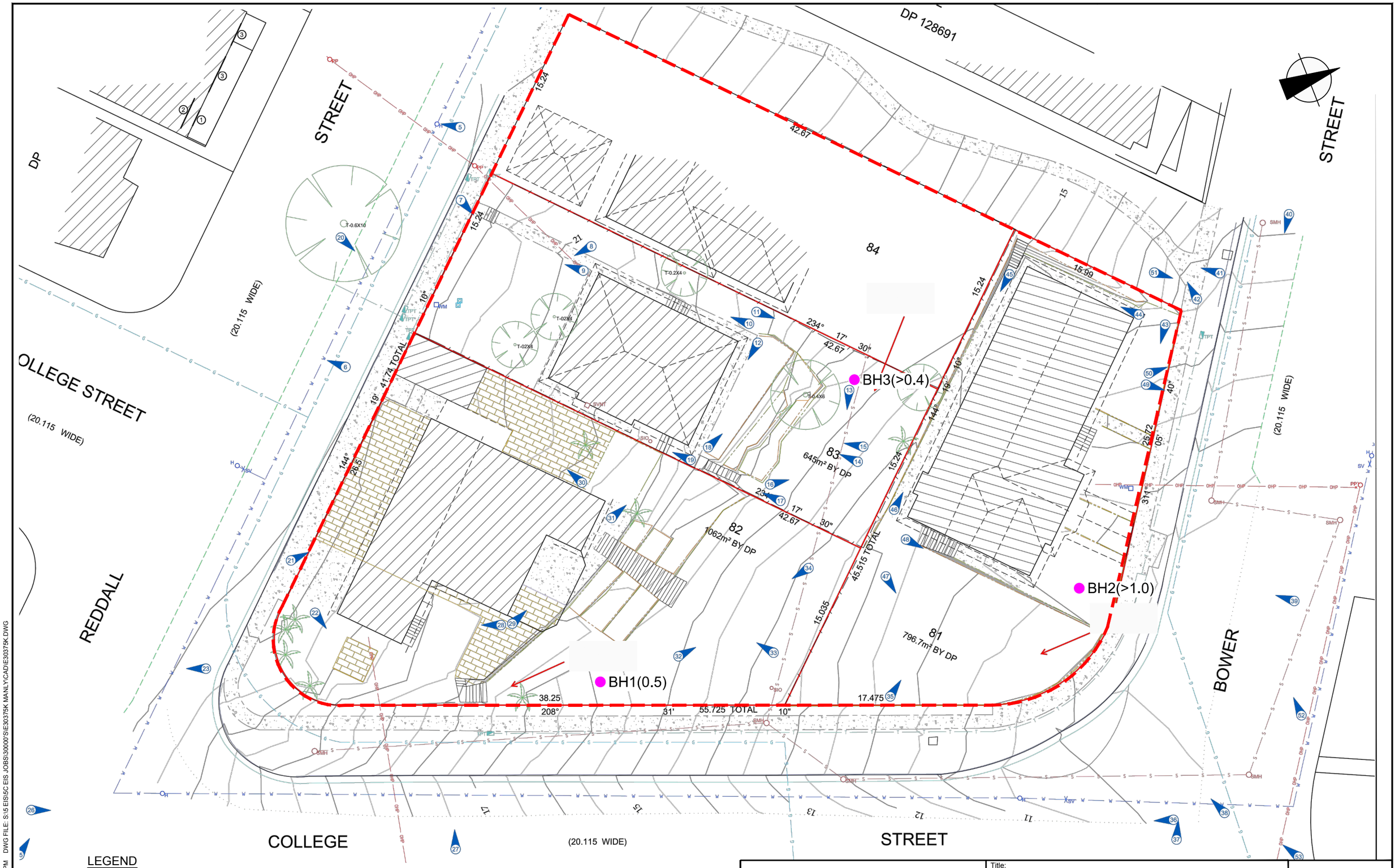

LEGEND

APPROXIMATE SITE BOUNDARY

BH (Fill Depth) BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m)

0 3 6 9 12 15

SCALE 1:300 @A3 METRES

This plan should be read in conjunction with the EIS report.

Title: **SAMPLE LOCATION PLAN**

Location: 31-35 & 95 REDDALL STREET & BOWER STREET MANLY, NSW

Report No: E30375K

Figure No: 2

ENVIRONMENTAL INVESTIGATION SERVICES

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