Prepared for
John Holland CPB Ghella Joint Venture
Prepared by
Ramboll Australia Pty Ltd
Date
18 September 2020
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SITE AUDIT REPORT
MARRICKVILLE DIVE, MURRAY STREET, MARRICKVILLE NSW

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& HEALTH

18 September 2020

John Holland CPB Ghella Joint Venture
Attn.: Krissy Vajda
Level 9, 50 Bridge Street
Sydney NSW 2000

By email: krissy.vajda@sydneymetro2.com.au

Dear Krissy

SITE AUDIT REPORT - MARRICKVILLE DIVE, MURRAY STREET, MARRICKVILLE NSW

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Ref 318000323-007

I have pleasure in submitting the Site Audit Report for the subject site. The Site Audit Statement, produced in accordance with the NSW *Contaminated Land Management Act 1997*, is included as Appendix B of the Site Audit Report. The Audit was commissioned by John Holland CPB Ghella Joint Venture to assess the suitability of the site for its intended Metro train dive structure (commercial/industrial) land use.

The Audit was initiated to comply with requirements of *Condition E67 of Infrastructure Approval, application SSI 15_7400,* approved by the Minister for Planning on 9 January 2017, and is therefore a statutory audit.

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

Yours faithfully,
Ramboll Australia Pty Ltd

Tom Onus
EPA Accredited Site Auditor 1505

cc: NSW EPA – Statement only
Inner West Council

Ramboll Australia Pty Ltd
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LIST OF ABBREVIATIONS

Measures

ACM	Asbestos Containing Material
ADE	ADE Consulting Group Pty Ltd
ADWG	Australian Drinking Water Guidelines
AHD	Australian Height Datum
ANZG	Australian & New Zealand Guidelines
ASS	Acid Sulphate Soil
AST	Aboveground Storage Tank
ANZECC	Australian and New Zealand Environment and Conservation Council
BaP	Benzo(a)pyrene
BGL	Below Ground Level
BTEXN	Benzene, Toluene, Ethylbenzene, Xylenes & Naphthalene
CLM Act	NSW Contaminated Land Management Act 1997
COC	Chain of Custody
Council	Inner West Council
CS	Characteristic Situation
CSM	Conceptual Site Model
DGV	Default Guideline Value
Douglas	Douglas Partners Pty Ltd
DP	Deposited Plan
DQI	Data Quality Indicator
DQO	Data Quality Objective
DSI	Detailed Site Investigation
ENM	Excavated Natural Material
EPA	Environment Protection Authority (NSW)
EPL	Environment Protection Licence
GIL	Groundwater Investigation Level
GSV	Gas Screening Value
GSW	General Solid Waste
HGG	Hazardous Ground Gas
HIL	Health Investigation Level
HSL	Health Screening Level
HW	Hazardous Waste
IAA	Interim Audit Advice
JHCPBG JV	John Holland CPB Ghella Joint Venture
LCS	Laboratory Control Sample
LEP	Local Environment Plan
Metals	As: Arsenic, Cd: Cadmium, Cr: Chromium, Cu: Copper, Ni: Nickel, Pb: Lead, Zn: Zinc, Hg: Mercury
ML	Management Limits
MS	Matrix Spike
NATA	National Association of Testing Authorities
NC	Not Calculated
ND	Not Detected
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
NL	Non-Limiting
n	Number of Samples
OCPs	Organochlorine Pesticides
OEH	Office of Environment and Heritage
OPPs	Organophosphorus Pesticides
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PFAS	Per- and Poly-fluoroalkyl substances
pH	A measure of acidity, hydrogen ion activity
PID	Photoionisation Detector
PQL	Practical Quantitation Limit
PSI	Preliminary Site Investigation
QA/QC	Quality Assurance/Quality Control

Ramboll	Ramboll Australia Pty Ltd – previously Ramboll Environ Australia Pty Ltd and ENVIRON Australia Pty Ltd
RAP	Remediation Action Plan
RPD	Relative Percent Difference
RRE	Resource Recovery Exemption
RRO	Resource Recovery Order
RSL	Regional Screening Level
SAR	Site Audit Report
SAS	Site Audit Statement
SPR	Source-pathway-receptor
SSI	State Significant Infrastructure
TEQ	Toxic Equivalence Quotient
TPHs	Total Petroleum Hydrocarbons
TRHs	Total Recoverable Hydrocarbons
TV	Trigger Value
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VENM	Virgin Excavated Natural Material
VOCs	Volatile Organic Compounds
-	On tables is "not calculated", "no criteria" or "not applicable"

1. INTRODUCTION

1.1 Audit Details

A site contamination audit has been conducted in relation to the Marrickville Dive site of the Sydney Metro City and South West, which is located at Murray Street, Marrickville.

The Audit was conducted to provide an independent review by an EPA Accredited Auditor of whether the land is suitable for any specified use or range of uses, i.e. a "Site Audit" as defined in Section 4 (1) (b) (iii) of the NSW *Contaminated Land Management Act 1997* (the CLM Act).

A State Significant Infrastructure (SSI) development application (SSI 15_7400) was approved by the NSW Minister for Planning on 9 January 2017 for the construction and operation of a metro rail line, approximately 16.5 km long (of which approximately 15.5 km is located in underground rail tunnels) between Chatswood and Sydenham, including the construction of a tunnel under Sydney Harbour, links with the existing rail network, seven metro stations, and associated ancillary infrastructure. Condition E67 of the SSI development approval relates to contamination and requires a site audit as follows:

> *"If a Site Contamination Report prepared under Condition E66 finds such land contains contamination, a site audit is required to determine the suitability of a site for a specified use. If a site audit is required, a Site Audit Statement and Site Audit Report must be prepared by a NSW EPA Accredited Site Auditor. Contaminated land must not be used for the purpose approved under the terms of this approval until a Site Audit Statement is obtained that declares the land is suitable for that purpose and any conditions on the Site Audit Statement have been complied with."*

The Audit was initiated to comply with condition E67 of the SSI approval and is therefore a statutory audit. The site audit is also a requirement of Clause 10.14B of the Sydney Metro City & Southwest Tunnel and Station Excavation Works Design and Construction Deed (Contract No: 00013/11200).

Details of the Audit are:

Requested by:	Caitlin Richards on behalf of John Holland CPB Ghella Joint Venture (JHCPBG JV)
Request/Commencement Date:	5 October 2017
Auditor:	Tom Onus
Accreditation No.:	1505

1.2 Project Background

As part of the Sydney Metro City and South West (Sydney Metro) Tunnel and Station Excavation (TSE) Works Package, a Remediation Action Plan (RAP) was developed to detail the work required to remediate impacted fill material during construction of the dive structure and tunnel portal. The RAP was reviewed by the Auditor (see Section 1.3 for details) prior to remediation commencing.

The site comprises the 'dive structure' shown in blue on Attachment 1 (Appendix A) and the 'TransGrid structure' shown in green on Attachment 1 (Appendix A). The surrounding 'Works Area' shown in red on Attachment 3 (Attachment A) is not part of the site. Remediation was undertaken by excavation and off-site disposal of all fill material and natural soil/bedrock. The depth of excavation ranges from the surface (south corner) to approximately 18 metres below ground level (mbgl) at the tunnel portal wall at the northern end of the site. The base of the site comprises approximately 200 mm thick concrete slab and the walls include bored piles with

shotcrete between the piles. A water collection sump is located at the base of the excavation at the tunnel portal wall.

1.3 Interim Audit Advice

Interim Audit Advice (IAA) was prepared by the Auditor in 2018 which provided an initial review of the suitability and appropriateness of a RAP, as well as a review of the previous investigations undertaken at the site. The IAA is provided in Appendix C. The reports reviewed for the IAA are listed in Section 1.4 below.

The IAA concluded that the proposed process for remediation of fill material was practical and that the site could be made suitable for the proposed land use if remediated in accordance with the RAP. The IAA noted that *"At the completion of remediation of the site, a Section A Site Audit Statement and supporting Site Audit Report certifying suitability for the proposed use should be prepared."*

The IAA is attached in Appendix C and is referenced throughout this Site Audit Report (SAR) where required, however, full details of the IAA are not repeated.

1.4 Scope of the Audit

The scope of work undertaken for the IAA included:

- Review of the following reports:
  - 'Report on Preliminary Site Investigation, Sydney Metro City and South West, Tunnel and Station Excavation Works Package, Proposed Marrickville Dive, Murray Street, Marrickville, prepared for John Holland CPB Ghella JV, Project 85608.15, March 2018', report reference: Revision 0, dated 21 March 2018, prepared by Douglas Partners Pty Ltd (Douglas) (*the PSI*).
  - 'Report on Detailed Site Investigation, Sydney Metro City and South West, Tunnel and Station Excavation Works Package, Proposed Marrickville Dive, Murray Street, Marrickville, prepared for John Holland CPB Ghella JV, Project 85608.15, March 2018', report reference: Revision 1, dated 22 March 2018, prepared by Douglas (*the DSI*).
  - 'Report on Remediation Action Plan, Sydney Metro City and South West, Tunnel and Station Excavation Works Package, Proposed Marrickville Dive, Murray Street, Marrickville, prepared for John Holland CPB Ghella JV, Project 85608.15, April 2018', report reference: Revision 0, dated 12 April 2018, prepared by Douglas (*the RAP*).
- A site visit by the Auditor on 20 October 2017.
- Discussions with JHCPBG JV, and with Douglas who undertook the investigations and prepared the RAP.

The PSI makes reference to a number of previous geotechnical and contamination investigation reports prepared for the site by various consultants including Douglas, Golder Associates Pty Ltd (Golder), Pells Sullivan Meynink (PSM) and Environmental & Earth Sciences (EES). The RAP references a hydrogeological interpretive report (dated 19 March 2018) prepared by PSM. A summary of relevant information from these reports was included in the Douglas reports. Copies of these reports have not been provided to the Auditor for this review.

The scope of work undertaken in competing the SAR included:

- Review of 'Report on Validation of Remediation, Sydney Metro City and South West - Tunnel and Station Excavation Works Package, Sydney Metro City and South West – Marrickville Dive, Murray Street, Marrickville, NSW', report reference: Revision 0, dated 16 September 2020, prepared by Douglas (the Validation Report).

- Review of supporting documentation including waste classification reports prepared by Douglas, ADE Consulting Group Pty Ltd (ADE) and Down to Earth Geotechnical and Environmental for material disposed from the site.
- Discussions with JHCPBG JV, and with Douglas who undertook the remediation and validation works.

2. SITE DETAILS

2.1 Location

The site is identified as the '*Dive Structure'* and '*TransGrid Structure*', shown in blue and green respectively on Attachment 1 (Appendix A). The surrounding Works Area, which forms part of the wider Marrickville Metro site and shown in red in Attachment 3 (Appendix A), has been excluded from the Douglas investigations and is not part of the site audit area. The site details are as follows:

Street address:	Part of Murray Street, Marrickville, NSW 2204 2 Edinburgh Road, Marrickville, NSW 2204 50-52 Murray Street, Marrickville, NSW 2204 18 Edinburgh Road, Marrickville, NSW 2204 5-15 Murray Street, Marrickville, NSW 2204 1A Sydney Steel Road, Marrickville, NSW 2204
Identifier:	Part Lot 1 DP622660 Part Lot 100 DP1162506 Part Lot 38 DP4991 Part Lot 10 DP874363 Part Lot 4 DP802920 Part Lot 100 DP1231062
Local Government:	Inner West Council (former Marrickville Council)
Owner:	Transport for New South Wales
Site Area:	Approximately 0.8 ha

The boundaries of the site comprise the walls of the excavation. The Works Area is bound by the rail corridor to the south, Sydney Steel Road and industrial properties to the west, Edinburgh Road to the north and Railway Parade to the east.

A survey plans of the site has been provided in Attachments 2a, 2b and 2c (Appendix A) and includes the coordinates of the Site Audit boundary.

2.2 Zoning

The current zoning of the site is IN1 General Industrial under Marrickville Local Environment Plan (LEP) 2011.

2.3 Adjacent Uses

The site is located within an area of commercial/industrial land use. The surrounding site use includes:

North: The Works Area, then Edinburgh Road and commercial industrial land uses.

East: The Works Area, then the Railway corridor and Railway Parade. Camdenville Park (a former brick pit) is located approximately 80 m to the east.

South: The Works Area, then the railway corridor. Commercial/industrial to the south of the corridor. A former brick pit was located to the south of the railway corridor.

West: The Works Area, then commercial/industrial land uses and Sydney Steel Road.

A concrete lined stormwater drain is located approximately 30 m to the north and west of the site. The drain runs from the north to the west within the Works Area and drains into the Sydenham Pit and Drainage Pumping Station (No. 001) located approximately 200 m to the

southwest. Douglas identified the closest sensitive ecological receptor for groundwater as the Cooks River, located approximately 2 km to the southwest.

The former brick pits to the east and south of the site are potential sources of contamination. The PSI summarised investigations previously undertaken by EES at Camdenville Park (former brick pit) in 2006-2007 which identified elevated levels of methane (CH_4) associated with landfilling of the former brick pit.

The PSI identified a number of former (between 1950 and 1970) dry cleaners, motor garages and service stations within 500 m up-gradient of the site. A search of the NSW EPA list of notified contaminated sites include a number of sites within a 500 m radius of the site (discussed in Section 3).

2.4 Site Condition

2.4.1 Pre-Remediation

Douglas inspected the site on 20 September 2017 and noted the following:

- The site comprised a number of different lots (identified above). The majority of the lots were vacant with demolition of former buildings underway in some lots. A large warehouse (former refrigerated store) was located in the central section of the site. The warehouse was used to store construction material for the proposed dive development. An electrical substation was located to the west of the site.
- The majority of the site was paved with asphalt and concrete. Murray Street crossed through the north section of the site.
- Four (4) fill/dip points for underground fuel storage tanks (USTs) (Attachment 3, Appendix A) were located in the Works Area to the north and west of the site.
- A concrete lined drainage channel was located to the north of the site which ran from north to west and drained into a concrete lined pond located to the southwest.

During the Auditor's site visit on 20 October 2017, the site condition was consistent with observations made by Douglas, with the following additional features noted:

- Two above ground water tanks were located to the immediate west of the site.
- Equipment for tunnel casting was located on the west section of the site, which limited visual observation of the ground surface.
- Low to medium density trees and vegetation was observed along the south boundary adjacent to the railway corridor.
- An open test pit on the southwest site corner revealed fill containing ash/slag below the asphalt pavement.

2.4.2 Post-Remediation

Specific post remediation site conditions were not described by Douglas however the Validation Report indicates that all pre-existing fill materials were removed from within the Dive Structure. The excavation depths required in the southern portion of the structure were shallower than the pre-existing fill depth, it is understood that the pre-existing fill and upper layer of natural clay were geotechnically unsuitable for use and were therefore removed and disposed of off-site. Douglas included aerial imagery dated August 2020 which appeared to show concrete across the site.

2.5 Proposed Development

The proposed development includes the excavation and construction of a Dive Structure and tunnel portal for the launch and support of two boring machines and the TransGrid bridging structure over the Dive Structure to link the existing rail corridor south to the future stabling yard

located to the west. The depth of excavation for the Dive Structure ranges from the surface (south corner) to approximately 18 metres below ground level (mbgl) at the tunnel portal wall in the northeast end (Attachment 3, Appendix A). The base of the structure comprises approximately 200 mm thick temporary concrete slab and the walls include reinforced concrete soldier piles with shotcrete between the piles. A water collection sump is located at the base of the excavation at the tunnel portal. The Dive Structure will be drained from this sump. The TransGrid structure covers an area of 900 m^2 (including the portion above the dive structure).

For the purposes of this audit, the 'commercial/industrial' land use scenario will be assumed.

3. SITE HISTORY

The IAA noted that the PSI provided a summary of the site history based on a review of historical title deeds, aerial photographs, NSW EPA records and Section 149 (now termed Section 10.7) certificates. Douglas reviewed NSW SafeWork records as part of the DSI. The site history from the IAA is summarised as follows.

The site has been used for various commercial/industrial purposes since the 1940s. Title records indicated various industries were operational at the site including chemical manufacturing, metal works, dyers/bleachers, steel manufacturing, construction equipment, refrigeration, electrical equipment and air-conditioning, boilermakers, engineering firms, fuel merchants, foundries, printers, electroplaters, motor panel beaters/wreckers/painters and tyre dealers. Camdenville Park brickworks and other brick pits were noted in the immediate surrounds prior to the 1950s and were infilled between the 1950s and 2000.

The SafeWork NSW records indicated licenses to store dangerous goods at 2 Edinburgh Road and 50-52 Murray Street. The dangerous goods include one (possibly two) underground fuel storage tanks (USTs) at 50-52 Murray Street, and LPG gas cylinder and UST (abandoned in-situ with sand and concrete slurry) at 2 Edinburgh Road. The approximate location of these features are shown in Attachment 3, Appendix A.

The review of the NSW EPA public records indicated that there were a number of properties located close to the site that had been notified as contaminated to the EPA.

The DSI stated that the Marrickville Metro Shopping Centre (MMSC) (34 Victoria Road) is located approximately 200 m to the northwest. Douglas consider that the VOC groundwater plume at the MMSC site is localised with low risk of migration onto the subject site.

Camdenville Park (May Street, St Peters) is a former brickpit and landfill. Based on the site location and history, the DSI concluded that landfill gas from Camdenville Park could have impacted the site.

3.1 Auditor's Opinion

In the Auditor's opinion, the site history provides an adequate indication of past on-site and off-site activities that may have resulted in site contamination, including chemical manufacturing, metal works, dyers/bleachers, steel manufacturing, construction equipment, refrigeration, electrical equipment and air-conditioning, boilermakers, engineering firms, fuel merchants, foundries, printers, electroplaters, motor panel beaters/wreakers/painters and tyre dealers. Details of site operations were not provided, such as chemical use and storage locations. The Auditor considers that the site history is broadly understood and adequate for identification of contaminants of concern (Section 4) and remediation of the site (Section 12).

4. CONTAMINANTS OF CONCERN

As outlined in the IAA, the Douglas PSI and DSI provided a list of contaminants of concern and potentially contaminating activities. These have been tabulated in Table 4.1.

Table 4.1: Contaminants of Concern

Area	Activity	Potential Contaminants
Entire Site	Fill and surface soil imported from unknown sources to form/ level the site and demolition of former buildings.	Metals, total petroleum hydrocarbons (TPH), benzene, toluene, ethylbenzene, xylenes & naphthalene (BTEX), polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides (OCPs), organophosphorus pesticides (OPPs), polychlorinated biphenyls (PCBs), phenols, lead (from paint) and asbestos.
Entire Site	Fill and surface soil impacted by former commercial/ industrial land use at the site.	Petroleum hydrocarbons (BTEX, TPH), OCP, OPP, PCBs, PAHs, Volatile Organic Compounds (VOCs), Semi Volatile Organic Compounds (SVOCs), metals, and phenols.
Off-Site Sources	Impacts from former infilled brickworks and USTs located up-gradient from the site.	Metals, petroleum hydrocarbons (BTEX, TPH), PAHs, VOC, phenols, OCP, OPP, ammonia, nutrients, cyanide and landfill gas (methane, carbon dioxide and toxic trace gases).

4.1 Auditor's Opinion

The Auditor considers that the analyte list used by Douglas adequately reflects the site history and condition.

5. STRATIGRAPHY AND HYDROGEOLOGY

5.1 Stratigraphy

Douglas reviewed geological maps and reported that the site is underlain by Ashfield Shale which comprises black to dark grey shale and laminite.

The sub-surface profile of the site encountered during the Douglas DSI prior to remediation is summarised by the Auditor in Table 5.1.

Table 5.1: Stratigraphy

Depth (mbgl)	Subsurface Profile
0.0 – 0.4	Fill material comprising grey clayey and sandy gravel road base materials underlying asphalt and concrete pavements. Concrete foundations with slabs separated by foam was detected in some locations.
0.3 – 2.0	Fill material comprising clay, sand and gravel with inclusions of brick, metal, concrete, ash, PVC, tile, glass, coal wash/fly ash and asbestos containing material (ACM).
1.8 – 5	Natural clay and silty clay.
0.6 to termination depth (9.9)	Weathered shale bedrock.

mbgl – metres below ground level

The subsurface profile comprised relatively shallow fill (<2.0 mbgl) underlain by natural clay soil and shale bedrock.

Douglas indicated that the north-eastern portion of the site is located within an area of disturbed terrain with unknown occurrences of acid sulfate soils (ASS). The south-western portion of the site is located within an area of no known occurrence of ASS. The DSI included sampling and analysis of selected fill, natural and bedrock samples for ASS. Douglas reported that a lack of a defined sulphur trail indicates that ASS are not present and there is no requirement for an ASS management plan.

Following remediation of the site (discussed in Section 12), fill material and natural soil/rock were removed from the entire site area to a depth of up to approximately 18 mbgl.

5.2 Hydrogeology

The PSI undertook a search of the groundwater information database maintained by the NSW Government and did not identify any groundwater bores within a 0.5 km radius of the site.

As part of the DSI, two groundwater monitoring wells (MW08 and MW09) were installed on the site (Attachment 3, Appendix A). Groundwater observations and sampling were undertaken by Douglas as part of the DSI on 31 October 2017. A monitoring well previously installed by PSM (JCG-BH-1123) was also sampled. Depth to groundwater in the monitoring wells was recorded between 1.7 to 3.6 mbgl.

The DSI included field records of groundwater parameters recorded during sampling. They indicated that the pH was 4.41 to 5.21, dissolved oxygen (DO) was 1.01 to 2.58 mg/L, redox was 3 to 1208 mV, and electrical conductivity (EC) was 0.8 to 4.28 mS/cm.

Douglas concluded that based on the topography, groundwater is anticipated to flow to the southwest and that groundwater flow would be impacted by a concrete lined drainage channel located approximately 30 m to north and west of the site which drains into the Sydenham Pit and Drainage Pumping Station (No. 001) located further to the southwest of the site. Douglas identified the closest sensitive ecological receptor for groundwater as the Cooks River, located approximately 2 km to the southwest. Excess surface water run-off is anticipated to flow into the local stormwater network.

The RAP included a summary of the PSM (2018) Hydrogeological Interpretive Report, which modelled the groundwater seepage rates expected during and post construction. Details of the modelling and the results are included in the Hydrogeological Interpretive Report. Douglas summarised the findings as follows:

- Maximum modelled seepage rate during construction was 74 kL/day;
- Modelled steady state seepage rate post construction was 17 kL/day;
- Water bearing zone is from residual soils of Ashfield Shale at depths of 1.5 to 2.5 m. During the initial stages of development, groundwater inflow is likely to be from the storage within the residual soils and shale;
- The modelled zone of capture for the first 10 years would extend to approximately 370 m from the site; and
- Historical land use (former Camdenville Park landfill, former brick pits and landfill fronting Unwins Bridge Road and Mary Street, Sydney Park and Alexandria landfill) may have an impact on groundwater quality and potential for contamination migration (ammonia, nitrate, organic compounds and metals).

The Auditor has not reviewed the PSM (2018) Hydrogeological Interpretive Report, however, considers that the primary long-term source of seepage/ inflows is likely to be shale. This is based on the stratigraphy and hydrogeology encountered during the DSI.

5.3 Auditor's Opinion

The Auditor considers that the site stratigraphy and hydrogeology are sufficiently well known for the purpose of the Audit.

6. EVALUATION OF QUALITY ASSURANCE AND QUALITY CONTROL

An evaluation of the overall quality of the data obtained in previous investigations (DSI) at the site was presented in the IAA (Appendix C). In considering the data as a whole the Auditor concluded in the IAA that:

- The data are likely to be representative of the overall site conditions, including fill, natural soil and groundwater. Results for volatile organics in soil samples collected by solid stem auger may underestimate actual concentrations. The data is considered adequate to identify contaminants of concern for remedial planning purposes.
- The investigation data are considered to be complete. However, Douglas has recommended an additional round of groundwater and hazardous ground gas (HGG) screening.
- There is a high degree of confidence that the data are comparable for each sampling and analytical event.
- The laboratories provided adequate information to conclude that the data are of sufficient precision.
- There is a high degree of confidence that the data are accurate.

An evaluation of the overall quality of the data obtained during remediation and validation is presented in Section 12.4.

7. ENVIRONMENTAL QUALITY CRITERIA

The Auditor has assessed the results against Tier 1 criteria from National Environmental Protection Council (NEPC) *National Environmental Protection (Assessment of Site Contamination) Measure 1999*, as Amended 2013 (NEPM, 2013). Other guidance has been adopted where NEPM (2013) is not applicable or criteria are not provided. Based on the proposed development (excavation and construction of a dive structure and tunnel portal), the human health criteria for 'commercial/industrial' was adopted. This was considered to most relevant during remediation and ongoing operation of the site, however, is likely to be conservative for short term exposure by construction workers and ongoing site use.

7.1 Soil Assessment Criteria

7.1.1 Human Health Assessment Criteria

The Auditor has adopted human health assessment criteria from the following sources:

- NEPM (2013) Health Investigation Levels (HILs) for 'Commercial/Industrial' (HIL D) land use.
- NEPM (2013) Health Screening Levels (HSLs) for 'Commercial/Industrial' (HSL D) land use. The HSLs assumed a sand soil type. Depth to source adopted was <1 m as an initial screen.
- NEPM (2013) Management Limits (MLs) for petroleum hydrocarbons for 'Commercial/Industrial' land use and assuming coarse soil texture.
- The presence/absence of asbestos.
- Friebel & Nadebaum (2011) HSLs for direct contact for all land use categories, and vapour inhalation/direct contact pathways for intrusive maintenance workers.

7.1.2 Ecological Assessment Criteria

The Auditor has not adopted ecological soil assessment criteria as soil from the site was excavated to a maximum depth of 18 mbgl and disposed off-site during development of the dive structure. Ecological soil criteria are applicable to depths of 2 mbgl and are therefore not applicable for the remaining natural soil.

7.1.3 Soil Aesthetic Considerations

The Auditor has considered the need for soil remediation based on 'aesthetic' contamination as outlined in *Section 3.6 Aesthetic Considerations* of NEPM (2013) Schedule B1, which acknowledges that there are no chemical-specific numerical aesthetic guidelines. Instead, site assessment requires a balanced consideration of the quantity, type and distribution of foreign material or odours in relation to the specific land use and its sensitivity.

7.1.4 Imported Fill

Imported fill has been assessed in relation to attributes expected of virgin excavated natural material (VENM). The NSW EPA (2014) *Waste Classification Guidelines, Part 1: Classifying Waste* defines VENM as "*…natural material (such as clay, gravel, sand, soil or rock fines):*

- *'that has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial, mining or agricultural activities*
- *'that does not contain sulphidic ores or soils, or any other waste, and includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved from time to time by a notice in the NSW Government Gazette."*

On this basis, the Auditor considers that for soil to be classified as VENM, the following criteria generally apply:

- Organic compounds (including petroleum hydrocarbons, PAHs, OCPs, PCBs and phenols) should be less than the PQLs.
- Inorganic compounds should be consistent with background concentrations.
- The material should not contain or comprise actual or potential acid sulphate soil.

Imported material, such as excavated natural material (ENM) or mulch, was assessed against the requirements of the applicable resource recovery order (RRO) and resource recovery exemption (RRE) issued by the EPA under clause 93 of the *Protection of the Environment Operations (Waste) Regulation 2014*.

7.2 Groundwater Assessment Criteria

7.2.1 Human Health Assessment Criteria

NEPM (2013) HSLs are not appropriate for assessing risks from groundwater to human health at the site due to the potential for direct contact. The Auditor has adopted human health assessment criteria from the following sources to assess risk from direct contact, inhalation and incidental ingestion:

- NHMRC (2011) *National Water Quality Management Strategy, Australian Drinking-Water Guidelines* (ADWG), Version 3.5 Updated August 2018.
- USEPA Regional Screening Levels (RSLs) Residential Tap Water Criteria. Online database of assessment criteria that are current as of May 2020. Tap water assessment criteria derived for carcinogenic compounds were multiplied by a factor of 10 to adjust the target cancer risk level from 1:1,000,000 to 1:100,000 to be consistent with Australia's recommended target cancer risk level. For some chemicals, where a criteria has been derived using both non-cancer and cancer toxicity data, the lower criteria was adopted.
- WHO (2017) Guidelines for Drinking-water Quality, Fourth Edition, incorporating the 1st addendum.
- WHO (2008) *Petroleum Products in Drinking-water. Background document of WHO Guidelines for Drinking-water Quality* (adopted in absence of health-based criteria in WHO (2017) because the taste and odour of petroleum products will in most cases be detectable at concentrations below those of health concern).

7.2.2 Ecological Assessment Criteria

The Auditor has adopted ecological groundwater assessment criteria from the following sources:

- ANZG (2018) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.* Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia (www.waterquality.gov.au/anz-guidelines). Criteria for freshwater water and 95% level of protection were adopted.

7.3 Ground Gas Considerations

The Auditor has assessed the ground gas data provided by the consultant with reference to the NSW EPA (2020) *Assessment and Management of Hazardous Ground Gases*.

7.4 Auditor's Opinion

Groundwater monitoring wells were screened across different soil profiles (fill, clay and shale). Groundwater identified in the wells may therefore relate to perched groundwater conditions.

Given the absence of bores for beneficial groundwater use and presence of a reticulated water supply for the area, extraction and use of groundwater as a resource is unlikely. Therefore, assessment of direct contact and consumption of groundwater is not considered to be required.

The environmental quality criteria referenced by the Auditor are consistent with those adopted by Douglas and in the IAA with the exception of the following:

- The DSI does not mention assessment of 'aesthetic' contamination as outlined in the NEPM (2013). However, the report results discuss potential aesthetic issues detected during sampling.
- The DSI and IAA adopted GILs listed in NEPM (2013) for protection of aquatic ecosystems referenced in ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. The 95% freshwater level of protection was adopted. The ANZG (2018) DGVs for freshwater and 95% level of protection adopted by the Auditor are largely based on trigger values (TVs) from ANZECC (2000).
- The DSI and IAA adopted the NSW EPA (2012) *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases*. These guidelines were recently updated in 2019 and amended in 2020 and were adopted by the Auditor. It is noted that the criteria have not materially changed.

Given the results obtained, the Auditor considers that these discrepancies do not affect the overall conclusions reached by Douglas and the Auditor.

8. EVALUATION OF SOIL RESULTS

The soil analytical results from the DSI undertaken prior to the preparation of the RAP were reviewed by the Auditor and presented in the IAA (Appendix C). In assessing the results reviewed in the IAA, the Auditor made the following observations:

- The soil analytical results for the majority of the fill and natural samples were below the health screening criteria.
- One ACM fragment (sample MVTP11-A) within fill material in test pit MVTP11 tested positive for Chrysotile asbestos. The fill profile at this location was described as sandy clay with inclusions of brick, ash and charcoal and extended to approximately 0.5 mbgl. ACM was not detected in the soil samples from this location. Natural soil was not tested for asbestos. Potential ACM was not observed in fill at other locations.
- One elevated lead concentration (3,400 mg/kg) was detected in the fill sample MVTP10 (0.2-0.3 mbgl). The fill in this test pit was described as sandy ash extending to approximately 0.35 mbgl. The result was less than 250% of the human health screening criteria of 1,500 mg/kg. The lead result of a deeper natural clay sample MVTP10 (0.4-0.5 mbgl) was 69 mg/kg, which is below the screening criteria, indicating that contamination was confined to the fill. Samples of fill material from other areas of the site contained elevated lead concentrations (up to 810 mg/kg), however were less than the human health criteria.
- Other metals were reported at concentrations elevated above typical background concentrations, however, were less than the adopted human health screening criteria.
- An elevated total DDT+DDE+DDD concentration (64 mg/kg) was detected in fill sample MVTP16 (0.1-0.2 mbgl) collected from silty sand fill with slag and ash extending to 0.65 mbgl. Minor detections of OCPs (Aldrin and Dieldrin) were also noted in fill samples MVBH07 (0.4-0.5 mbgl) and MVTP17 (0.5-0.6 mbgl). OCP concentrations were less than the human health screening criteria.
- TRH and PAHs were detected in natural samples obtained from less than 1 mbgl in MVTP10, MVTP11, MVTP12 and MVTP13. The results were below the screening criteria. A discussion on the potential source of these contaminants was not included in the DSI. A review of the test pit logs revealed that these samples were obtained very close to the interface with the fill and the detections could be a result of cross-contamination from the overlying fill or the presence of inclusions such as charcoal detected in MVTP12.

8.1 Auditor's Opinion

The soil analytical results obtained during the DSI are consistent with the site history and field observations. The results indicate the fill to be locally impacted by lead and ACM with results above the screening criteria. The fill is also impacted by OCPs (DDT+DDE+DDD), PAHs, VOCs, TRH and other metals (at concentrations less than the criteria). In the Auditor's opinion, the soil analytical results reviewed in the IAA indicate that contamination was present at the site and remediation of fill material containing lead and ACM is required. Remediation of fill material was undertaken and is discussed further in Section 12.

9. EVALUATION OF GROUNDWATER RESULTS

Groundwater monitoring was undertaken during the DSI. Douglas installed two monitoring wells at the site and undertook one groundwater monitoring event which included sampling from a groundwater monitoring well installed by others, as part of the DSI. The groundwater analytical results from the DSI, undertaken prior to the preparation of the RAP, were reviewed by the Auditor in preparation of the IAA (Appendix C). In assessing the results reviewed in the IAA, the Auditor made the following observations:

- The groundwater analytical results for the majority of the analytes were below the health and ecological screening criteria.
- Elevated concentrations of individual metals including copper, nickel and zinc were detected in the groundwater samples. The DSI concluded that the metals can be attributed to diffuse urban-sourced background levels and not from a site-specific source.
- The cadmium laboratory detection limit (PQL) is above the ecological screening criteria. Cadmium was detected in one sample at a concentration equal to the PQL. Cadmium results are not considered to be a significant issue.
- Low concentrations of ammonia, methane, TRH F1, chloroform, cis-1,2-dichloroethene (DCE) and trichloroethene (TCE) were detected in the groundwater samples. The TCE concentration exceeded the USEPA RSL carcinogenic criteria (4.9 µg/L), however was less than RSL criteria for ingestion (12 µg/L), dermal contact (74 µg/L) and inhalation (9.6 µg/L). The ammonia and other VOC results were less than the screening criteria and are not considered to pose a significant risk to site receptors. The DSI noted that the source of ammonia and methane could be the former backfill in the brick pits or swamp sediments. The source of TRH and VOC is likely from historical on-site land use.

The IAA concluded that *"The metals concentrations detected are not considered to present a risk to human health and are likely to represent regional groundwater conditions. The RAP recommends an additional groundwater monitoring event prior to the commencement of remediation to assess if significant groundwater contamination is present at the site"*.

9.1 Additional Data Collected

Subsequent to the IAA, an additional groundwater monitoring event (GME) was undertaken by Douglas in March 2018 with the results appended to the Validation Report. Due to the destruction of one Douglas installed monitoring well, the sampling was undertaken from one Douglas well (MVMW09) and one well installed previously by others (JCG-BH-1123). Samples were collected from both the well base and within mid-column of the well. The samples obtained from the well base were analysed for VOCs only while the samples obtained from within mid-column were analysed for metals, TRH, BTEX, PAHs, phenols, OCP, OPP, PCBs, VOCs, ammonia and dissolved methane. Concentrations were generally below the laboratory detection limit with the exception of metals, ammonia and dissolved methane. Concentrations of copper, nickel and zinc were detected in both samples above the adopted ecological criteria and a concentration of manganese was also detected in one well above the adopted ecological criteria. The nickel and manganese concentrations in one well were also above the adopted ADWG. Low concentrations of ammonia were detected in both monitoring wells, however, were below the adopted ecological criteria. Dissolved methane was also detected in one monitoring well.

Douglas reported in the Validation Report that the results of the additional sampling were consistent with the DSI results and that the need for additional assessment, remediation or management was not required.

9.2 Auditor's Opinion

In the Auditor's opinion, the groundwater analytical results are consistent with the field observations and indicate that significant groundwater contamination is not present at the site. The metals concentrations detected are not considered to present a risk to human health and are likely to represent regional groundwater conditions. The Auditor is satisfied that further investigation or remediation of groundwater is not required to demonstrate suitability of the site.

10. EVALUATION OF HAZARDOUS GROUND GAS DATA

As part of the DSI, hazardous ground gas (HGG) screening was undertaken at the ground surface and in the two groundwater monitoring wells installed by Douglas. The HGG results from the DSI, undertaken prior to the preparation of the RAP, were reviewed by the Auditor in preparation of the IAA (Appendix C).

Douglas reported that the ground surface screening did not detect any methane. Carbon dioxide and oxygen were detected in the monitoring wells. Methane, carbon monoxide and hydrogen sulphide were not detected in the monitoring wells. Relatively low flows were noted, with the highest recorded value of 0.6 L/hr.

Douglas calculated a gas screening value (GSV) of 0.05 based on the highest recorded flow rate. The GSV of 0.05 is less than the lowest gas screening threshold of 0.07 recommended by the EPA (2012) *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gas Guidelines* (replaced by NSW EPA (2020) *Assessment and Management of Hazardous Ground Gases*).

Douglas recommended an additional round of HGG screening to meet the minimum sampling requirements outlined in the EPA guidelines.

The IAA concluded that *"the HGG screening results were consistent with the field observations. An additional round of screening has been recommended by Douglas to assess if significant HGG is present at the site"*.

10.1 Additional Data Collected

Subsequent to the IAA, a ground gas monitoring event was undertaken by Golder-Douglas in June 2019 for the adjacent proposed Stabling Yard site. The Auditor has not been provided with the report documenting this ground gas sampling event however the Validation Report provides a summary of the results.

The Validation Report indicates that HGG screening was undertaken at three monitoring wells (VW-MN01 – VW-MN03) located in an offsite area to the west of the site (Attachment 4, Appendix A). Douglas indicated that excavation works at the site had commenced and that the northern area of the site near Well VW-MN01 would have been greater than 10 m, whilst excavation would not have commenced in the southern area, near Well VW-MN02. Douglas indicated that the secant pile wall around the site was constructed ahead of the excavation and would likely act as a barrier to any preferentially pathways from off-site sources.

The Validation Report documents methane detected in one location at 0.1 % (v/v) and carbon dioxide detections ranging from 2.1 to 14.1 % (v/v). Very low flow was reported with all three locations recording flow of 0.1 L/hr.

Douglas reported the calculated site GSV from the additional results to be less than the lowest gas screening threshold of 0.07 in NSW EPA (2020). Douglas indicated that this GSV equates to a characteristic situation (CS) of 1 ("very low risk"). Douglas acknowledged that Table 7 of NSW EPA (2020) recommends that for sites with carbon dioxide levels of >5% that an increase to CS2 ("low risk") be considered. Douglas noted that CS1 was most applicable based on methane being below the detection limit, low flow rates, the low sensitivity of the site and the presence of concrete slabs/piles covering soils at the site.

10.2 Auditor's Opinion

In the Auditor's opinion, the additional HGG screening results were consistent with the results reviewed as part of the IAA, including field observations and did not identify concentrations and flow rates that would indicate a significant risk to site users.

11. EVALUATION OF CONCEPTUAL SITE MODEL

A conceptual site model (CSM) is a representation of the source, pathway and receptor linkages at a site. Douglas developed a CSM and used it iteratively throughout the site assessment to inform decisions around investigation and remediation requirements. The CSM was initially developed following the preliminary investigations and included in the RAP and was reviewed by the Auditor in the IAA. The Auditor concluded in the IAA that the CSM presented was an adequate representation of the contamination at the site. Table 11.1 provides the Auditors review of the pre-remediation CSM presented in the Validation Report.

Table 11.1: Review of the Pre-Remediation Conceptual Site Model

Element of CSM	Consultant	Auditor Opinion
Contaminant source and mechanism	Asbestos in fill soils, sourced from imported fill or demolition of former structures. OCP and lead impacted soils, sourced from previous land uses or imported fill. Potential for ground gas (landfill, including methane in groundwater) from offsite infilled brickworks. Ammonia and VOC in groundwater. The source of these could be nearby swamp sediments and/or from wastes in backfilled brick pits in the vicinity of the site and/or from former commercial/industrial activities, such as former off-site dry cleaners. Possible groundwater contamination from previous offsite industrial/commercial activities. Unexpected contamination finds during excavation including USTs along the north and east excavation boundaries.	The source and mechanism for soil is considered appropriate. The source of VOCs in groundwater has not been identified, however is likely to be related to current or historical use of the site or nearby sites. Douglas consider the risks to be low based on the Dive Structure being open and no unacceptable impacts have been detected in the DSI and the additional screening. The presence of HGG is considered by Douglas to be low based on the Dive Structure being open and no unacceptable impacts have been detected in the DSI and the additional screening. Contamination associated with the offsite UST was not identified during investigation of the site. Implementation of an unexpected finds process to address any contamination identified during excavation of the site is considered acceptable.
Affected media	Soil, groundwater and ground gas.	The Auditor agrees that soil is the primary affected media. Unacceptable risks have not been identified in groundwater and/or ground gas.
Receptor identification	Future maintenance workers in the rail corridor, construction workers, adjacent land users, surface water receptors, groundwater and in-ground built structures.	Fill material will be entirely removed from the Dive site during remediation. Contamination was not identified in the existing fill material to remain within the TransGrid area of the site. The only relevant receptor is therefore considered to be construction workers.
Exposure pathways	Inhalation of dust and vapours, ingestion and/or dermal contact, surface water runoff, lateral migration of groundwater and ground gasses, direct contact of contaminated ground with in-ground structures, fire, explosion or asphyxiation from the accumulation of migrating ground gases and groundwater extraction for dewatering and disposal.	The CSM identified all potential exposure pathways. Complete exposure pathways are considered to be inhalation, direct contact and incidental ingestion during construction. No complete pathways are considered likely to be present following construction of the dive structure.

Element of CSM	Consultant	Auditor Opinion
Presence of preferential pathways for contaminant movement	Not discussed	Not considered relevant for fill material removed during remediation. Preferential pathways for groundwater and ground gas migration are likely to be present on the site, however, are not considered relevant as contamination representing a risk to human health has not been identified.
Potentially complete source-pathway-receptor (SPR) linkages requiring remediation or management	The pre-remediation CSM did not clearly specify potentially complete SPR linkages.	Potentially complete SPR linkages were to be largely addressed during excavation of the dive structure.
Evaluation of data gaps	The RAP identified data gaps in the form of additional groundwater and ground gas assessments. These were completed and no additional data gaps were identified in the CSM.	Identified data gaps from the RAP have been addressed and no further potentially significant data gaps have been identified.

11.1 Auditor's Opinion

The Auditor is of the opinion that the CSM was a reasonable representation of the contamination at the site prior to remediation during the dive structure excavation.

12. EVALUATION OF REMEDIATION

12.1 Remediation Required

Douglas determined remedial requirements based on review of investigation results against screening criteria and consideration of aesthetic issues. The RAP considered the horizontal extent of the remediation to be the excavation footprint, and the vertical extent to be the depth of contaminated or potentially contaminated soils, or the base of the excavation (whichever occurs first). Douglas anticipated that all contaminated or potentially contaminated soils within the excavation footprint will be removed as part of the bulk excavation works required for the development. Excavation and off-site reuse or disposal of the soil was therefore considered in the RAP by Douglas to be the only practicable remediation strategy.

An evaluation of the RAP was undertaken by the Auditor as part of the IAA (Appendix C), which included a comparison with the requirements of OEH (2011) *Guidelines for Consultants Reporting on Contaminated Sites* (current at the time of the IAA). The RAP was found to address the required information, and the Auditor concluded that the remediation approach was adequate to address contaminated fill material during redevelopment of the site through excavation and off-site disposal of contaminated fill material and natural soil and successful validation.

12.2 Addition of TransGrid Bridging Structure

Subsequent to the review of the RAP and issue of the IAA, JHCPBG JV were engaged to construct the TransGrid bridging structure which spans the constructed dive structure to link the existing rail corridor south of the dive structure to the future stabling yard located to the west. Douglas prepared a remediation work method statement (RWMS) in September 2019 for the addition of the TransGrid bridging structure to the site and included information on potential contamination information and remediation information referencing the RAP.

Douglas considered in the RWMS that the results of the previous intrusive investigations and the remediation related procedures within the RAP are relevant to the bridging structure. The main contaminants of concern are likely to be similar, i.e. metals, asbestos, hydrocarbons and pesticides. Douglas also considered that the results from previous investigations, within the footprint of the dive structure, indicated that the fill and natural soils in the area of the bridging structure are likely to be suitable for site re-use within the larger Marrickville dive site or disposed offsite.

The Auditor reviewed the RWMS during the course of the Audit, which was updated in response to the Auditor's comments. The Auditor considered that the procedures within the RMWS and RAP were adequate for the TransGrid bridging structure.

12.3 Remedial Works Undertaken

General excavation and spoil management was carried out in stages by JHCPBG JV and State Roads Construction (SRC) who supplied the operator and equipment. The Validation Report indicates that asbestos removal and load out of all asbestos impacted material was undertaken by JHCPBG JV under the supervision of Pure Contracting Pty Ltd (Licence Number AD210803) with Hibbs and Associates Pty Ltd (Hibbs) providing occupational hygiene services (air monitoring and surface clearances). Environmental consulting was provided by three consultants as follows:

- Douglas between January 2018 and May 2018.
- Down to Earth Geotechnical and Environmental (D2E) between February 2018 and May 2018.
- ADE Consulting Group Pty Ltd (ADE) between May 2018 to March 2020.

Following demolition of site buildings and structures, the following sequence of remediation/bulk earthworks was undertaken:

- Assessment of imported materials to be temporarily used during construction and to raise site levels in localised areas due to over excavation of pre-existing fill which was deemed to be geotechnically unsuitable to remain onsite. Imported materials were subsequently classified for off-site disposal by Douglas and others and, following completion of use on site, were disposed of off-site to licensed facilities.
- Further in situ and ex situ waste classification testing and assessments were performed to better define waste classification extents.
- The defined waste classification extents were then progressively excavated and disposed offsite in accordance with their assigned classification.
- Further assessment and/or validation of Unexpected Finds (UF). UFs included two onsite USTs and a stockpile classified ex situ as hazardous waste. The Validation Report indicated that the remedial methodologies adopted for the unexpected finds were excavation and off-site disposal.
- Virgin Excavated Natural Material (VENM) inspections following the removal of contaminated materials.

Douglas indicated that in order to minimise potential cross contamination, once the VENM interface was identified/confirmed, any outstanding fill areas were over-excavated into the VENM (approximately 250 mm) to ensure that all overlying fill was removed prior to excavation of the natural soils as VENM.

12.4 Validation Activities

12.4.1 Validation of Lead Exceedance MVTP10

The Validation Report indicates that MVTP10, which was identified to contain lead concentrations in fill soils above the adopted human health criteria, was located approximately 5 m outside the site boundary and therefore remediation was not undertaken. However, 13 delineation test pits were undertaken within the site boundary in the vicinity of MVTP10 to confirm elevated lead concentrations from MVTP10 did not extended within the site. This delineation area also included the DSI location MVTP11, which also required remediation for other contaminants discussed below. Douglas reported the lead results from the delineation samples to be considerably less than the human health criteria and that the identified lead at MVTP10 was considered to have been shown not to extend onto the site.

12.4.2 Validation of Asbestos Impacted Fill MVTP11

The Validation Report indicates the removal of the asbestos impacted fill at MVTP11 was validated during VENM assessments undertaken by ADE. MVTP11 is located close to the boundary between two excavation spoil grids (A1 and A2) and two VENM assessment reports were prepared by ADE for these two grid areas. The ADE reports applicable were not appended to the Validation Report however were provided separately.

Spoil grid A1 covered an area of approximately 500 m^2 while spoil grid A2 was approximately 1,000 m^2. ADE excavated five test pits within each excavation spoil grid (ten in total) and obtained samples of the natural soils. Ten samples were analysed for a range of contaminants including asbestos (presence/absence). Asbestos was not observed during the excavation of the test pits and asbestos was not detected in the samples analysed. ADE noted that between 0.1 and 0.3 m of imported materials was located at the surface of Grid A1 and were not included in the VENM assessment.

12.4.3 Validation of Impacted Natural Soils

The Validation Report indicates that delineation/validation sampling of PAH impacted natural soils at MVTP13 (0.4-0.5 m) was completed by ADE. The ADE report was appended to the Validation Report and indicated that four validation test pits were excavated approximately 3 m in each cardinal direction around the MVTP13 location. One validation sample per test pit was obtained

from the natural soils at a depth of 0.5 mbgl. One additional test pit was excavated at MVTP13 with a validation sample obtained at a depth of 0.8 mbgl. The five samples were analysed for PAHs with all results reported less than the PQL. ADE considered that MVTP13 "*has been adequately horizontally delineated to 3 m in each cardinal direction away from the initial sampling location*" and "*has been adequately vertically delineated to 0.8 mbgl*". ADE indicate that, following excavation and removal of the impacted natural material, that remaining in situ natural surrounding soils should be classified as VENM.

Douglas indicated in the Validation Report that VENM assessments were undertaken by ADE at the top of the VENM horizon from over the entire Dive excavation area which included the previously identified impacted natural soils. These reports were not appended to the Validation Report however were provided separately. Douglas indicated that the majority of these VENM assessments were undertaken by ADE whilst either existing fill or temporarily placed imported materials were still present. The VENM assessments included the excavation of test pits through any overlying fill and into the underlying natural soil/bedrock. Douglas report that the ADE VENM assessments included analysis for a wide variety of contaminants of concern which also included the appropriate contaminants previously detected in the impacted natural soils. Douglas provide a summary of the ADE VENM assessment results/reports which are applicable to the previously identified impacted natural material. The summaries provided by Douglas indicate that all analytes previously detected in the impacted natural material were detected below the laboratory limit of reporting during the ADE VENM assessments. Douglas note that previously identified toluene impacted natural material at MVBH6 (0.9-1.1 m) was likely to have been removed and disposed offsite to allow for the piling pad construction.

Douglas conclude in the validation report that based on the ADE VENM information "*it is considered that the natural soils with contaminant impacts … were addressed as part of the VENM assessments.*".

12.4.4 Validation of Hazardous Waste Excavations

The DSI identified concentrations of OPPs and OCPs in the vicinity of sample location MVTP16 (0.1-0.2) which was classified as hazardous waste (HW). Douglas indicated that ADE completed two rounds of delineation sampling and the reports were appended to the Validation Report. Initially, ADE undertook sampling from piling spoil at the boundaries of the site before undertaking delineation test pits spaced approximately 2 m in each cardinal direction around the MVTP16 location. Samples were obtained from the same depth as the initial MVTP16 sample. A further delineation test pit was excavated at the MVTP16 location with a sample obtained at a depth of 0.4 m. ADE noted that at the time of sampling imported sandstone had been placed for a piling pad in this area and the thickness of this placed material was taken into account when determining the sampling depths. Delineation samples obtained were analysed for OCP and OPP with all results reports to be less than the laboratory PQL. ADE considered that MVTP16 had "*been adequately horizontally delineated to 2 m in each cardinal direction away from the initial sampling location*" and had "*been adequately vertically delineated to 0.4 m below original ground level at the initial sampling location*".

The Validation Report indicates that Marrickville Stockpile 19 (MVSP19) was sourced from an area of the site and was classified ex situ by Douglas as HW-special waste (asbestos). The waste classification report prepared for the stockpile indicated that the source area required validation. The Validation Report indicates that ADE undertook validation sampling in the source area of MVSP19 and the results were appended to the Validation Report. ADE indicated that at the time of validation sampling the MVSP19 source area had been filled with placed imported sandstone material and that validation samples were obtained of the underlying natural materials at depths of approximately 0.6 to 0.8 mbgl. ADE obtained seven natural soil samples to validate the MVSP19 source area. ADE indicated limitations on obtaining grid based sampling from the area due to inaccessibility and the presence of a concrete slab. The seven samples were analysed for

metals, BTEX, OCP, OPP, PAHs, PCBs, TRH, phenols, VOCs and asbestos. Metals results were considered to be within background ranges by ADE, results for all organic analytes were below the laboratory PQL and asbestos was not observed or detected in the samples. ADE considered that no remaining impacted material are present in the source area of MVSP19 and that the area was validated in accordance with the RAP.

12.4.5 Validation of Asbestos in Stockpiles Following Removal

The Validation Report indicates that asbestos clearances were provided (by others) following removal of stockpiles found to contain asbestos. Documentation provided in the Validation Report included asbestos clearance documentation prepared by Hibbs which appeared to be documenting asbestos clearance for exposed surface's following removal of asbestos impacted stockpiles.

12.4.6 Validation of Unexpected Finds

The Validation Report indicates that two USTs (UST 1 and UST 2) were encountered during bulk earthworks in the eastern portions of the site (Attachment 5, Appendix A). UST 1 was encountered during excavation of Grid A1 in March 2018 while UST 2 was encountered during excavation of Grid A2 in May 2018.

UST 1

Douglas estimated the volume of UST 1 to be 2,500 L. The Validation Report indicates that liquid waste was removed from the UST by JHCPBG JV prior to removal of the UST from the ground. Upon inspection, Douglas indicated that the UST was in average condition with visible rust/oxidation on the surface.

Following removal of the UST and the surrounding soil, the resultant UST excavation was approximately 4.3 m long, 5 m wide and the base was approximately 0.5 m below the surrounding excavation level (approximately 2.4 m below the original concrete pavement). The top of the excavation walls comprised brown gravelly silty clay fill, with red and orange clay beneath. One soil sample of the red and orange clay was collected from each wall at a depth of 2.2 m below the original surface (MVUST1-N, MVUST1-E, MVUST1-S and MVUST1-W) and at the base of the excavation (MVUST1-B1). Strong petroleum odours were noted to be present in natural soils during the sampling, with PID readings ranging from 9 ppm (base) to 328 ppm (southern wall). Samples were analysed for metals, TRH, BTEX, PAHs, VOCs and phenols. Douglas reported that some analytes were recorded at concentrations above the expected background values for natural soils and included concentrations of TRH detected in all samples and concentrations of cyclohexane and naphthalene detected in the MVUST1-W sample.

Further excavation of the tank pit was undertaken to remove petroleum hydrocarbon impacted materials. Following the additional excavation, the tank pit excavation was approximately 13 m by 15 m and a depth of approximately 3.4 m below the original surface level. A total of twelve validation samples were collected, comprising four wall samples (MVUST-1 to MVUST-4) and eight base samples (MVUST-5 to MVUST-12) across the excavation pit. All samples were screened using a calibrated PID to provide an indication of the presence of volatile organic compounds. The results were recorded at between 70 and 15,000 ppm. Samples were analysed for metals, TRH, BTEX, PAHs, VOCs, phenols and asbestos. Douglas report that TRH, PAH, BTEX and VOC were also below the laboratory PQL in all of the twelve validation samples.

Based on the site observations and the laboratory results, Douglas considered that soil contamination resulting from the UST and at concentrations above the adopted criteria has been successfully removed. Douglas also noted that residual petroleum odours remained however considered these not to be of concern from a site use perspective due to the impacted soils requiring removal for the development, odour was generally of low level, the site use is not sensitive and the odours would be expected to naturally attenuate over time.

The Validation Report indicates that ADE completed VENM Assessments which included the UST 1 area. It is understood that no hydrocarbon odours were noted by ADE during the VENM sampling events. The Validation Report indicates that the odorous soils noted by Douglas were likely to have been excavated and disposed offsite with two stockpiles (MVSP13 and MVSP UST) of material from the UST 1 area.

UST 2

The Validation Report indicates that ADE were advised that the UST had an approximate volume of 5,000 L, was in fair condition with no liquid contents.

ADE report the dimensions of the UST excavation to be 1.5 m wide, 2 m long and 1.5 deep. A total of five validation samples were collected, comprising four wall samples (TP2 to TP5) and one base sample (TP1) across the excavation pit. All samples and excavation faces were screened using a calibrated PID to provide an indication of the presence of volatile organic compounds. PID readings were not reported by ADE however elevated PID readings were detected following initial excavation surrounding the UST and further soil materials were excavated and removed until PID readings were less than 5 ppm. Samples were analysed for lead, TRH, BTEX and PAHs. ADE report that all samples were below the adopted remediation acceptance criteria (RAC) specified in the RAP. With the exception of lead, which was detected within background ranges, all results were also less than the laboratory PQL. ADE concluded that "*remaining in-situ materials within the UST excavation footprint do not exhibit any signs of contamination (odours / staining). Analytical results indicate the surface materials within the subject excavation meet the relevant RAC.*".

12.4.7 Evaluation of Validation QA/QC

Validation data generally comprised analytical validation data for soils obtained following removal of the unexpected UST finds, impacted natural soils and higher classification waste streams discussed in Section 12.4. Based on the QA/QC tables (Table 6.1 and 6.2 in IAA) used by the Auditor to assess previous data in the IAA attached in Appendix C, the Auditor has assessed the overall quality of the data presented in the Validation Report. In considering the data as a whole, the Auditor concludes that:

- The data from site validation are likely to be representative of the overall soil conditions.
- The data is considered to be adequately complete.
- There is a high degree of confidence that data is comparable for each sampling and analytical event.
- The laboratories provided information to conclude that data is of sufficient precision.
- There is a high degree of confidence that data is accurate.

12.4.8 Imported Material

The Validation Report indicates that approximately 12,000 tonnes (t) of material was imported to the site for a mixture of temporary use and permanent use to allow for construction activities that formed part of the excavation works. The Validation Report indicates that the JHCPBG JV was provided with and reviewed the relevant documentation prior to importation of the material onto the site. It is further understood that the JHCPBG JV considered that the imported material met the appropriate resource recovery exemption and resource recovery order for importation without the need for further classification by an Environmental Consultant. The materials imported are summarised in Table 12.1.

Table 12.1: Imported Fill

Source	Volume Imported (t)	Material Type	Supporting Documentation	Site Use
WestConnex M5 Tunnel (Arncliffe Compound)	2,907	Sandstone (VENM)	VENM Classification Report prepared by ADE (April 2017). ADE obtained 15 samples from a tunnel shaft noted to be approximately 40 mbgl. ADE described the material as in situ rock materials generally consisting of grey to brown sandstone. Samples were analysed for a range of potential contaminants including metals, TRH, BTEX, PAHs, PCBs, OCP, OPP, total phenols, PFAS, ammonia and asbestos. Concentrations of organic analytes were below the PQLs, asbestos was not detected and metals concentrations were low and consistent with expectations for natural soils/bedrock. Three groundwater samples were also obtained by ADE from fractures along the exposed sandstone face. Groundwater samples were analysed for ammonia, nitrate and nitrite. The laboratory results were not provided however ADE indicated that a slight detection of nitrate and nitrite were recorded in one sample with all other results below the PQL	Temporary and permanent purposes
WestConnex M5 Tunnel (Bexley Shaft)	6,677	Clay (VENM)	VENM Classification Report prepared by ADE (January 2017) for soil materials from approximately 4.5 mbgl. ADE obtained five samples from depths greater than 4.5 mbgl in five boreholes drilled within the approximate site area of 314 m^2. ADE described the material as consisting of dark grey to light brown silty clay. Samples were analysed for a range of potential contaminants including metals, TRH, BTEX, PAHs, PCBs, OCP, OPP and asbestos. Concentrations of organic analytes were below the PQLs, asbestos was not detected and metals concentrations were low and consistent with expectations for natural soils.	Temporary and permanent purposes
WestConnex Stage 3B (Rozelle Interchange)	1,370	Sandstone (Tunnel spoil)	Two waste analysis and classification reports prepared by ADE (March and July 2020) for tunnel spoil generated from tunnel site C. ADE described the material as tunnelling spoil materials generally consisting of crushed sandstone and silty sand: fine to medium-grained, light to medium grey-brown, moderately graded with sandstone boulders, moist to wet. Trace amounts of shotcrete were present. The March 2020 report included the collection of ten samples from a 360 m^3 stockpile while the July 2020 report included the collection of ten samples from a 255 m^3 stockpile. Samples were analysed for a range of	Permanent purposes

Source	Volume Imported (t)	Material Type	Supporting Documentation	Site Use
			potential contaminants including metals, TRH, BTEX, PAHs, PCBs, OCP, OPP, phenols, sulfates, chlorides, pH, electrical conductivity and asbestos. ADE considered that the concentrations encountered within the samples analysed were consistent with published background concentrations with the exception of two samples obtained from each stockpile which encountered trace levels of TRH C_{16}-C_{34}. Asbestos was also not detected. Based on the results, ADE classified the tunnel spoil as Rozelle Interchange Tunnel Spoil Order 2019 under the NSW EPA *Rozelle Interchange Tunnel Spoil Exemption 2019* and *Rozelle Interchange Tunnel Spoil Order 2019*	
Boral Recycling Pty Ltd (Widemere)	964	Recovered aggregate.	Two test reports dated June 2018 and July 2018 were provided in the Validation report which included analysis of foreign materials, metals and electrical conductivity. The reports contained a project name *"Phase 87 – Weekly Testing of Material for Recovered Aggregate Order 2014 Field request No: 2501"*, which Douglas interpreted to indicate testing is undertaken on a weekly basis. The reported test results were within the thresholds set out in the NSW EPA, *The Recovered Aggregate Order 2014*.	Temporary purposes

Douglas indicated that once the material imported for temporary use was no longer needed on site they were subsequently classified and disposed of off-site. Douglas understand that this included the majority of the sandstone (VENM) and all of the recovered aggregate. The off-site disposal of these imported materials is discussed in Section 15.4.

12.4.9 Material Disposed Off-Site

Waste materials generated on-site were sampled and classified in accordance with the EPA (2014) *Waste Classification Guidelines*. Sampling from stockpiles of excavated soils and in-situ material was undertaken to characterise and classify the waste materials prior to off-site disposal. The Validation Report reports that 149,087 tonnes (t) of waste material was disposed off-site including the following waste types:

- General Solid Waste (non-putrescible) (GSW)
- GSW (non-putrescible) Special waste (asbestos)
- Hazardous Waste (HW)
- Excavated Natural Material (ENM)
- Virgin Excavated Natural Material (VENM)
- Two USTs (UST 1 and UST 2)
- Liquid waste removed from UST 1.

Quantities of other wastes associated with demolition and construction activities were also documented in the Validation Report.

Waste materials were disposed from the site between December 2017 and May 2020. Douglas included supporting documentation from the contractors including waste disposal dockets, tipping information and registers for receival sites.

The Auditor has reviewed the documentation provided and is of the opinion that the supplied documentation is consistent with the remedial works described. Further assessment of the waste classifications and disposal quantities is provided in Section 15.4.

12.5 Auditor's Opinion

In the Auditors' opinion, the excavation works were appropriate to remediate onsite contamination.

13. CONTAMINATION MIGRATION POTENTIAL

Based on the remediation/excavation works outlined in the Validation Report, it is considered that all on-site sources of contamination have been removed during remediation/excavation works. Contaminants detected prior to remediation within the soil at the site have not adversely affected the groundwater quality except possibly locally. As the highest concentrations in soil were removed as part of the remediation works, ongoing impacts are unlikely. In the Auditors opinion, the site in its remediated condition has a negligible potential for migration of contamination, including to groundwater.

The HGG screening results did not identify concentrations and flow rates that would indicate a significant risk to site users. Due to the depth of excavation required for construction of the dive structure, there is potential for HGG migration pathways to be intercepted. In the Auditor's opinion, as the site is an open void and consists of concrete slabs and a secant pile wall around the site acting as a barrier, the potential for HGG to migrate onto the site is considered to be low.

14. ASSESSMENT OF RISK

Based on assessment of results against relevant guidelines and consideration of the overall investigations and remediation performed, the Auditor considers that contaminant concentrations remaining onsite do not pose a risk to site users or the environment under the proposed land use scenario.

Contaminants within groundwater are not likely to pose a risk to human health as the impacts are mostly localised and concentrations were less than adopted human health criteria. It is also noted that abstraction and use on-site is not expected as a viable aquifer is not readily accessible.

HGG screening results did not identify concentrations and flow rates that would indicate a significant risk to site users, however, due to the site excavation works having potential to intercept migratory pathways there is a potential risk of HGG migration from the former landfill located to the east of the site. However, the risk is considered to be low and acceptable given that the site is an open void and construction consists of concrete slabs and a secant pile walls.

15. COMPLIANCE WITH REGULATORY GUIDELINES AND DIRECTIONS

15.1 General

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

The investigations were generally conducted in accordance with SEPP 55 Planning Guidelines and reported in accordance with the OEH (2011) *Guidelines for Consultants Reporting on Contaminated Sites* (which was applicable at the time the reports were prepared). The Validation Report was generally prepared in accordance with the NSW EPA (2020) *Consultants Reporting on Contaminated Land*.

15.2 Development Approval

A statutory site audit is required for the proposed Marrickville Dive Site, part of the Sydney Metro rail project between Chatswood and Sydenham, to address the requirements of Condition E67 of Infrastructure Approval, application SSI 15_7400, approved by the NSW Minister for Planning on 9 January 2017. Condition E67 relates to contamination and requires a site audit as follows:

> *"If a Site Contamination Report prepared under Condition E66 finds such land contains contamination, a site audit is required to determine the suitability of a site for a specified use. If a site audit is required, a Site Audit Statement and Site Audit Report must be prepared by a NSW EPA Accredited Site Auditor. Contaminated land must not be used for the purpose approved under the terms of this approval until a Site Audit Statement is obtained that declares the land is suitable for that purpose and any conditions on the Site Audit Statement have been complied with."*

This SAR and accompanying Site Audit Statement (SAS) were prepared to comply with this condition.

15.3 Duty to Report

Consideration has been given to the requirements of the EPA (2015) *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*. Based on the findings of this SAR, the Auditor considers that the site is not required to be notified under the Duty to Report requirements.

15.4 Waste Management

In accordance with Section 4.3.7 of the NSW EPA (2017) *Guidelines for the NSW Site Auditor Scheme (3rd Edition),* the Auditor has checked the following aspects relating to waste disposal and recycling.

15.4.1 Waste Classification

Forty-one waste classification letters prepared by Douglas, ADE and Down to Earth Geotechnical and Environmental were listed in the Validation Report as relevant to the site, with only four appended to the Validation Report. The remaining waste classification letters were provided separately to the Auditor and approximately 50% were reviewed in detail during the course of the audit. The Validation Report includes a waste classification register prepared by the JHCPBG JV which documents all waste classification reports prepared for the site. It was reported that wastes were classified in accordance with the NSW EPA (2014) *Waste Classification Guidelines, Part 1: Classifying Waste*. The adopted waste classification strategy included sampling from stockpiles of excavated soils and in-situ material.

Based on the summary of waste classification reports presented in Table 2 of the Validation Report, the waste classification reports were prepared for the following soils at the site:

- GSW (non - putrescible) - Special waste (asbestos waste) for selected fill.
- GSW (non - putrescible) for select fill material, non-VENM natural soils and imported materials.
- HW for fill material identified at former location MVTP16 and stockpile MVSP19.
- ENM for imported VENM, select fill and piling spoil.
- VENM for remaining natural soils and bedrock.

15.4.2 Waste Volumes, Disposal Receipts and Disposal Facilities

The Validation Report provides disposal dockets for the off-site disposal of different wastes which occurred between December 2017 and May 2020. Dockets include materials disposed during demolition and excavation stages of the project. The Validation Report also includes a waste receiving site register and a waste tracking register prepared by the JHCPBG JV.

Douglas report in Table 10 of the Validation Report that a total of 149,087 t (including ENM and VENM) was removed off-site. The JHCPBG JV records provided in Appendix K of the Validation Report indicate that a total of 159,411.81 t was removed off-site. The Auditor has assessed the volumes presented and calculates a similar number to those provided by the JHCPBG JV. Based on the volumes presented by Douglas, it would appear that the construction and demolition wastes included in the JHCPBG JV information are not included in the Douglas calculations. The addition of the construction and demolition waste volumes to the Douglas calculated total would provide a similar value to the Auditor and the JHCPBG JV. This discrepancy is therefore not considered to be significant.

Table 15.1 summarises the waste disposal information for non-VENM soil disposed off-site to several waste management facilities that are licensed to receive the specified waste under their Environmental Protection Licence (EPL).

Table 15.1: Summary of Waste Disposal

Waste Classification	Tonnage (t)	Disposal Facility	EPL No.
GSW (non-putrescible)	1,570.32	Genesis Dial A Dump (Eastern Creek)	13426
GSW (non-putrescible)	4,714.81	MET Recycling (Silverwater)	20948
GSW (non-putrescible)	3,507.42	Cleanaway Enviroguard (Erskine Park)	4865
GSW (non-putrescible)	2,197.12	Hi-Quality Waste Management (St Marys)	5857
GSW (non-putrescible)	5,474.02	Sydney Recycling Park (Kemps Creek)	12901
GSW (non-putrescible)	8,286.06	Breen Holdings (Kurnell)	4608
GSW (non-putrescible)	2,353.69	Aussie Skips (Greenacre)	21389
GSW (non-putrescible) and Special waste (Asbestos)	4,180	Genesis Dial A Dump (Eastern Creek)	13426
GSW (non-putrescible) and Special waste (Asbestos)	5,658.92	Cleanaway Enviroguard (Erskine Park)	4865
HW	27.80	Suez Ventia SV Joint Venture (Victoria)	Licence no. Works Approval 10104
HW	2,450.24	We Kando Chinchilla (Queensland)	Environmental authority EPPR03467515
Liquid Waste	3.9	Toxfree (South Windsor)	4602

15.4.3 Auditor's Opinion

The Auditor considers that the waste management assessed as part of the remedial works was undertaken in accordance with the relevant guidelines and regulations. As discussed in Section 12.4, validation sampling was generally not undertaken following removal of defined extents of different (higher) classified wastes however VENM assessments were performed on the underlying natural material which validated removal of pre-existing fill material and the JHCPBG JV over excavated into the VENM by approximately 250 mm to ensure overlying fill areas were removed. In the Auditors opinion the lack of validation sampling has been compensated by the VENM assessments and over excavation procedure.

15.5 VENM and Other Imported Materials

As detailed in Section 12.4.8, VENM and other materials were imported to the site for temporary use to allow for construction activities and for permeant use as fill to backfill excavations. Douglas indicated in the Validation Report that temporary use materials were excavated, waste classified and disposed off-site and therefore are no longer present at the site. As discussed in Section 12.4.8, imported materials remaining for permanent use were deemed suitable for use from a contamination perspective.

15.6 Licenses

Douglas did not confirm that the asbestos remediation works involved a Class A or Class B Asbestos removal contractor, however, did confirm that Pure Contracting were contracted for removal of asbestos. The asbestos materials clearance reports prepared by Hibbs and provided by Douglas in the Validation Report do not indicate who the licenced asbestos removal contractors were that undertook the removal works. Copies of the appropriate licences were not provided to the Auditor, however the Auditor undertook a search of the SafeWork NSW asbestos licence database on 16 September 2020 which indicates that Pure Contracting are licenced for non-friable and friable asbestos removal works (Licence number: AD210803).

15.7 Conflict of Interest

The Auditor has considered the potential for a conflict of interest in accordance with the requirements of section 3.2.3 of the NSW EPA (2017) *Guidelines for the NSW Site Auditor Scheme*.

The Auditor considers that there are no conflicts of interest, given that:

1. The Auditor is not related to a person by whom any part of the land is owned or occupied.
2. The Auditor does not have a pecuniary interest in any part of the land or any activity carried out on any part of the land.
3. The Auditor has not reviewed any aspect of work carried out by, or a report written by, the site auditor or a person to whom the site auditor is related.

16. CONCLUSIONS AND RECOMMENDATIONS

Based on the results documented in the Validation Report, Douglas concluded that "*all identified on-site sources of contamination have been removed and suitably validated. No off-site sources which are likely to render the site unsuitable for its proposed use have been identified. Accordingly, it is considered that the site has been made suitable for the proposed development*".

Based on the information presented in Douglas reports and observations made on site, and following the Decision-making process for assessing urban redevelopment sites in NSW EPA (2017) *Guidelines for the NSW Site Auditor Scheme (3rd Edition)*, the Auditor concludes that the site is suitable for the purposes of 'commercial/industrial' land use (proposed rail dive structure).

Groundwater has not been assessed for any beneficial re-use. Any future use of groundwater would require appropriate assessment and regulatory approvals from the NSW Office of Water.

17. OTHER RELEVANT INFORMATION

This Audit was conducted on the behalf of JHCPBG JV for the purpose of assessing whether the land is suitable for the proposed commercial/industrial uses i.e. a "Site Audit" as defined in Section 4 (definition of a 'site audit' (b)(iii)) of the CLM Act.

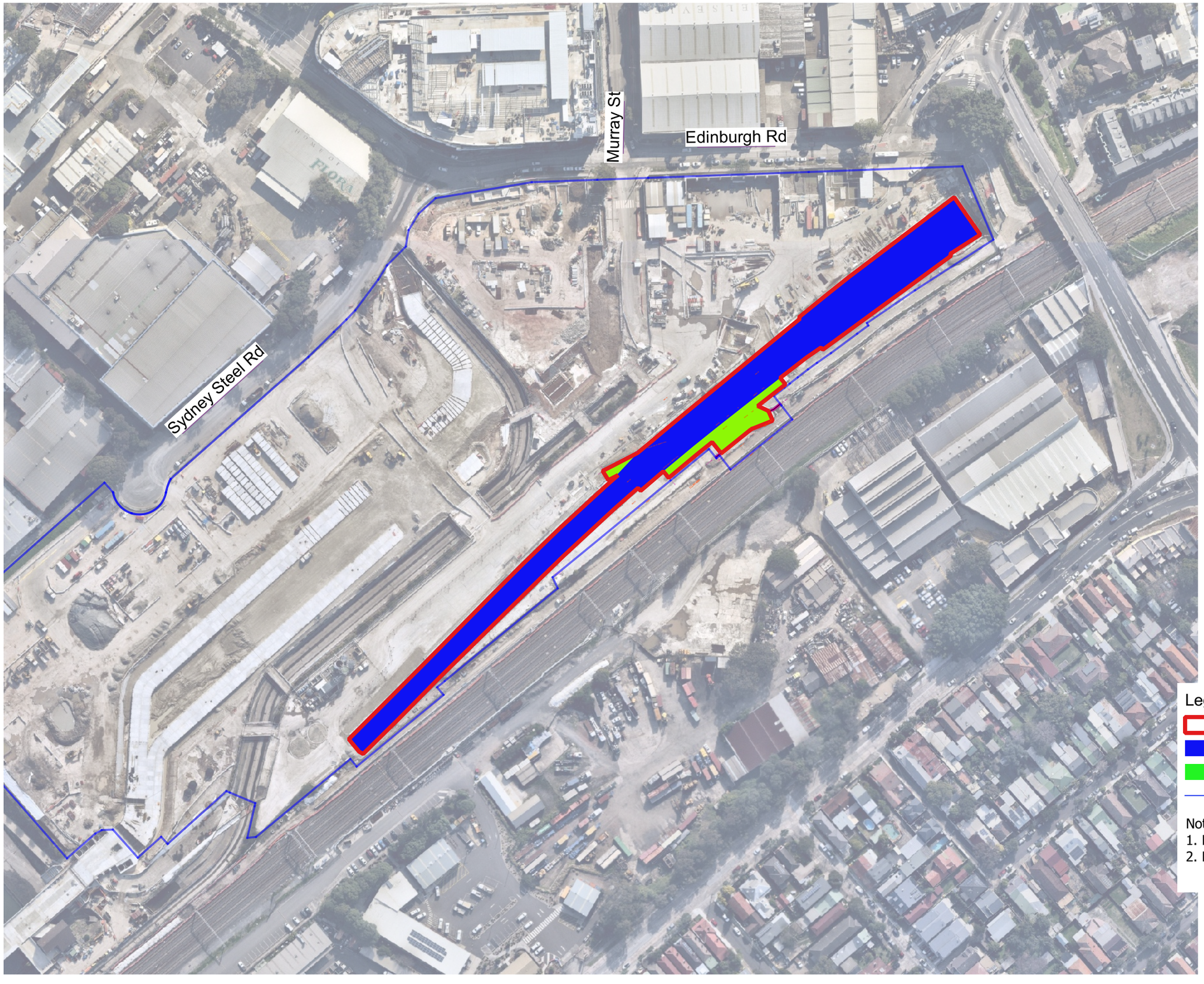
This summary report may not be suitable for other uses. Douglas included limitations in their reports. The Audit must also be subject to those limitations. The Auditor has prepared this document in good faith, but is unable to provide certification outside of areas over which the Auditor had some control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

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

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

APPENDIX A
ATTACHMENTS

Attachment 1: Site Location
Attachment 2a: Site Survey
Attachment 2b: Site Survey
Attachment 2c: Site Survey
Attachment 3: Sample Location Plan
Attachment 4: Additional HGG and Groundwater Monitoring Well Locations
Attachment 5: Unexpected Find UST Locations



Legend

- Site Boundary
- Dive Structure
- TransGrid Structure (excluding portion above Dive)
- Marrickville works area

Notes:
1. Basemap from nearmap.com (dated 02/08/2020)
2. Locations shown are approximate only

0 50 100 150 m

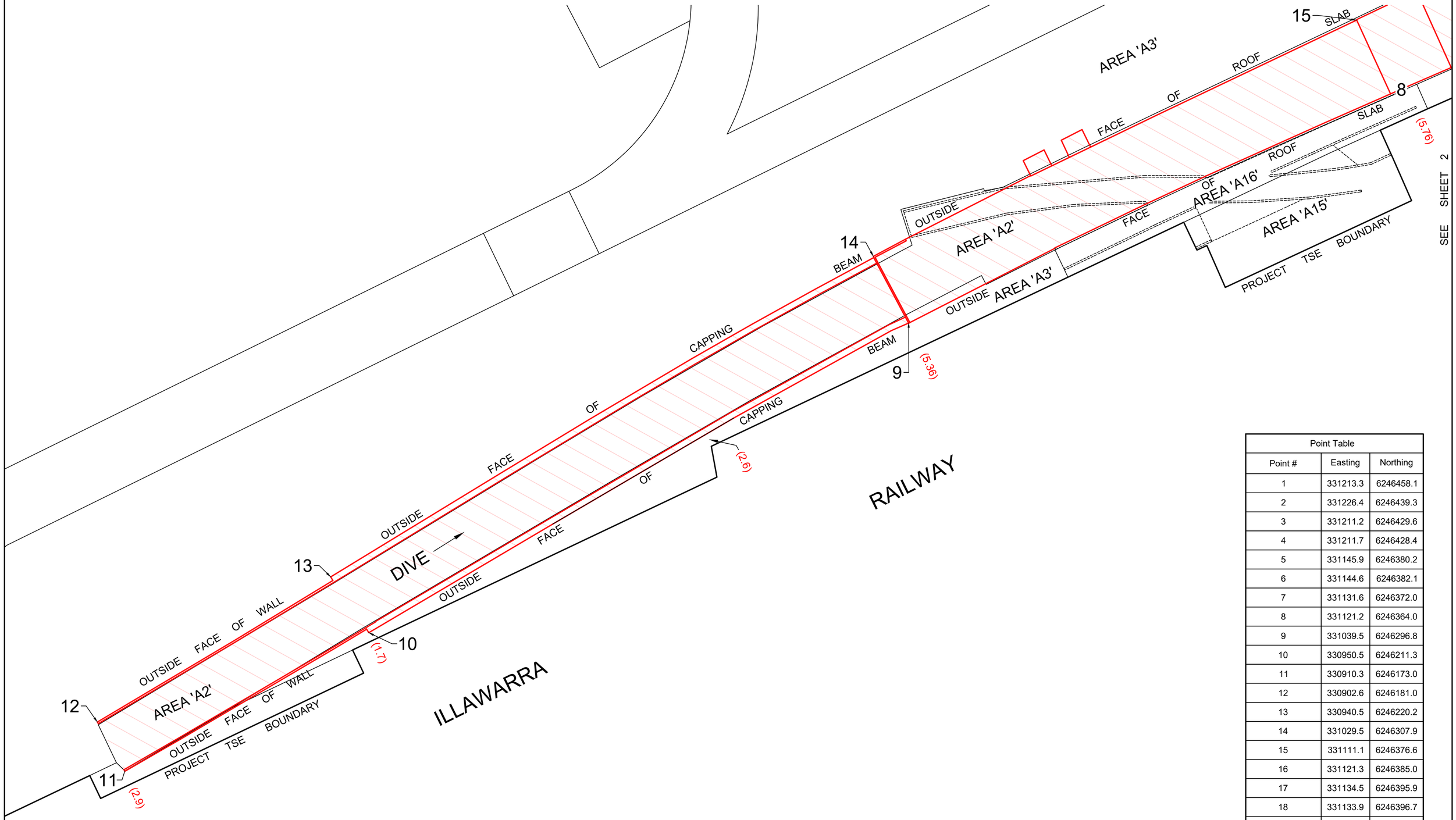
Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT:	JHCPBGJV		
OFFICE:	Sydney	DRAWN BY:	NLE
SCALE:	1:2000 @ A3	DATE:	14.09.2020

TITLE: **SITE LOCATION AND SUB-AREAS**
Sydney Metro City & South West - TSE
Marrickville Dive, Murray Street, Marrickville

N

PROJECT No:	85608.15
DRAWING No:	R.030.D.01
REVISION:	1



Point Table		
Point #	Easting	Northing
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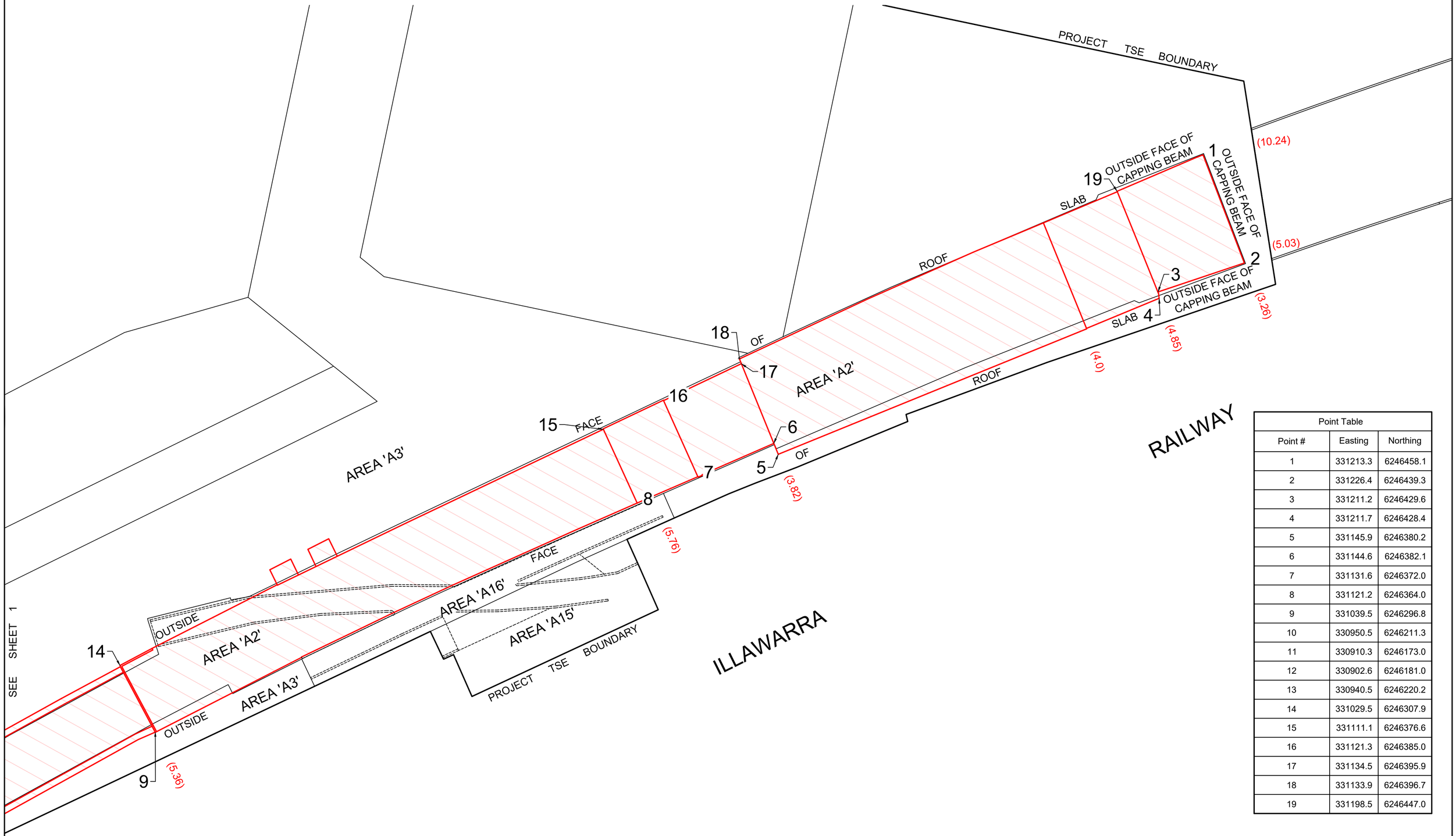
2	331226.4	6246439.3
3	331211.2	6246429.6
4	331211.7	6246428.4
5	331145.9	6246380.2
6	331144.6	6246382.1
7	331131.6	6246372.0
8	331121.2	6246364.0
9	331039.5	6246296.8
10	330950.5	6246211.3
11	330910.3	6246173.0
12	330902.6	6246181.0
13	330940.5	6246220.2
14	331029.5	6246307.9
15	331111.1	6246376.6
16	331121.3	6246385.0
17	331134.5	6246395.9
18	331133.9	6246396.7
19	331198.5	6246447.0

NOTE:
PROJECT BOUNDARY AND TSE AREAS DEFINED FROM DRAWING NWRLSRT-RPS-SRT-SR-DWG-000063-T.3-TSE FIGURE 2.1.DWG

Surveyor Name: ADAM LONG Date: 19/08/2020 Reference: 18-569 DP13	PLAN OF SURVEY INFORMATION ONLY LOCATION OF PORTION 2 WORKS WITHIN TSE PROJECT AREA	LGA: INNER WEST Locality: MARRICKVILLE Reduction Ratio 1:500 Lengths are in metres.	Registered:	DP



Point Table		
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5	331145.9	6246380.2
6	331144.6	6246382.1
7	331131.6	6246372.0
8	331121.2	6246364.0
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10	330950.5	6246211.3
11	330910.3	6246173.0
12	330902.6	6246181.0
13	330940.5	6246220.2
14	331029.5	6246307.9
15	331111.1	6246376.6
16	331121.3	6246385.0
17	331134.5	6246395.9
18	331133.9	6246396.7
19	331198.5	6246447.0

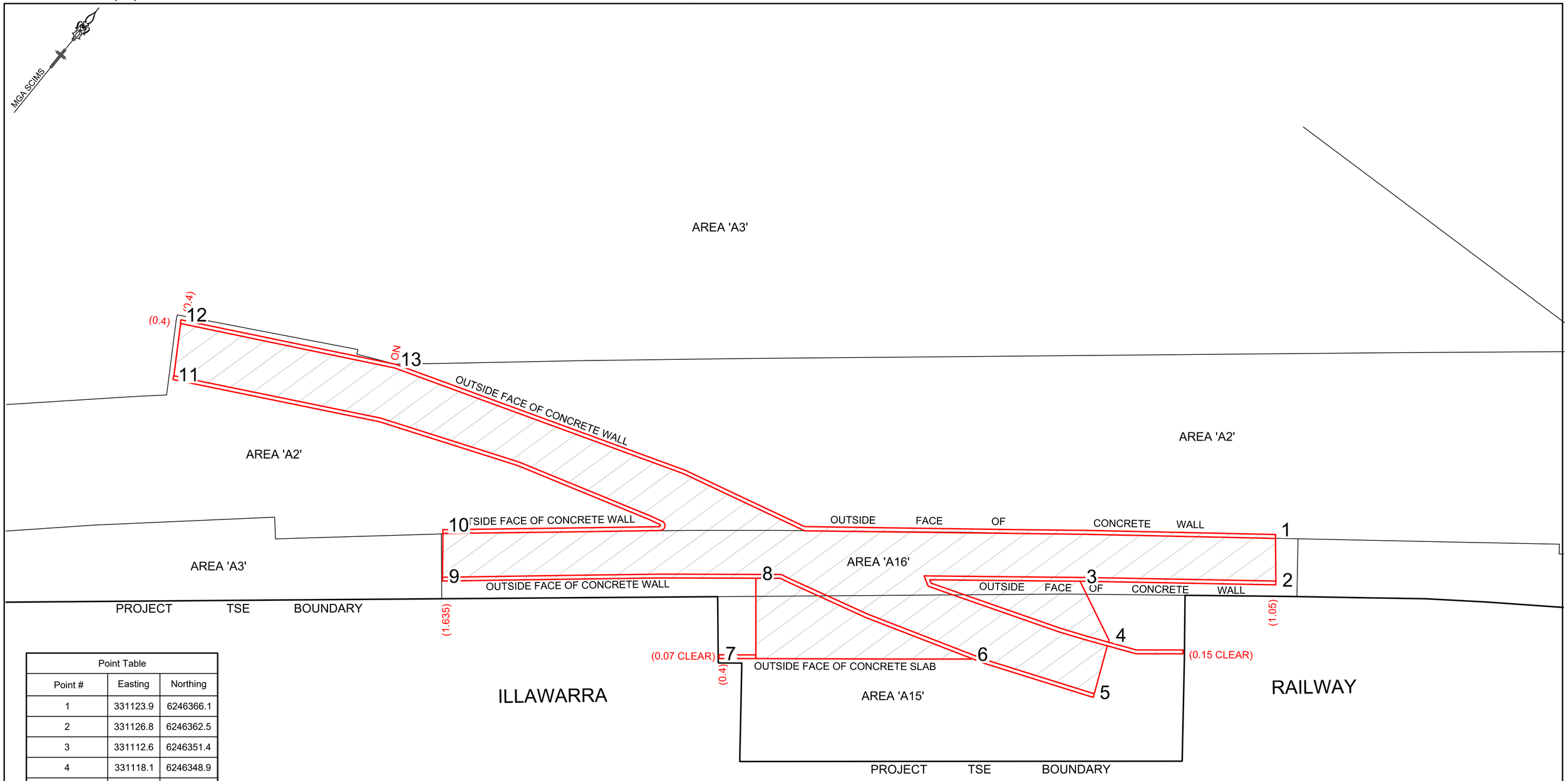
NOTE:
PROJECT BOUNDARY AND TSE AREAS DEFINED FROM DRAWING NWRLSRT-RPS-SRT-SR-DWG-000063-T.3-TSE FIGURE 2.1.DWG

Surveyor Name: ADAM LONG Date: 19/08/2020 Reference: 18-569 DP13	PLAN OF SURVEY INFORMATION ONLY LOCATION OF PORTION 2 WORKS WITHIN TSE PROJECT AREA	LGA: INNER WEST Locality: MARRICKVILLE Reduction Ratio 1:500 Lengths are in metres.	Registered:	DP

PLAN FORM 2 (A2)

WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION

Attachment 2c: Site Survey



Point Table		
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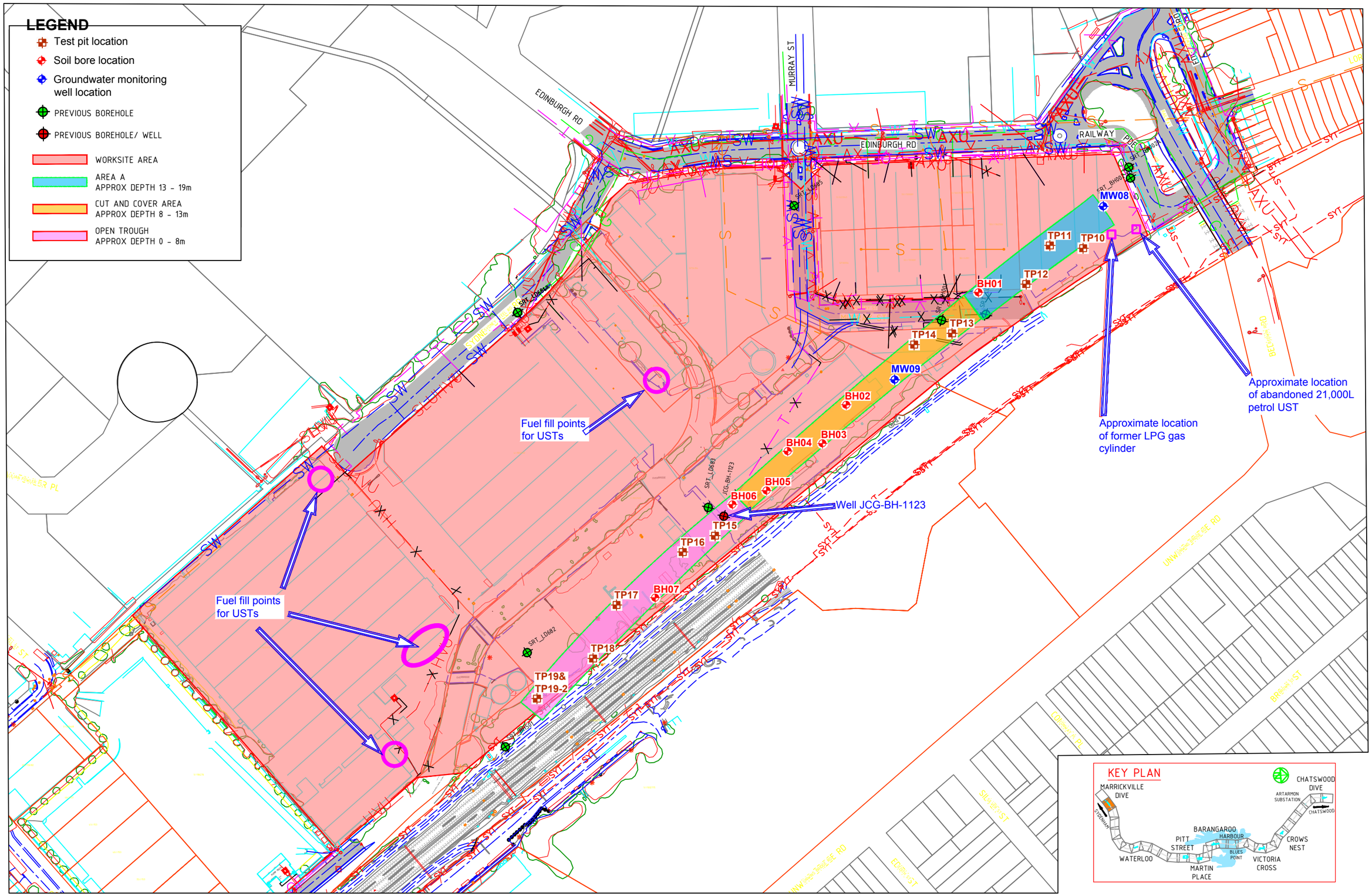
5	331120.3	6246343.9
6	331109.3	6246339.5
7	331091.3	6246325.0
8	331089.2	6246332.9
9	331067.0	6246314.5
10	331064.0	6246318.2
11	331036.0	6246313.3
12	331033.1	6246318.1
13	331051.0	6246327.3

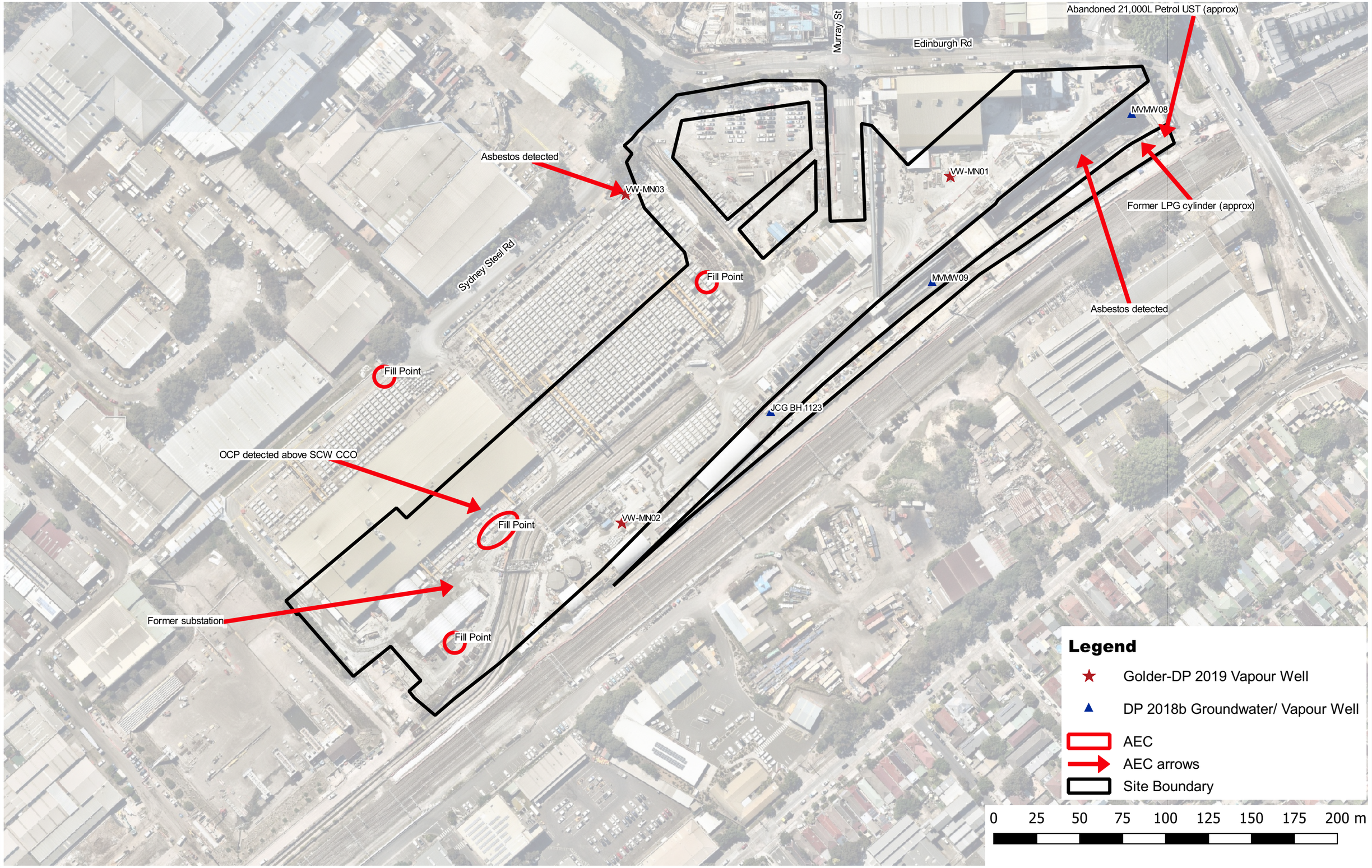
NOTE:
PROJECT BOUNDARY AND TSE AREAS DEFINED FROM DRAWING NWRLSRT-RPS-SRT-SR-DWG-000063-T.3-TSE FIGURE 2.1.DWG

Surveyor Name: ADAM LONG Date: 19/08/2020 Reference: 18-569 DP12	PLAN OF SURVEY INFORMATION ONLY LOCATION OF PORTION 13 WORKS WITHIN TSE PROJECT AREAS	LGA: INNER WEST Locality: MARRICKVILLE Reduction Ratio 1:250 Lengths are in metres.	Registered:	DP

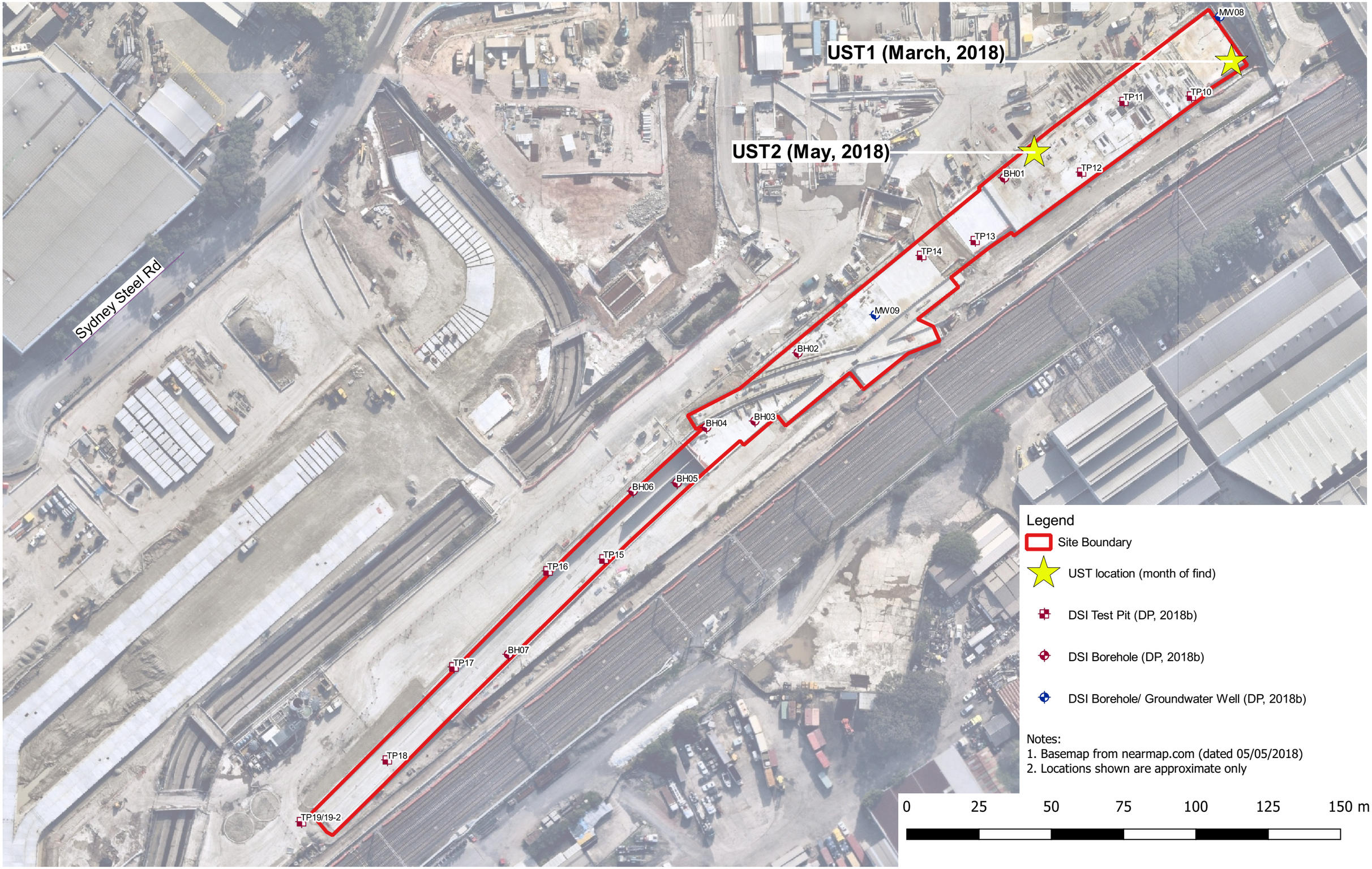
SYDNEY METRO REF: SMCSWTSE-JAL-TPW-CN-DRG-101011



Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: John Holland CPB Ghella JV	TITLE: **Test Locations, Sydney Metro City & South West, Tunnel and Station Works Package, Proposed Marrickville Dive, Murray Street, MARRICKVILLE**	PROJECT No: 85608.15
	OFFICE: Sydney / DRAWN BY: PSCH		DRAWING No: 2
	SCALE: 1:1000 @ A3 / DATE: 22.2.2018		REVISION: 1



Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: John Holland CPB Contractors Ghella Joint Venture	TITLE: **Previous Soil Vapour Wells** **Proposed Culvert Realignment, Proposed Stabling Yard** **Murray Street, Marrickville**	PROJECT No: 85608.16
	OFFICE: Sydney / DRAWN BY: NLE		DRAWING No: 5
	SCALE: As shown / DATE: 16.04.2020		REVISION: 3



Legend

- Site Boundary
- UST location (month of find)
- DSI Test Pit (DP, 2018b)
- DSI Borehole (DP, 2018b)
- DSI Borehole/ Groundwater Well (DP, 2018b)

Notes:
1. Basemap from nearmap.com (dated 05/05/2018)
2. Locations shown are approximate only

0 25 50 75 100 125 150 m

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT:	JHCPBGJV		
OFFICE:	Sydney	DRAWN BY:	NLE
SCALE:	1:1200 @ A3	DATE:	14.09.2020

TITLE: **LOCATION OF UST UNEXPECTED FINDS**
Sydney Metro City & South West - TSE
Marrickville Dive, Murray Street, Marrickville

N

PROJECT No:	85608.15
DRAWING No:	R.030.D.03
REVISION:	1

APPENDIX B
SITE AUDIT STATEMENT

NSW Site Auditor Scheme

Site Audit Statement

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

This form was approved under the *Contaminated Land Management Act 1997* on 12 October 2017.

For information about completing this form, go to Part IV.

Part I: Site audit identification

Site audit statement no. TO-024-3

This site audit is a:

☒ statutory audit

☐ non-statutory audit

within the meaning of the *Contaminated Land Management Act 1997*.

Site auditor details

(As accredited under the *Contaminated Land Management Act 1997*)

Name:	Tom Onus
Company:	Ramboll Australia Pty Ltd
Address:	Level 3
	100 Pacific Highway, North Sydney
	Postcode: 2060
Phone:	02 9954 8133
Email:	tonus@ramboll.com

Site details

Address: Part of Murray Street, 2 Edinburgh Road, 50-52 Murray Street, 18 Edinburgh Road, 5-15 Murray Street and 1A Sydney Steel Road, Marrickville, NSW 2204

Postcode: 2204

Property description

The site covers an irregular rectangular shape (see figures at end of Part I of this statement). The Lot/Deposited Plan (DP) numbers for the site are as follows:

- Part Lot 1 DP622660
- Part Lot 100 DP1162506
- Part Lot 38 DP4991
- Part Lot 10 DP874363
- Part Lot 4 DP802920
- Part Lot 100 DP1231062

Local government area: Inner West Council

Area of site (include units, e.g. hectares): Approximately 0.8 hectares

Current zoning: IN1 General Industrial under the Marrickville Local Environment Plan 2011

Regulation and notification

To the best of my knowledge:

☐ **the site is** the subject of a declaration, order, agreement, proposal or notice under the *Contaminated Land Management Act 1997* or the *Environmentally Hazardous Chemicals Act 1985,* as follows: (provide the no. if applicable)

- ☐ Declaration no.
- ☐ Order no.
- ☐ Proposal no.
- ☐ Notice no.

☒ **the site is not** the subject of a declaration, order, proposal or notice under the *Contaminated Land Management Act 1997* or the *Environmentally Hazardous Chemicals Act 1985*.

To the best of my knowledge:

☐ the site **has** been notified to the EPA under section 60 of the *Contaminated Land Management Act 1997*

☒ the site **has not** been notified to the EPA under section 60 of the *Contaminated Land Management Act 1997*.

Site audit commissioned by

Name: Caitlin Richards

Company: John Holland CPB Ghella Joint Venture

Address: Level 9, 50 Bridge Street, Sydney, NSW

Postcode: 2000

Phone: 0407 176 672

Email: caitlin.richards@sydneymetro2.com.au

Contact details for contact person (if different from above)

Name: Krissy Vajda

Phone: 0439 477 649

Email: krissy.vajda@sydneymetro2.com.au

Nature of statutory requirements (not applicable for non-statutory audits)

☐ Requirements under the *Contaminated Land Management Act* 1997 (e.g. management order; please specify, including date of issue)

☒ Requirements imposed by an environmental planning instrument (please specify, including date of issue)

Condition E67 of Infrastructure Approval, application SSI 15_7400, approved by the Minister for Planning on 9 January 2017

☐ Development consent requirements under the *Environmental Planning and Assessment Act 1979* (please specify consent authority and date of issue)

☐ Requirements under other legislation (please specify, including date of issue)

Purpose of site audit

☒ **A1** To determine land use suitability

Intended uses of the land: Dive structure for below ground train network

OR

☐ **A2** To determine land use suitability subject to compliance with either an active or passive environmental management plan

Intended uses of the land:

OR

(Tick all that apply)

☐ **B1** To determine the nature and extent of contamination

☐ **B2** To determine the appropriateness of:

- ☐ an investigation plan
- ☐ a remediation plan
- ☐ a management plan

☐ **B3** To determine the appropriateness of a **site testing plan** to determine if groundwater is safe and suitable for its intended use as required by the *Temporary Water Restrictions Order for the Botany Sands Groundwater Resource 2017*

☐ **B4** To determine the compliance with an approved:

- ☐ **voluntary management proposal** or
- ☐ **management order** under the *Contaminated Land Management Act 1997*

☐ **B5** To determine if the land can be made suitable for a particular use (or uses) if the site is remediated or managed in accordance with a specified plan.

Intended uses of the land:

Information sources for site audit

Consultancies which conducted the site investigations and/or remediation:

Douglas Partners Pty Ltd (Douglas)

Titles of reports reviewed:

‘Report on Preliminary Site Investigation, Sydney Metro City and South West, Tunnel and Station Excavation Works Package, Proposed Marrickville Dive, Murray Street, Marrickville, prepared for John Holland CPB Ghella JV, Project 85608.15, March 2018’, report reference: Revision 0, dated 21 March 2018, prepared by Douglas

‘Report on Detailed Site Investigation, Sydney Metro City and South West, Tunnel and Station Excavation Works Package, Proposed Marrickville Dive, Murray Street, Marrickville, prepared for John Holland CPB Ghella JV, Project 85608.15, March 2018’, report reference: Revision 1, dated 22 March 2018, prepared by Douglas

'Report on Remediation Action Plan, Sydney Metro City and South West, Tunnel and Station Excavation Works Package, Proposed Marrickville Dive, Murray Street, Marrickville, prepared for John Holland CPB Ghella JV, Project 85608.15, April 2018', report reference: Revision 0, dated 12 April 2018, prepared by Douglas
'Report on Validation of Remediation, Sydney Metro City and South West - Tunnel and Station Excavation Works Package, Sydney Metro City and South West – Marrickville Dive, Murray Street, Marrickville, NSW', report reference: Revision 0, dated 16 September 2020, prepared by Douglas

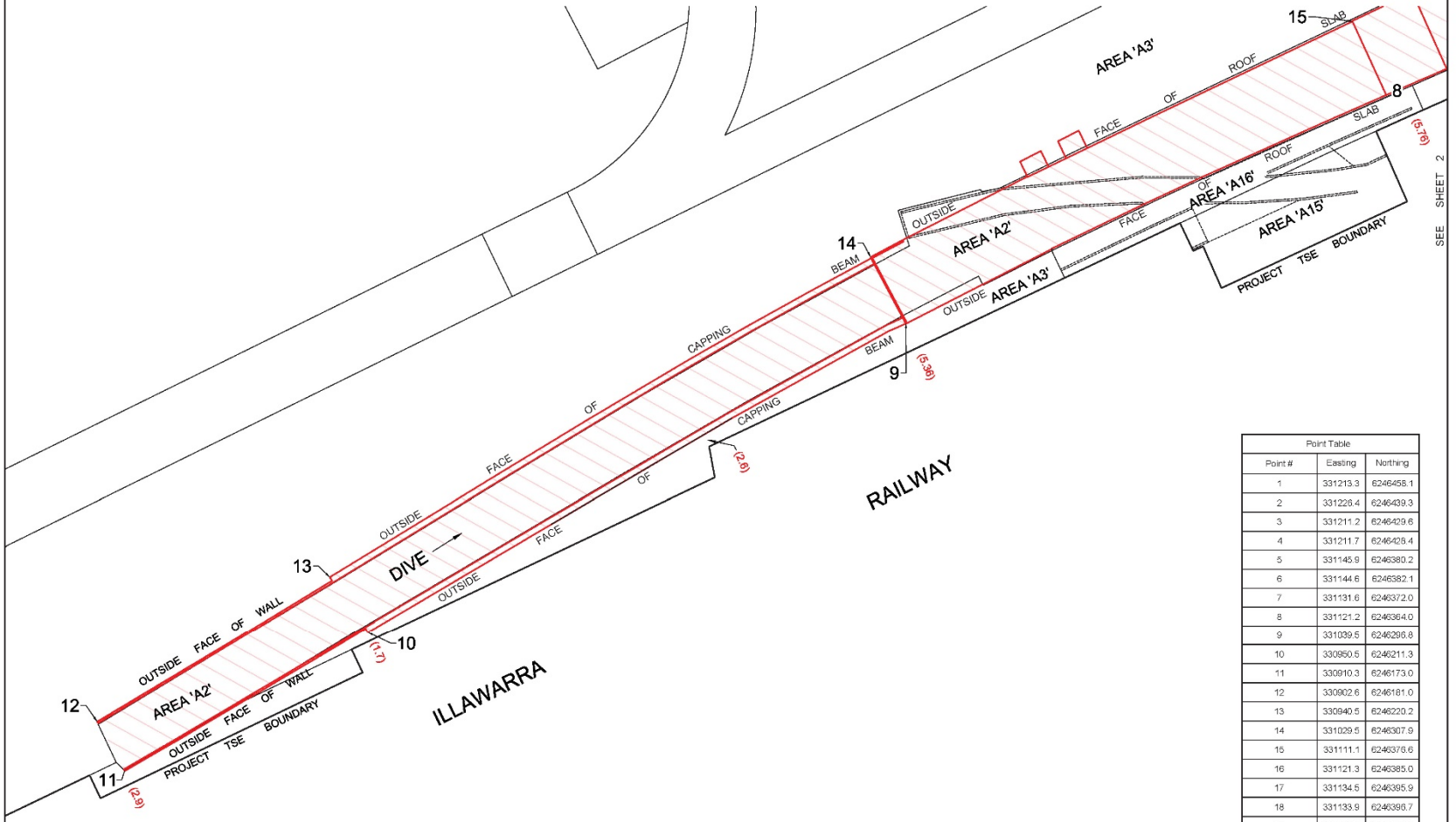
Other information reviewed, including previous site audit reports and statements relating to the site:

Review of supporting documentation including waste classification reports prepared by Douglas, ADE Consulting Group Pty Ltd (ADE) and Down to Earth Geotechnical and Environmental for material disposed from the site.

Site audit report details

Title:	Site Audit Report – Marrickville Dive, Murray Street, Marrickville NSW
Report no.:	TO-024-3 (Ramboll Ref: 318000323-007) Date: 18 September 2020

PLAN FORM 2 (A2) WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION Sheet 1 of 2 sheets



Point Table		
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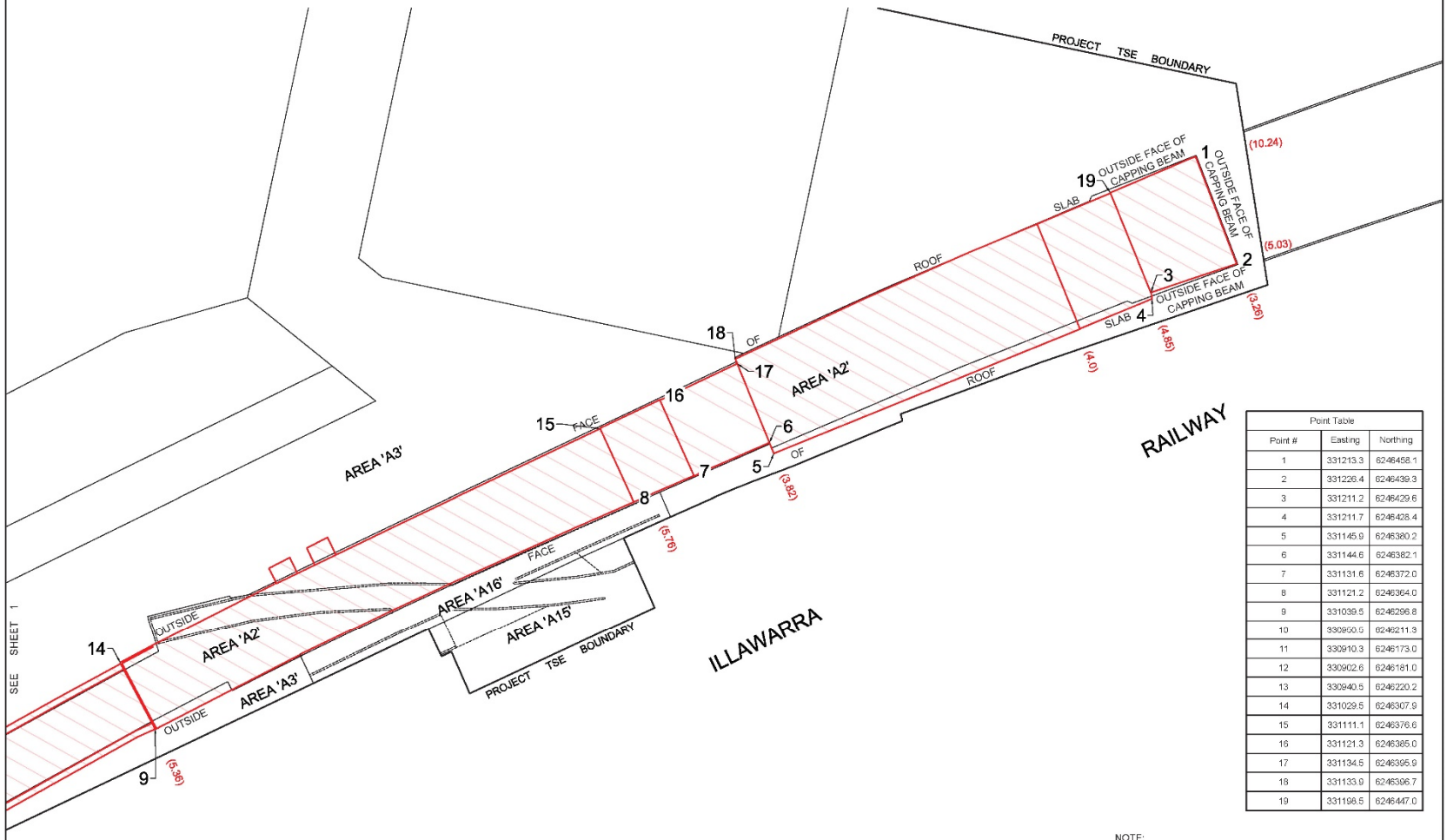
2	331226.4	6246439.3
3	331211.2	6246429.6
4	331211.7	6246426.4
5	331145.9	6246380.2
6	331144.6	6246382.1
7	331131.6	6246372.0
8	331121.2	6246364.0
9	331039.5	6246296.8
10	330950.5	6246211.3
11	330910.3	6246173.0
12	330902.6	6246181.0
13	330940.5	6246220.2
14	331029.5	6246307.9
15	331111.1	6246376.6
16	331121.3	6246385.0
17	331134.5	6246395.9
18	331133.9	6246396.7
19	331198.5	6246447.0

NOTE:
PROJECT BOUNDARY AND TSE AREAS DEFINED FROM DRAWING NWRLSRT-RPS-SRT-SR-DWG-000063-T.3-TSE FIGURE 2.1.DWG

Surveyor Name: ADAM LONG Date: 19/08/2020 Reference: 18-569 DP13	PLAN OF SURVEY INFORMATION ONLY LOCATION OF PORTION 2 WORKS WITHIN TSE PROJECT AREA	LGA: INNER WEST Locality: MARRICKVILLE Reduction Ratio 1:500 Lengths are in metres.	Registered: DP

SYDNEY METRO REF: SMCSWTSE-JAL-TPW-CN-DRG-101012

PLAN FORM 2 (A2) WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION Sheet 2 of 2 sheets



Point Table		
Point #	Easting	Northing
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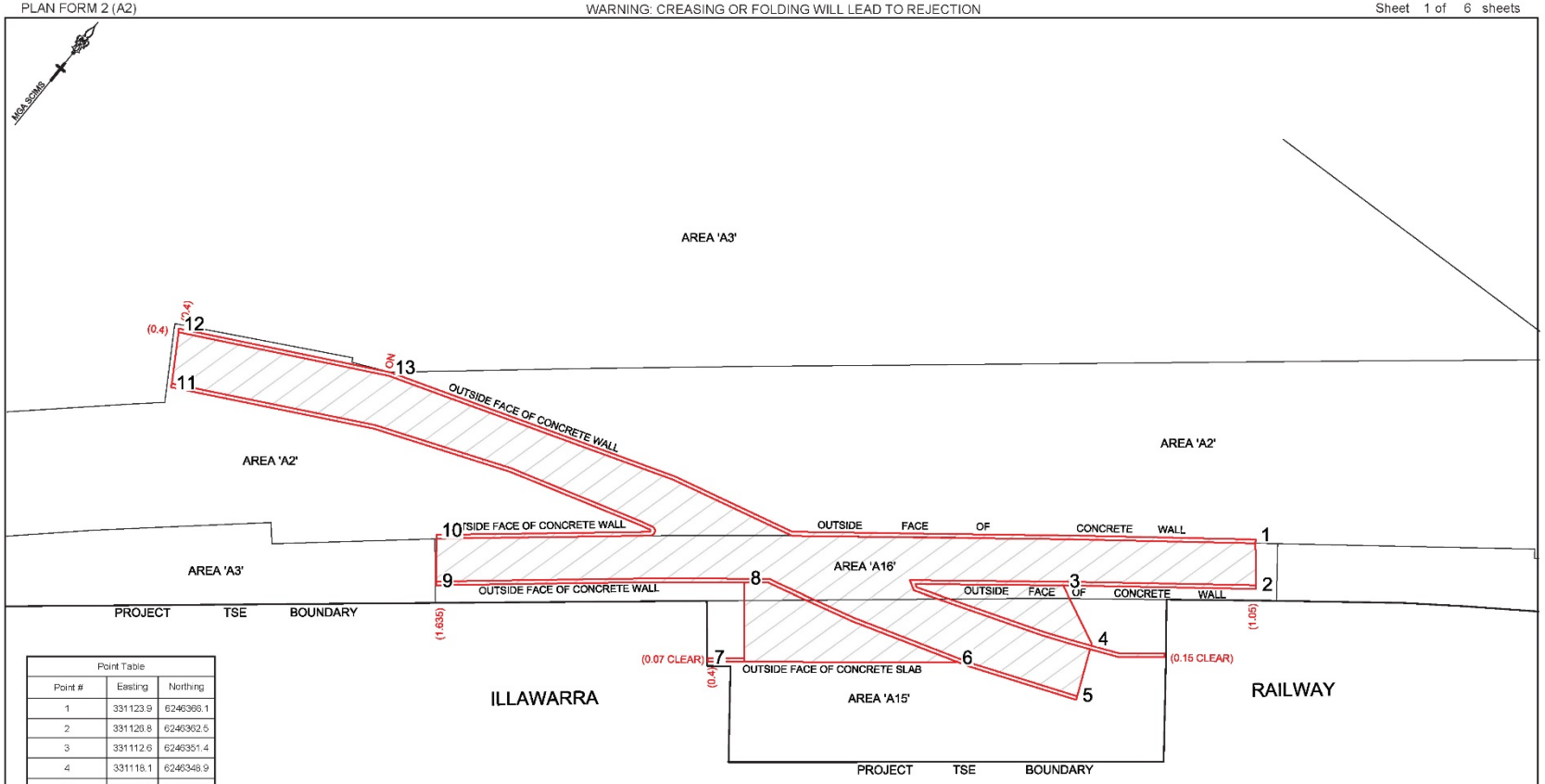
6	331144.6	6246382.1
7	331131.6	6246372.0
8	331121.2	6246364.0
9	331039.5	6246296.8
10	330960.6	6246211.3
11	330910.3	6246173.0
12	330902.6	6246181.0
13	330940.5	6246220.2
14	331029.5	6246307.9
15	331111.1	6246376.6
16	331121.3	6246385.0
17	331134.5	6246395.9
18	331133.9	6246396.7
19	331198.5	6246447.0

NOTE:
PROJECT BOUNDARY AND TSE AREAS DEFINED FROM DRAWING NWRLSRT-RPS-SRT-SR-DWG-000063-T.3-TSE FIGURE 2.1.DWG

Surveyor Name: ADAM LONG Date: 19/08/2020 Reference: 18-569 DP13	PLAN OF SURVEY INFORMATION ONLY LOCATION OF PORTION 2 WORKS WITHIN TSE PROJECT AREA	LGA: INNER WEST Locality: MARRICKVILLE Reduction Ratio 1:500 Lengths are in metres.	Registered:	DP

SYDNEY METRO REF: SMCSWTSE-JAL-TPW-CN-DRG-101012

PLAN FORM 2 (A2) WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION Sheet 1 of 6 sheets



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6	331109.3	6246339.5
7	331091.3	6246325.0
8	331089.2	6246332.9
9	331067.0	6246314.5
10	331064.0	6246318.2
11	331036.0	6246313.3
12	331033.1	6246318.1
13	331051.0	6246327.3

NOTE:
PROJECT BOUNDARY AND TSE AREAS DEFINED FROM DRAWING NWRLSRT-RPS-SRT-SR-DWG-000063-T.3-TSE FIGURE 2.1.DWG

Surveyor Name: ADAM LONG Date: 19/08/2020 Reference: 18-569 DP12	PLAN OF SURVEY INFORMATION ONLY LOCATION OF PORTION 13 WORKS WITHIN TSE PROJECT AREAS	LGA: INNER WEST Locality: MARRICKVILLE Reduction Ratio 1:250 Lengths are in metres.	Registered:	DP

SYDNEY METRO REF: SMCSWTSE-JAL-TPW-CN-DRG-101011

Part II: Auditor's findings

Please complete either Section A1, Section A2 or Section B, not more than one section. (Strike out the irrelevant sections.)

- Use **Section A1** where site investigation and/or remediation has been completed and a conclusion can be drawn on the suitability of land uses **without the implementation** of an environmental management plan.

- Use **Section A2** where site investigation and/or remediation has been completed and a conclusion can be drawn on the suitability of land uses **with the implementation** of an active or passive environmental management plan.

- Use **Section B** where the audit is to determine:
    - (B1) the nature and extent of contamination, and/or
    - (B2) the appropriateness of an investigation, remediation or management plan[1], and/or
    - (B3) the appropriateness of a site testing plan in accordance with the *Temporary Water Restrictions Order for the Botany Sands Groundwater Source 2017*, and/or
    - (B4) whether the terms of the approved voluntary management proposal or management order have been complied with, and/or
    - (B5) whether the site can be made suitable for a specified land use (or uses) if the site is remediated or managed in accordance with the implementation of a specified plan.

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

Section A1

I certify that, in my opinion:

The **site is suitable** for the following uses:

(Tick all appropriate uses and strike out those not applicable.)

☐ ~~Residential, including substantial vegetable garden and poultry~~

☐ ~~Residential, including substantial vegetable garden, excluding poultry~~

☐ ~~Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry~~

☐ ~~Day care centre, preschool, primary school~~

☐ ~~Residential with minimal opportunity for soil access, including units~~

☐ ~~Secondary school~~

☐ ~~Park, recreational open space, playing field~~

☒ Commercial/industrial

☐ ~~Other (please specify):~~

~~OR~~

☐ ~~I certify that, in my opinion, the **site is not suitable** for any use due to the risk of harm from contamination.~~

Overall comments:

Historical investigations at the site identified lead and asbestos contamination in fill soils. Fill soils were also impacted by organochlorine pesticides (OCPs), polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), total recoverable hydrocarbons (TRH) and other metals at concentrations less than the criteria. The contamination sources are from historic commercial/industrial onsite land uses. Elevated concentrations of metals were identified in groundwater above the site assessment criteria however were attributed to urban background levels. Low concentrations of hydrocarbons and VOCs were detected in groundwater samples, however at concentrations below the site assessment criteria. The groundwater detections are from historic commercial/industrial onsite and offsite land uses including upgradient underground storage tanks (USTs). A potential offsite source of hazardous ground gas (HGG) was identified, however results of monitoring onsite did not identify concentrations and flow rates that would indicate a significant risk to site users.

The development (dive structure and tunnel portal) required excavation to a maximum depth of approximately 18 m. Two unexpected finds in the form of USTs were encountered during excavation works. The unexpected finds were assessed and remediated in accordance with the RAP. All excavated soils and rock were classified and disposed offsite. The excavation works successfully removed the onsite sources of contamination.

Section A2

I certify that, in my opinion:

Subject to compliance with the **attached** environmental management plan[2] (EMP), the site is suitable for the following uses:

(Tick all appropriate uses and strike out those not applicable.)

☐ Residential, including substantial vegetable garden and poultry

☐ Residential, including substantial vegetable garden, excluding poultry

☐ Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry

☐ Day care centre, preschool, primary school

☐ Residential with minimal opportunity for soil access, including units

☐ Secondary school

☐ Park, recreational open space, playing field

☐ Commercial/industrial

☐ Other (please specify):

_____

EMP details

Title: _____

Author: _____

Date: _____ No. of pages: _____

EMP summary

This EMP (attached) is required to be implemented to address residual contamination on the site.

The EMP: (Tick appropriate box and strike out the other option.)

☐ requires operation and/or maintenance of **active** control systems[3]

☐ requires maintenance of **passive** control systems only[3].

[2] Refer to Part IV for an explanation of an environmental management plan.
[3] Refer to Part IV for definitions of active and passive control systems.

~~Purpose of the EMP:~~

~~Description of the nature of the residual contamination:~~

~~Summary of the actions required by the EMP:~~

~~How the EMP can reasonably be made to be legally enforceable:~~

~~How there will be appropriate public notification:~~

~~Overall comments:~~

Section B

Purpose of the plan[4] which is the subject of this audit:

_____

_____

_____

I certify that, in my opinion:

(B1)

☐ The nature and extent of the contamination **has** been appropriately determined

☐ The nature and extent of the contamination **has not** been appropriately determined

AND/OR (B2)

☐ The investigation, remediation or management plan **is** appropriate for the purpose stated above

☐ The investigation, remediation or management plan **is not** appropriate for the purpose stated above

AND/OR (B3)

☐ The site testing plan:

☐ **is** appropriate to determine

☐ **is not** appropriate to determine

if groundwater is safe and suitable for its intended use as required by the *Temporary Water Restrictions Order for the Botany Sands Groundwater Resource 2017*

AND/OR (B4)

☐ The terms of the approved voluntary management proposal* or management order** (strike out as appropriate):

☐ **have** been complied with

☐ **have not** been complied with.

*voluntary management proposal no. _____

**management order no. _____

AND/OR (B5)

☐ The site **can be made suitable** for the following uses:

(Tick all appropriate uses and strike out those not applicable.)

☐ Residential, including substantial vegetable garden and poultry

☐ Residential, including substantial vegetable garden, excluding poultry

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

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

IF the site is remediated/managed* in accordance with the following plan (**attached**):

*Strike out as appropriate

Plan title

Plan author

Plan date No. of pages

SUBJECT to compliance with the following condition(s):

Overall comments:

Part III: Auditor's declaration

I am accredited as a site auditor by the NSW Environment Protection Authority (EPA) under the *Contaminated Land Management Act 1997.*

Accreditation no. 1505

I certify that:

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

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

Signed 

Date 18 September 2020

Part IV: Explanatory notes

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

How to complete this form

Part I

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

Part II

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

The auditor is to complete either Section A1 or Section A2 or Section B of Part II, **not** more than one section.

Section A1

In Section A1 the auditor may conclude that the land is *suitable* for a specified use or uses OR *not suitable* for any beneficial use due to the risk of harm from contamination.

By certifying that the site is *suitable*, an auditor declares that, at the time of completion of the site audit, no further investigation or remediation or management of the site was needed to render the site fit for the specified use(s). **Conditions must not be** imposed on a Section A1 site audit statement. Auditors may include **comments** which are key observations in light of the audit which are not directly related to the suitability of the site for the use(s). These observations may cover aspects relating to the broader environmental context to aid decision-making in relation to the site.

Section A2

In Section A2 the auditor may conclude that the land is *suitable* for a specified use(s) subject to a condition for implementation of an environmental management plan (EMP).

Environmental management plan

Within the context of contaminated sites management, an EMP (sometimes also called a 'site management plan') means a plan which addresses the integration of environmental mitigation and monitoring measures for soil, groundwater and/or hazardous ground gases throughout an existing or proposed land use. An EMP succinctly describes the nature and location of contamination remaining on site and states what the objectives of the plan are, how contaminants will be managed, who will be responsible for the plan's implementation and over what time frame actions specified in the plan will take place.

By certifying that the site is suitable subject to implementation of an EMP, an auditor declares that, at the time of completion of the site audit, there was sufficient information satisfying guidelines made or approved under the *Contaminated Land Management Act 1997*

(CLM Act) to determine that implementation of the EMP was feasible and would enable the specified use(s) of the site and no further investigation or remediation of the site was needed to render the site fit for the specified use(s).

Implementation of an EMP is required to ensure the site remains suitable for the specified use(s). The plan should be legally enforceable: for example, a requirement of a notice under the CLM Act or a development consent condition issued by a planning authority. There should also be appropriate public notification of the plan, e.g. on a certificate issued under s.149 of *the Environmental Planning and Assessment Act 1979*.

Active or passive control systems

Auditors must specify whether the EMP requires operation and/or maintenance of active control systems or requires maintenance of passive control systems only. Active management systems usually incorporate mechanical components and/or require monitoring and, because of this, regular maintenance and inspection are necessary. Most active management systems are applied at sites where if the systems are not implemented an unacceptable risk may occur. Passive management systems usually require minimal management and maintenance and do not usually incorporate mechanical components.

Auditor's comments

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

Section B

In Section B the auditor draws conclusions on the nature and extent of contamination, and/or suitability of plans relating to the investigation, remediation or management of the land, and/or the appropriateness of a site testing plan in accordance with the *Temporary Water Restrictions Order for the Botany Sands Groundwater Source 2017*, and/or whether the terms of an approved voluntary management proposal or management order made under the CLM Act have been complied with, and/or whether the site can be made suitable for a specified land use or uses if the site is remediated or managed in accordance with the implementation of a specified plan.

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

For a site that *can be made suitable*, any **conditions** specified by the auditor in Section B should be limited to minor modifications or additions to the specified plan. However, if the auditor considers that further audits of the site (e.g. to validate remediation) are required, the auditor must note this as a condition in the site audit statement. The condition must not specify an individual auditor, only that further audits are required.

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

Part III

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

Where to send completed forms

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

- the **NSW Environment Protection Authority**: nswauditors@epa.nsw.gov.au or as specified by the EPA

  AND

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

APPENDIX C
INTERIM AUDIT ADVICE

24 April 2018

John Holland CPB Ghella Joint Venture
Attn: Robert Muir
Senior Environment Coordinator
Sydney Metro City & Southwest
Level 3, 140 Sussex Street, Sydney NSW 2000

By email: Robert.Muir@sydneymetro2.com.au

Dear Robert

RE: INTERIM AUDIT ADVICE LETTER NO. 3 - REMEDIATION ACTION PLAN, MARRICKVILLE DIVE, MURRAY STREET, MARRICKVILLE, NSW

1. INTRODUCTION

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

T +61 2 9954 8100

www.ramboll.com

Ref 318000323-007

As a NSW Environment Protection Authority (EPA) accredited Contaminated Sites Auditor, I am conducting an Audit in relation to the subject site. This initial review has been undertaken to provide an independent review of the suitability and appropriateness of a Remediation Action Plan (RAP).

A statutory site audit is required for the proposed Marrickville Dive development, part of the Sydney Metro rail project between Chatswood and Sydenham, to address the requirements of Condition E67 of Infrastructure Approval, application SSI 15_7400, approved by the Minister for Planning on 9 January 2017. The site audit is also a requirement of Clause 10.14B of the Sydney Metro City & Southwest Tunnel and Station Excavation Works Design and Construction Deed (Contract No: 00013/11200).

This Interim Audit Advice (IAA) letter is based on a review of the documents listed below and observations made on a site visit on 20 October 2017, as well as discussions with John Holland CPB Ghella Joint Venture (JHCPBG JV) and Douglas Partners Pty Ltd (DP) who undertook the investigations.

The reports reviewed were:

- *'Report on Preliminary Site Investigation, Sydney Metro City and South West, Tunnel and Station Excavation Works Package, Proposed Marrickville Dive, Murray Street, Marrickville, prepared for John Holland CPB Ghella JV, Project 85608.15, March 2018'*, report reference: Revision 0, dated 21 March 2018, prepared by DP (the PSI).
- *'Report on Detailed Site Investigation, Sydney Metro City and South West, Tunnel and Station Excavation Works Package, Proposed Marrickville Dive, Murray Street, Marrickville, prepared for John Holland CPB Ghella*

JV, Project 85608.15, March 2018', report reference: Revision 1, dated 22 March 2018, prepared by DP (the DSI).

- *'Report on Remediation Action Plan, Sydney Metro City and South West, Tunnel and Station Excavation Works Package, Proposed Marrickville Dive, Murray Street, Marrickville, prepared for John Holland CPB Ghella JV, Project 85608.15, April 2018'*, report reference: Revision 0, dated 12 April 2018, prepared by DP (the RAP).

A copy of the PSI (draft), DSI (Rev0) and RAP (draft) reports were issued for audit review. Review comments (issued by the Auditor by email) were incorporated into the final DP reports (listed above). The PSI makes reference to a number of additional reports that were not provided to the Auditor for this review, including:

- DP and Golder Associates Pty Ltd (Golder) geotechnical investigation and contamination assessment report for the proposed dive site prepared in January 2017 (Report No. 1650773-056-R-RevB).
- Pells Sullivan Meynink Pty Ltd (PSM) geotechnical investigation which included installation of one groundwater monitoring well (JCG-BH-1123).
- Environmental & Earth Sciences (EES) contamination and hazardous ground gas (HGG) investigation reports prepared by for Camdenville Park (approximately 80 m to the east and up-gradient of the site).
- PSM hydrogeological interpretive report (dated 19 March 2018).

A summary of relevant information from these reports was included in the DP reports.

2. SITE DETAILS

2.1 Location

The site is identified as the '*excavation footprint'* (the site) for the dive structure shown on Attachment 1. The site includes a number of lots/DPs and corresponding street addresses detailed below. The site also includes a small section of Murray Street. The '*Worksite Area*' shown on Attachment 1 surrounding the '*excavation footprint'* has been excluded from the DP investigations and is not part of the site audit.

The site details are as follows:

Street address:	Part of Murray Street, Marrickville, NSW 2204
	2 Edinburgh Road, Marrickville, NSW 2204
	50-52 Murray Street, Marrickville, NSW 2204
	18 Edinburgh Road, Marrickville, NSW 2204
	5-15 Murray Street, Marrickville, NSW 2204
	1A Sydney Steel Road, Marrickville, NSW 2204
Identifier:	Part Lot 1 DP622660
	Part Lot 100 DP1162506
	Part Lot 38 DP4991
	Part Lot 10 DP874363

	Part Lot 4 DP802920
Local Government:	Inner West Council (former Marrickville Council)
Owner:	Transport for New South Wales
Site Area:	Approximately 0.8 ha
Zoning:	IN1 – General Industrial

2.2 Site Condition

DP inspected the site on 20 September 2017 and noted the following:

- The site comprised a number of different lots (identified above). The majority of the lots were vacant with demolition of former buildings underway in some lots. A large warehouse (former refrigerated store) was located in the central section of the site. The warehouse was used to store construction material for the proposed dive development. An electrical substation was located to the west of the site.
- The majority of the site was paved with asphalt and concrete. Murray Street crossed through the north section of the site.
- Four (4) fill/dip points for underground fuel storage tanks (USTs) (Attachment 1) were located in the Worksite area to the north and west of the site.
- A concrete lined drainage channel was located to the north of the site which ran from north to west and drained into a concrete lined pond located to the southwest.

During the Auditor's site visit on 20 October 2017, the site condition was consistent with observations made by DP, with the following additional features noted:

- Two above ground water tanks were located to the immediate west of the site.
- Equipment for tunnel casting was located on the west section of the site, which limited visual observation of the ground surface.
- Low to medium density trees and vegetation was observed along the south boundary adjacent to the railway corridor.
- An open test pit on the west site corner revealed fill containing ash/slag below the asphalt pavement.

2.3 Adjacent Uses

The site is located within an area of commercial/industrial landuse. The surrounding site use includes:

- North: Former commercial/industrial now part of the Worksite area. Sydney Steel Road is located beyond the worksite area to the north.
- East: Railway corridor and commercial/industrial. Railway Parade is located to the east. Camdenville Park (a former brick pit) is located approximately 80 m to the east.
- South: Railway corridor. Commercial/industrial to the south of the corridor. A former brick pit was located to the south of the railway line.
- West: Commercial/industrial.

A concrete lined stormwater drain is located approximately 30 m to the north and west of the site. The drain runs from the north to the west within the Worksite area and drains into the Sydenham Pit and Drainage Pumping Station (No. 001) located approximately 200 m to the west. DP identified the closest sensitive ecological receptor for groundwater as the Cooks River, located approximately 2 km to the southwest.

The former brick pits to the east and south of the site are potential sources of contamination. The PSI summarised investigations previously undertaken by EES at Camdenville Park (former brick pit) in 2006-2007 which identified elevated levels of methane (CH_4) associated with landfilling of the former brick pit.

The PSI identified a number of former (between 1950 and 1970) dry cleaners, motor garages and service stations within 500 m up-gradient of the site. A search of the NSW EPA list of notified contaminated sites include three sites (Camdenville Park, Marrickville Metro Shopping Centre and SRA Land) located within a radius of 500 m.

2.4 Proposed Development

The proposed development includes the excavation and construction of a dive structure and tunnel portal for the launch and support of two boring machines. The depth of excavation will range from the surface (south corner) to approximately 18 metres below ground level (mbgl) at the tunnel portal wall in the northeast end (Attachment 2). The base of the structure will comprise approximately 200 mm thick temporary concrete slab and the walls will include reinforced concrete soldier piles with shotcrete between the piles. A water collection sump will be located at the base of the excavation at the tunnel portal. The dive structure will be drained.

For the purposes of this audit, the 'commercial/industrial' land use scenario will be assumed.

3. SITE HISTORY

The PSI site history assessment included a review of historical title deeds, aerial photographs, historical business directories, NSW EPA records and Section 149 (2&5) certificates. SafeWork NSW records were reviewed by DP as part of the DSI. The site history is summarised in Table 3.1.

Table 3.1: Site History

Date	Activity
1907 – 1930s	The site was mostly vacant with a few commercial and residential properties in the northeast. Various smallhold proprietors were noted on the title records.
1930s – 1950s	The residential properties were demolished. Some sections were used for materials storage. Additional commercial/industrial buildings were constructed. Camdenville Park brickworks and other brick pits were noted in the immediate surrounds.
1950s – 2000	A review of title records indicate various industries were operational at the site including chemical manufacturing, metal works, dyers/bleachers, steel manufacturing, construction equipment, refrigeration, electrical equipment and air-conditioning, boilermakers, engineering firms, fuel merchants, foundries, printers, electroplaters, motor panel beaters/wreckers/painters and tyre dealers. Camdenville Park brickworks had been infilled and developed as a park.
2000-2017	The landuse was commercial/industrial occupied by some of the above industries.
2017 to date	The site is currently owned and occupied by Transport for NSW for the metro development. Demolition of buildings commenced in 2017.

The summary indicates that the site has been used for various commercial/industrial purposes since the 1940s. The SafeWork NSW records show licenses to store dangerous goods at 2 Edinburgh Road and

50-52 Murray Street (Attachment 2). The dangerous goods include one (possibly two) underground fuel storage tanks (USTs) at 50-52 Murray Street, and LPG gas cylinder and UST (abandoned in-situ with sand and concrete slurry) at 2 Edinburgh Road.

A review of the NSW EPA public records indicates three properties located close to the site notified as contaminated to the EPA. The properties include: Camdenville Park (May Street, St Peters), Marrickville Metro Shopping Centre (34 Victoria Road) and SRA Land (117 Railway Parade).

The DSI stated that the Marrickville Metro Shopping Centre (MMSC), listed on the EPA register as a contaminated site is located approximately 200 m to the northwest. DP consider that the VOC groundwater plume at the MMSC site is localised with low risk of migration onto the subject site.

Based on the site location and history, potential contamination from Camdenville Park and SRA Land could have impacted the site from these off-site sources.

3.1 Auditor's Opinion

In the Auditor's opinion, the site history provides an adequate indication of past on-site and off-site activities that may have resulted in site contamination, including chemical manufacturing, metal works, dyers/bleachers, steel manufacturing, construction equipment, refrigeration, electrical equipment and air-conditioning, boilermakers, engineering firms, fuel merchants, foundries, printers, electroplaters, motor panel beaters/wreakers/painters and tyre dealers. Details of site operations were not provided, such as chemical use and storage locations. The Auditor considers that the site history is broadly understood and adequate for identification of contaminants of concern (Section 4) and remedial planning (Section 10).

4. CONTAMINANTS OF CONCERN

The PSI and DSI provided a list of the contaminants of concern and potentially contaminating activities. These have been tabulated in Table 4.1.

Table 4.1: Contaminants of Concern

Source/Area	Activity	Potential Contaminants
Entire Site	Fill and surface soil imported from unknown sources to form/ level the site and demolition of former buildings.	Metals, total petroleum hydrocarbons (TPH), benzene, toluene, ethylbenzene, xylenes & naphthalene (BTEX), polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides (OCPs), organophosphorus pesticides (OPPs), polychlorinated biphenyls (PCBs), phenols, lead (from paint) and asbestos.
Entire Site	Fill and surface soil impacted by former commercial/ industrial landuse at the site.	Petroleum hydrocarbons (BTEX, TPH), OCP, OPP, PCBs, PAHs, Volatile Organic Compounds (VOCs), Semi Volatile Organic Compounds (SVOCs), metals, and phenols.
Off-Site Sources	Impacts from former infilled brickworks and USTs located up-gradient from the site.	Metals, Petroleum hydrocarbons (BTEX, TPH), PAHs, VOC, phenols, OCP, OPP, ammonia, nutrients, cyanide and landfill gas (methane,

		carbon dioxide and toxic trace gases).

4.1 Auditor's Opinion

The Auditor considers that the analyte list used by DP adequately reflects the site history and condition.

5. STRATIGRAPHY AND HYDROGEOLOGY

Following a review of the DP reports, a summary of the site stratigraphy and hydrogeology conditions at the site are compiled below.

5.1 Topography, Geology and Stratigraphy

The PSI states that the site is located in a relatively low lying area of Marrickville at approximately 6 m Australian Height Datum (AHD) with a slight slope to the southwest. The majority of the site is underlain by stream, alluvial and estuarine sediments and by deeper Ashfield Shale bedrock. The majority of the site is located within the Birrong soil landscape characterised by alluvial soil, while the southern corner is within the Blacktown soil landscape comprising of residual soils. The Council Local Environmental Plan (LEP) and NSW Acid Sulfate Soil (ASS) Risk Map show that the site is subject to ASS risk and the north eastern section is located in an area classed as *'disturbed terrain'*.

The sub-surface profile detailed by DP in the DSI is summarised in Table 5.1.

Table 5.1: Stratigraphy

Depth (mbgl)	Subsurface Profile
0.0 – 0.4	Fill material comprising grey clayey and sandy gravel road base materials underlying asphalt and concrete pavements. Concrete foundation with slabs separated by foam was detected in some locations.
0.3 – 2.0	Fill material comprising clay, sand and gravel with inclusions of brick, metal, concrete, ash, PVC, tile, glass, coal wash/ fly ash and asbestos containing material (ACM).
1.8 – 5	Natural clay and silty clay.
0.6 to termination depth (9.9)	Weathered shale bedrock.

mbgl – metres below ground level

The DSI included sampling and analysis of selected fill, natural and bedrock samples for ASS. DP reported that a lack of a defined sulphur trail indicates that ASS are not present and there is no requirement for an ASS management plan.

5.2 Hydrogeology

The PSI undertook a search of the groundwater information database maintained by the NSW Government and did not identify any groundwater bores within a 0.5 km radius of the site. DP concluded that based on the topography, groundwater is anticipated to flow to the southwest. Groundwater flow would be impacted by a concrete lined drainage channel located approximately 30 m to north and west of the site which drains into the Sydenham Pit and Drainage Pumping Station (No. 001) located further to the southwest of the site. DP identified the closest sensitive ecological receptor

for groundwater as the Cooks River, located approximately 2 km to the southwest. Excess surface water run-off is anticipated to flow into the local stormwater network.

As part of the DSI, two groundwater monitoring wells were installed on the site (Attachment 2). Groundwater observations and sampling were undertaken by DP as part of the DSI on 31 October 2017. A monitoring well previously installed by PSM (JCG-BH-1123) was also sampled. Depth to groundwater in the monitoring wells was recorded between 1.7 to 3.6 mbgl.

The DSI included field records of groundwater parameters recorded during sampling. They indicated that the pH was 4.41 to 5.21, dissolved oxygen (DO) was 1.01 to 2.58 mg/L, redox was 3 to 1208 mV, and electrical conductivity (EC) was 0.8 to 4.28 mS/cm.

The RAP includes a summary of the PSM (2018) Hydrogeological Interpretive Report, which modelled the groundwater seepage rates expected during and post construction. Details of the modelling and the results are included in the Hydrogeological Interpretive Report. DP summarised the findings as follows:

- Maximum modelled seepage rate during construction was 74 kL/day;
- Modelled steady state seepage rate post construction was 17 kL/day;
- Water bearing zone is from residual soils of Ashfield Shale at depths of 1.5 to 2.5 m. During the initial stages of development, groundwater inflow is likely to be from the storage within the residual soils and shale;
- The modelled zone of capture for the first 10 years would extend to approximately 370 m from the site; and
- Historical land use (former Camdenville Park landfill, former brick pits and landfill fronting Unwins Bridge Road and Mary Street, Sydney Park and Alexandria landfill) may have an impact on groundwater quality and potential for contamination migration (ammonia, nitrate, organic compounds and metals).

The Auditor has not reviewed the PSM (2018) Hydrogeological Interpretive Report, however considers that the primary long term source of seepage/ inflows is likely to be shale. This is based on the stratigraphy and hydrogeology encountered during the DSI.

5.3 Auditor's Opinion

The Auditor considers that the site stratigraphy and hydrogeology conditions detailed by DP adequately reflect the site conditions and are sufficient for remediation planning.

6. EVALUATION OF QUALITY ASSURANCE AND QUALITY CONTROL

The Auditor has assessed the overall quality of the data by review of the information presented in the referenced reports, supplemented by field observations. The Auditor's assessment follows in Tables 6.1 and 6.2.

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

Sampling and Analysis Plan and Sampling Methodology	Auditor's Opinion
Data Quality Objectives (DQO) The PSI and DSI defined specific DQOs in accordance with the seven step process outlined in Schedule B2 of NEPM (2013).	These were considered appropriate for the investigations conducted.

Table 6.1: QA/QC – Sampling and Analysis Methodology Assessment	
Sampling and Analysis Plan and Sampling Methodology	**Auditor's Opinion**
Sampling pattern and locations *Soil:* The DSI adopted a general grid pattern or systematic sampling plan. Investigation locations were spaced to gain coverage of the majority of the site. The various fill materials at the site were also targeted for sampling. *Groundwater:* two monitoring wells (MW08 and MW09) were concentrated in the north and central portions of the site and a monitoring well (JCG-BH-1123) previously installed in the central west of the site was also monitored. Considering the site topography, no wells were located down-gradient in the southwest section of the site. *HGG:* HGG field screening was limited to groundwater monitoring wells MW08 and MW09.	In the Auditor's opinion these investigation locations adequately target the main areas of concern.
Sampling density *Soil:* The DSI included a sampling density of 19 locations (see Drawing 2 in attachments) over approximately 0.8 ha, which meets the minimum recommended by EPA (1995) *Sampling Design Guidelines*. The coverage provides a 95% confidence of detecting a residual hot spot of approximately 24 m diameter. Samples analysed for asbestos were not collected in accordance with the density outlined in NEPM (2013) (Schedule B1). *Groundwater:* A total of 3 groundwater samples were obtained from the monitoring wells at the site.	In the Auditor's opinion the sampling density was appropriate. Considering that the fill from the entire site would be excavated and disposed off-site as part of the development, the sampling adopted by DP is acceptable to assess the presence/ absence of asbestos in soil. HGG sampling for laboratory analysis was not undertaken for the DSI. Considering the relatively low risk of HGG migrating onto the site, the field screening was acceptable.
Sample depths *Soil:* Samples were collected and analysed from a range of depths targeting the fill and natural clay and shale bedrock. The sample depth intervals ranged from 0.5 to 2 mbgl. *Groundwater*: Groundwater samples were obtained from the standing water level (SWL) depths observed in the monitoring wells during sampling. The depth ranged from approximately 3.6 to 5 mbgl.	In the Auditor's opinion, this sampling strategy was appropriate and adequate to characterise the primary material types present on site.
Well construction The DP wells (MW08 and MW09) were installed from the surface to depths of approximately 8.5 and 9 mbgl, and were constructed of 50 mm diameter acid washed, class 18, PVC casing and machine slotted well screen intervals. The top of the screened interval was up to 1 mbgl, and therefore the screens of the wells should extend above the groundwater table. The wells were completed to assess shallow perched aquifer conditions. The construction details for the existing well (JCG-BH-1123) in the central west of the site were not provided.	The Auditor notes that, whilst it is preferable for monitoring wells to screen over a discrete short vertical interval, considering the site specific conditions, the wells are sufficient to provide an indication of the groundwater conditions.

Table 6.1: QA/QC – Sampling and Analysis Methodology Assessment	
Sampling and Analysis Plan and Sampling Methodology	**Auditor's Opinion**
Sample collection method *Soil*: Sample collection was by test pit and drilling (solid stem auger). Test pits samples were obtained directly from the excavator bucket. Drilling samples were collected from the auger flights, with external material removed prior to collecting the sample or via a SPT split spoon. *Groundwater*: Wells were installed by solid flight augers, developed with a pump and samples were collected by low flow peristaltic pump with dedicated sample tubing.	Sample collection from the auger flights is not ideal as it can result in loss of volatiles and sample cross contamination, although cross contamination was minimised by removing external material. As no major source of volatile contamination was identified and considering that a large portion of samples were from SPT split spoon, the overall sample collection method was found to be acceptable.
Decontamination procedures *Soil:* Sampling equipment was cleaned with detergent (3% Decon 90 solution), tap water and then de-ionised water prior to sampling and between sampling events to prevent cross contamination. New gloves were reportedly used for each new sample. *Groundwater*: Dedicated sampling equipment was used for each well. New gloves were reportedly used for each new sample.	Acceptable.
Sample handling and containers Soil samples were placed into prepared and preserved sampling bottles provided by the laboratory and chilled during storage and subsequent transport to the labs. Laboratory reports indicate that asbestos analysis was undertaken on sub-samples from soil jars. Groundwater samples to be analysed for heavy metals were field filtered.	Acceptable.
Chain of Custody (COC) Completed chain of custody forms were provided in the report.	Acceptable.
Detailed description of field screening protocols Field screening for volatiles was undertaken using a calibrated hand held PID unit. The PID screening procedure was provided and involved placing the samples in ziplock plastic bags and measuring VOCs in the headspace after allowing time for equilibration. PID readings are provided on borehole logs. The DSI noted that PID values were below 15ppm indicating a lack of PID detectable VOCs. A LFG analyser GA5000 gas detector was used to measure HGG prior to groundwater sampling. Groundwater field parameters were measured during well sampling and development.	Acceptable.

Table 6.1: QA/QC – Sampling and Analysis Methodology Assessment	
Sampling and Analysis Plan and Sampling Methodology	**Auditor's Opinion**
Calibration of field equipment Calibration information for the field equipment (PID, landfill gas analyser and groundwater meters) was included in the DSI.	The Auditor notes that HGG laboratory sampling and analysis was not undertaken. Assessment for the presence of HGG was dependant on one round of data obtained using the hand held landfill gas analyser. DP have recommended an additional round of HGG screening which will improve the overall data reliance.
Sampling logs Soil logs were provided within the DSI report, indicating sample depth, PID readings, lithology and observations. Groundwater field sampling records were provided. HGG field sampling records were provided.	Acceptable.

Table 6.2: QA/QC – Field and Lab Quality Assurance and Quality Control	
Field and Lab QA/QC	**Auditor's Opinion**
Field quality control samples Field quality control samples including trip blanks (1 per field batch), trip spikes (1 per field batch), rinsate blanks (1 per day), field intra-laboratory and inter-laboratory duplicates (5% of primary samples) were undertaken by DP during the DSI.	Acceptable.
Field quality control results The results of field quality control samples were generally within appropriate limits. The trip blank and majority of the field rinsate blank results were below the laboratory PQL. Slight detections of TRH C_6 – C_{10} and individual VOCs were made in the field rinsate blanks. The results were below the screening criteria and DP concluded that the likely source was from the demineralised water used for rinsing. DP states that the VOCs were a by-product of water treatment. The trip spike recovery was acceptable. Relative Percent Difference (RPD) calculations for the intra-laboratory soil and groundwater duplicate samples for five metals ranged from 40% to 118%. RPDs for the inter-laboratory soil and groundwater duplicate samples for six metals ranged from 43% to 75% and six PAHs from 82% to 193%. The DSI has assessed all field duplicate results along with the primary sample results against the site acceptance criteria.	Overall, the field quality control results were found to be acceptable. RPD exceedances were infrequent and minor and do not impact the overall dataset. DP assessed the results for primary samples and field duplicates against the site acceptance criteria which is considered appropriate. The Auditor has adopted the highest concentration from field duplicate and triplicate results.

Table 6.2: QA/QC – Field and Lab Quality Assurance and Quality Control	
Field and Lab QA/QC	**Auditor's Opinion**
NATA registered laboratory and NATA endorsed methods Laboratories used included: Envirolab Services Pty Ltd (primary) and Eurofins Scientific (secondary). Laboratory certificates were NATA stamped.	Acceptable.
Analytical methods Analytical methods were included in the laboratory test certificates. Both Envirolab and Eurofins provided brief method summaries of in-house NATA accredited methods used based on USEPA and/or APHA methods (excluding asbestos) for extraction and analysis in accordance with the NEPM (2013). Asbestos analysis was based on AS4964-2004.	Acceptable.
Holding times Review of the COCs and laboratory certificates indicate that the holding times had been met. DP also reported that holding times have been met.	Acceptable.
Practical Quantitation Limits (PQLs) *Soil:* PQLs were raised in the following soil samples due to interference from analytes other than those being tested: • OC/OP and PCBs were raised in one soil sample MVTP16 (0.1-0.2 mbgl) (Envirolab Report 178202, sample 16). The raised PQL were all below the quality criteria. • PCBs were slightly raised in five soil samples (Envirolab Report 178430, samples 1, 1d, 3, 5, 13). The raised PQL were all below the quality criteria. *Groundwater:* PQLs for the groundwater assessment were sufficiently low in the majority of the analytes and acceptable for the DSI. The PQL for Cadmium (0.1 µg/L) was above the quality criteria of 0.06 µg/L.	Overall the PQLs are acceptable. The elevated Cadmium PQL in groundwater was only marginally elevated above the trigger value and in the context of the results reported, this discrepancy does not materially affect the outcome of the audit.
Laboratory quality control samples Laboratory quality control samples including laboratory control samples, matrix spikes, surrogate spikes, blanks, internal standards and duplicates were undertaken by the laboratory.	Acceptable.
Laboratory quality control results The results of laboratory quality control samples were generally within appropriate limits, with the following exceptions: • Percentage spike recovery was not possible for some metals due to high concentrations or inhomogeneous nature of the metal in the sample. This was considered acceptable as acceptable recovery was reported for the laboratory control samples (LCS).	Overall, the laboratory quality control results are considered acceptable.

Table 6.2: QA/QC – Field and Lab Quality Assurance and Quality Control	
Field and Lab QA/QC	**Auditor's Opinion**
• Some samples sent for asbestos analysis were sub-sampled by the laboratory due to the weight of the sample exceeding the recommended 40-50g (presence/ absence). • The laboratory RPD acceptance criteria were exceeded for individual metals, PAHs and PCBs. The laboratory reported that this was attributed to non-homogenous nature of the samples. Triplicate results were issued by the laboratory to confirm the metal results exceeding the criteria.	
Data Quality Indicators (DQI) and Data Evaluation (completeness, comparability, representativeness, precision, accuracy) The DSI assessed the field and laboratory results against predetermined data quality indicators (DQIs) and internal standards. These were discussed with regard to the five category areas. There was limited discussion in the RAP regarding actions required if validation data do not meet the expected objectives.	An assessment of the data quality with respect to the five category areas has been undertaken by the Auditor and is summarised below.

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

- The laboratories provided adequate information to conclude that the data are of sufficient precision.
- There is a high degree of confidence that the data are accurate.
- The data are likely to be representative of the overall site conditions, including fill, natural soil and groundwater. Results for volatile organics in soil samples collected by solid stem auger may underestimate actual concentrations. The data is considered adequate to identify contaminants of concern for remedial planning purposes.
- The investigation data are considered to be complete. However, DP has recommended an additional round of groundwater and HGG screening.
- There is a high degree of confidence that the data are comparable for each sampling and analytical event.

7. ENVIRONMENTAL QUALITY CRITERIA

The Auditor has assessed **soil** data provided with reference to criteria from National Environmental Protection Council (NEPC) *National Environmental Protection (Assessment of Site Contamination) Measure 1999*, as Amended 2013 (NEPM, 2013). Based on the proposed development (excavation and construction of a dive structure and tunnel portal), the Tier 1 (screening) criteria for 'commercial/industrial' setting were referred to as follows.

- Human Health Assessment:
  - Health Based Investigation Levels (HIL D)

  - Soil Health Screening Levels (HSL D) for Vapour Intrusion. The most conservative criteria were adopted i.e. assumed depth to source < 1 m and sand.
  - Asbestos presence/ absence.
  - CRC CARE HSLs for direct contact and vapour inhalation for intrusive maintenance workers.
  - USEPA RSL (on-line) Composite Worker Soil criteria.
- Terrestrial Ecological Assessment (TEA): The soil data has not been assessed against the TEA as soil from the entire site will be excavated to depths of 8 m and 19 mbgl and disposed off-site during development of the dive structure. The TEA is applicable to depths of 2 mbgl, and is therefore not applicable for the remaining natural soil.
- Management Limits (ML commercial/industrial) assuming coarse soil.
- Aesthetics
  - The Auditor has considered the need for remediation based on 'aesthetic' contamination as outlined in the NEPM (2013).

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

- Human Health Assessment
  - NEPM HSLs are not applicable for groundwater intercepted during excavation.
  - NHMRC and NRMMC (2011) *Australian Drinking Water Guidelines* (ADWG) where HSLs are not applicable
  - USEPA RSL (on-line) Residential Tap Water Criteria for use where HSLs are not applicable or where local guidelines are not available for individual contaminants.
  - WHO (2008) Petroleum Products in Drinking-water guidelines where HSLs are not applicable.
  - ADWG (2011) criteria with a factor of 10 for incidental direct contact (for non-volatiles).
- Ecological Assessment
  - Groundwater Investigation Levels (GILs) listed in NEPM (2013) for protection of aquatic ecosystems referenced in ANZECC (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Trigger values (TVs) provided are concentrations that, if exceeded, indicate a potential environmental problem at the point of use and 'trigger' further investigation. The 95% fresh water level of protection was adopted.

Groundwater monitoring wells were screened across different soil profiles (fill, clay and shale). Groundwater identified in the wells may therefore relate to perched groundwater conditions. Given the absence of bores for beneficial groundwater use and presence of a reticulated water supply for the area, extraction and use of groundwater as a resource is unlikely. Therefore assessment of direct contact and consumption of groundwater is not considered to be required.

The Auditor has assessed the **ground gas** data with reference to the NSW EPA (2012) *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases*.

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

- The DSI does not mention assessment of 'aesthetic' contamination as outlined in the NEPM (2013). However, the report results discuss potential aesthetic issues observed during sampling.

8. EVALUATION OF SOIL ANALYTICAL RESULTS

Soil samples were analysed for a variety of contaminants detailed in Tables 8.1 (fill) and 8.2 (natural). The results have been assessed against the environmental quality criteria and summarised below. Soil sampling locations are presented in Attachment 2.

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

Analyte	n	Detections	Maximum	n > Human Health Screening Criteria (NEPM, 2013)
Asbestos in soil (presence/absence)	28	0	<PQL	-
Asbestos in fragments (ACM)	1	1	**ACM detected**	**Chrysotile asbestos detected**
Arsenic	29	15	200	0 above HIL D 3,000 mg/kg
Beryllium	28	2	2	0 above HIL D 500 mg/kg
Cadmium	29	8	2	0 above HIL D 900 mg/kg
Total Chromium	29	29	83	0 above HIL D 3,600 mg/kg
Copper	29	28	1,400	0 above HIL D 240,000 mg/kg
Lead	29	29	**3,400**	**1 above HIL D of 1,500 mg/kg**
Manganese	28	28	930	0 above HIL D 60,000 mg/kg
Mercury (inorganic)	29	10	1	0 above HIL D 730 mg/kg
Nickel	29	29	860	0 above HIL D 6,000 mg/kg
Selenium	28	0	4	0 above HIL D 10,000 mg/kg
Zinc	29	29	4,100	0 above HIL D 400,000 mg/kg
TRH (C_6-C_{10} minus BTEX)	29	0	<PQL	0 above HSL D (sand 0-1 m) 260 mg/kg 0 above ML 700 mg/kg
TRH (>C_{10}-C_{16} minus naphthalene)	29	2	52	0 above HSL D (sand 0-1 m) NL 0 above ML 1,000 mg/kg
TRH (>C_{16}-C_{34})	29	12	1,500	0 above ML 3,500 mg/kg
TRH (>C_{34}-C_{40})	29	9	390	0 above ML 10,000 mg/kg
BTEX	29	0	<PQL	0 above HSL D (sand 0-1 m)
Naphthalene	29	3	1	0 above HSL D (sand 0-1 m) NL
Total VOCs	21	1	2[a]	-
Total PAHs	29	24	210	0 above HIL D 4,000 mg/kg
Carcinogenic PAHs (BaP TEQ)	29	11	19	0 above HIL D 40 mg/kg

Table 8.1: Evaluation of Fill Soil Analytical Results – Summary Table (mg/kg)				
Analyte	**n**	**Detections**	**Maximum**	**n > Human Health Screening Criteria (NEPM, 2013)**
Benzo(a)pyrene	29	11	14	-
Total Phenols	21	0	<PQL	0 above HIL D 240,000 mg/kg
PCBs	21	2	1	0 above HIL D 7 mg/kg
OPPs	21	0	<PQL	0 above HIL D
OCPs	21	3	64[b]	0 above HIL D

n number of samples
- No criteria available/used
NL Non limiting
TEQ Toxicity equivalent quotient
a Carbon tetrachloride was detected in fill sample MVTP11 (0.1-0.2 mbgl)
b Total DDT+DDE+DDD value in sample MVTP16 (0.1-0.2 mbgl)

Table 8.2: Evaluation of Natural Soil Analytical Results – Summary Table (mg/kg)				
Analyte	**n**	**Detections**	**Maximum**	**n > Human Health Screening Criteria (NEPM, 2013)**
Arsenic	19	7	40	0 above HIL D 3,000 mg/kg
Beryllium	19	0	<PQL	0 above HIL D 500 mg/kg
Cadmium	19	0	<PQL	0 above HIL D 900 mg/kg
Total Chromium	19	19	20	0 above HIL D 3,600 mg/kg
Copper	19	18	74	0 above HIL D 240,000 mg/kg
Lead	19	19	180	0 above HIL D of 1,500 mg/kg
Manganese	19	18	370	0 above HIL D 60,000 mg/kg
Mercury (inorganic)	19	4	1	0 above HIL D 730 mg/kg
Nickel	19	11	8	0 above HIL D 6,000 mg/kg
Selenium	19	0	<PQL	0 above HIL D 10,000 mg/kg
Zinc	19	19	170	0 above HIL D 400,000 mg/kg
TRH (C_6-C_{10} minus BTEX)	19	0	<PQL	0 above HIL D (sand 0-1 m) 260 mg/kg 0 above ML 700 mg/kg
TRH (>C_{10}-C_{16} minus naphthalene)	19	0	<PQL	0 above HSL D (sand 0-1 m) NL 0 above ML 1,000 mg/kg
TRH (>C_{16}-C_{34})	19	1	460	0 above ML 3,500 mg/kg

Table 8.2: Evaluation of Natural Soil Analytical Results – Summary Table (mg/kg)				
Analyte	**n**	**Detections**	**Maximum**	**n > Human Health Screening Criteria (NEPM, 2013)**
TRH (>C_{34}-C_{40})	19	0	<PQL	0 above ML 10,000 mg/kg
BTEX	19	0	<PQL	0 above HSL D (sand 0-1 m)
Naphthalene	19	1	1	0 above HSL D (sand 0-1 m) NL
Total VOCs	18	1	2[a]	-
Total PAHs	19	4	110	0 above HIL D 4,000 mg/kg
Carcinogenic PAHs (BaP TEQ)	19	2	12	0 above HIL D 40 mg/kg
Benzo(a)pyrene	19	1	9	-
Total Phenols	18	0	<PQL	0 above HIL D 240,000 mg/kg
PCBs	18	0	<PQL	0 above HIL D 7 mg/kg
OPPs	18	0	<PQL	0 above HIL D
OCPs	18	0	<PQL	0 above HIL D

n number of samples
- No criteria available/used
NL Non limiting
a Carbon tetrachloride was detected in natural soil sample MVTP11 (0.9-1.1 mbgl)

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

- The soil analytical results for the majority of the fill and natural samples were below the health screening criteria.
- One ACM fragment (sample MVTP11-A) within fill material in test pit MVTP11 tested positive for Chrysotile asbestos. The fill profile at this location was described as sandy clay with inclusions of brock, ash and charcoaland extended to approximately 0.5 mbgl. ACM was not detected in the soil samples from this location. Natural soil was not tested for asbestos. Potential ACM was not observed in fill from other locations.
- One elevated lead concentration (3,400 mg/kg) was detected in the fill sample MVTP10 (0.2-0.3 mbgl). The fill in this test pit was described as sandy ash extending to approximately 0.35 mbgl. The result is less than 250% of the human health screening criteria of 1,500 mg/kg. The lead result of a deeper natural clay sample MVTP10 (0.4-0.5 mbgl) was 69 mg/kg, which is below the screening criteria, indicating that contamination was confined to the fill. Samples of fill material from other areas of the site contained elevated lead concentration (up to 810 mg/kg), however these were less than the human health screening criteria.
- Other metals were reported at concentrations elevated above typical background concentrations, however were less than the adopted human health screening criteria.
- An elevated total DDT+DDE+DDD concentration (64 mg/kg) was detected in fill sample MVTP16 (0.1-0.2 mbgl) collected from silty sand fill with slag and ash extending to 0.65 mbgl. Minor detections of OCPs (Aldrin and Dieldrin) were also noted in fill samples MVBH07 (0.4-0.5 mbgl) and MVTP17 (0.5-0.6 mbgl). OCP concentrations were less than the human health screening criteria.

- TRH and PAHs were detected in natural samples obtained from less than 1 mbgl in MVTP10, MVTP11, MVTP12 and MVTP13. The results were below the screening criteria. A discussion on the potential source of these contaminants was not included in the DSI. A review of the test pit logs revealed that these samples were obtained very close to the interface with the fill and the detections could be a result of cross-contamination from the overlying fill or the presence of inclusions such as charcoal detected in MVTP12.

8.1 Auditor's Opinion

In the Auditor's opinion, the soil analytical results are consistent with the site history and field observations. The results indicate the fill to be locally impacted by lead and ACM with results above the screening criteria. The fill is also impacted by OCPs (DDT+DDE+DDD), PAHs, VOCs, TRH and other metals (at concentrations less than the criteria). Remediation of fill material containing lead and ACM is required. The remedial strategy was outlined in the RAP which is summarised and reviewed in Section 10.

9. EVALUATION OF GROUNDWATER ANALYTICAL RESULTS

Groundwater samples were collected from monitoring wells MW08, MW09 and JL-BH-1123 by DP as part of the DSI. The analytical results are summarised below in Table 9.1. Sampling locations are presented in Attachment 2.

Table 9.1: Evaluation of Groundwater Analytical Results – Summary Table (µg/L)

Analyte	n	Detections	Maximum	n >ANZECC Fresh (2000)	n > ADWG/RSL
Arsenic	3	0	<PQL	0 above criterion of 24 µg/L	0 above criterion of 10 µg/L
Cadmium	3	1	**0.1**	**1 above criterion of 0.06 µg/L**	0 above criterion of 2 µg/L
Total Chromium	3	0	<PQL	0 above criterion of 1 µg/L	0 above criterion of 50 µg/L
Copper	3	2	**33**	**2 above criterion of 1.4 µg/L**	0 above criterion of 2,000 µg/L
Lead	3	0	<PQL	0 above criterion of 3.4 µg/L	0 above criterion of 10 µg/L
Mercury	3	0	<PQL	0 above criterion of 0.06 µg/L	0 above criterion of 1 µg/L
Nickel	3	3	**16**	**1 above criterion of 8 µg/L**	0 above criterion of 20 µg/L
Zinc	3	3	**160**	**3 above criterion of 8 µg/L**	-
Ammonia	3	2	130	0 above criterion of 900 µg/L	0 above aesthetic criterion 500 µg/L

Table 9.1: Evaluation of Groundwater Analytical Results – Summary Table (µg/L)					
Analyte	**n**	**Detections**	**Maximum**	**n >ANZECC Fresh (2000)**	**n > ADWG/RSL**
Total Cyanide	3	0	<PQL	0 above criterion of 7 µg/L	0 above criterion of 80 µg/L
TRH (C_6-C_{10} minus BTEX)	3	1	16[b]	-	0 above criterion of 15,000 µg/L[a]
TRH (>C_{10}-C_{16} minus naphthalene)	3	0	<PQL	-	-
TRH (>C_{16}-C_{34})	3	0	<PQL	-	-
TRH (>C_{34}-C_{40})	3	0	<PQL	-	-
Chloroform	3	1	4[b]	0 above criterion of 370 µg/L	-
Cis-1,2-dichloroethene	3	1	10[b]	-	0 above ADWG criterion of 60 µg/L
Trichloroethene	3	1	**8[b]**	0 above criterion of 330 µg/L	**1 above RSL criterion of 4.9 µg/L**
BTEX	3	0	<PQL	0 above criteria	0 above criteria
Total PAHs	3	0	<PQL	-	-
Total OCPs	3	0	<PQL	-	-
Total OPPs	3	0	<PQL	-	-
Total PCBs	3	0	<PQL	-	-
Total Phenols	3	0	<PQL	0 above criterion of 320 µg/L	-
Methane	3	3	50	-	-

n number of samples
- No criteria available/used
a WHO (2008) assessment criteria for TPH aliphatic fraction adjusted by x10 in accordance with NHMRC (2008) recommendations for incidental ingestion of groundwater
b The higher field duplicate results have been adopted

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

- The groundwater analytical results for the majority of the analytes were below the health and ecological screening criteria.
- Elevated concentrations of individual metals including copper, nickel and zinc were detected in the groundwater samples. The DSI concluded that the metals can be attributed to diffuse urban-sourced background levels and not from a site specific source.

- The cadmium laboratory detection limit (PQL) is above the ecological screening criteria. Cadmium was detected in one samples at a concentrations equal to the PQL. Cadmium results are not considered to be a significant issue.
- Low concentrations of ammonia, methane, TRH F1, chloroform, cis-1,2-dichloroethene (DCE) and trichloroethene (TCE) were detected in the groundwater samples. The TCE concentration exceeded the USEPA RSL carcinogenic criteria (4.9 µg/L), however was less than RSL criteria for ingestion (12 µg/L), dermal contact (74 µg/L) and inhalation (9.6 µg/L). The ammonia and other VOC results were less than the screening criteria and are not considered to pose a significant risk to site receptors. The DSI noted that the source of ammonia and methane could be the former backfill in the brick pits or swamp sediments. The source of TRH and VOC is likely from historical on-site land use.

9.1 Auditor's Opinion

In the Auditor's opinion, the groundwater analytical results are consistent with the field observations and indicate that significant groundwater contamination is not present at the site. The metals concentrations detected are not considered to present a risk to human health and are likely to represent regional groundwater conditions. The RAP recommends an additional groundwater monitoring event prior to the commencement of remediation to assess if significant groundwater contamination is present at the site.

10. EVALUATION OF HAZARDOUS GROUND GAS DATA

As part of the DSI, HGG screening was undertaken in the two groundwater monitoring wells installed by DP. The monitoring wells were installed with landfill gas caps for combined groundwater and ground gas screening.

The screening was conducted using a hand held landfill gas analyser (GA5000) with monitoring for 5 minutes (results recorded at 30 second intervals) at each location. The monitoring included testing for methane (CH_4), carbon dioxide (CO_2), oxygen (O_2), carbon monoxide (CO), hydrogen sulphide (H_2S) and gas flow rate.

DP reported that the surface screening did not detect any methane. Carbon dioxide and oxygen were detected in the monitoring wells. Methane, carbon monoxide and hydrogen sulphide were not detected in the monitoring wells. Relatively low flows were noted, with the highest recorded value of 0.6 L/hr.

DP calculated a gas screening value (GSV) of 0.05%v/v based on the highest recorded flow rate. The GSV of 0.05%v/v is less than the lowest gas screening threshold of 0.07%v/v recommended by the EPA (2012) *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gas Guidelines*.

DP recommended an additional round of HGG screening to meet the minimum sampling requirements outlined in the EPA guidelines.

10.1 Auditor's Opinion

In the Auditor's opinion, the HGG screening results are consistent with the field observations. An additional round of screening has been recommended by DP to assess if significant HGG is present at the site.

11. EVALUATION OF PROPOSED REMEDIATION

11.1 Conceptual Site Model

A conceptual site model (CSM) is a representation of the source, pathway and receptor linkages at a site. DP has developed a CSM based on the PSI and DSI. Table 10.1 provides the Auditor's review of the CSM used by DP to inform remediation of the site.

Table 10.1: Review of the Conceptual Site Model

Element of CSM	Consultant	Auditor Opinion
Contaminant source and mechanism	Contaminated fill material imported to the site from unknown sources. Detections of ammonia, VOCs and methane in groundwater. Additional monitoring proposed to better characterise the HGG and groundwater conditions. Unexpected contamination finds during excavation including USTs along the north and east excavation boundaries.	The source and mechanism for soil is considered appropriate. The source of VOCs in groundwater has not been identified, however is likely to be related to current or historical use of the site or nearby sites. DP recommends additional groundwater sampling during remediation. The presence and significance of HGG requires additional monitoring. Initial monitoring did not identify conditions considered to present a risk to human health. Contamination associated with the offsite UST was not identified during investigation of the site. Implementation of an unexpected finds process to address any contamination identified during excavation of the site is considered acceptable.
Affected media	Fill material, groundwater and HGG	Agree that fill is the primary affected media. Groundwater was investigated during the DSI and did not identify significant contamination. An additional round of groundwater testing has been recommended. DP recommended an additional round of HGG screening. Initial monitoring did not identify conditions considered to present a risk to human health.
Receptor identification	Future site users of the rail corridor, construction workers, adjacent land users, surface	The receptors have been adequately identified.

Table 10.1: Review of the Conceptual Site Model		
Element of CSM	**Consultant**	**Auditor Opinion**
	water receptors, groundwater and in-ground built structures.	
Exposure pathways	Ingestion, dermal absorption and inhalation of dust and vapours.	The exposure pathways have been adequately identified.
Presence of preferential pathways for contaminant movement	Not discussed	Preferential pathways for HGG and vapour migration are likely to be present on the site, including current and planned subsurface services and foundations for the proposed development.
Evaluation of data gaps	An additional round of HGG screening has been proposed by DP. The RAP proposed an additional round of groundwater monitoring to test for ammonia, methane, VOCs, TPH/BTEX.	Data gaps can be addressed prior to or during remediation of the site.

In the Auditor's opinion, the CSM developed is considered an adequate basis for assessing remedial requirements.

11.2 Remediation Required

The Auditor has assessed the RAP by comparison with the checklist included in OEH (2011) *Guidelines for Consultants Reporting on Contaminated Sites*. The RAP was found to address the required information, as detailed in Table 10.2, below.

Table 10.2: Evaluation of Remedial Action Plan	
Remedial Action Plan	**Auditor Comments**
Remedial Goal The RAP stated four remediation goals as outlined below: *'render the site suitable for the proposed land use; maintain records of the remediation and earthworks undertaken including validation as required; mitigate adverse impacts on surrounding land and waterways during the remediation by the management of dust, water and noise emissions; and maximise the protection of workers involved with remediation and earthworks'.*	In the Auditor's opinion, the goals are appropriate considering the proposed redevelopment of the site.
Discussion of the extent of remediation required DP identified the entire excavation footprint (Attachment 2) as the lateral remediation extent and the vertical extent to be the depth of contaminated soil or the base of the excavation. Due to the nature of the development, the bulk excavation will require removal of all site soil to the desired levels. The base and walls of the excavation will be validated.	The proposed extent of remediation is considered adequate. Further excavation would be undertaken in the event of validation failure.

Table 10.2: Evaluation of Remedial Action Plan	
Remedial Action Plan	**Auditor Comments**
Remedial Options The RAP stated that due to the bulk excavation requirement for the proposed development, excavation and off-site disposal was the only viable option.	Acceptable.
Selected Preferred Option Excavation and off-site disposal of contaminated fill. Capture, treatment and disposal of groundwater during construction is proposed.	Acceptable. The RAP does not specify the treatment process for groundwater disposal, however outlines that it will be undertaken under an Environmental Protection License (EPL).
Rationale Development of the site will involve bulk excavation from the surface to a depth of up to 19 mbgl. The majority of the impacted soil will be excavated and disposed off-site.	Acceptable.
Waste Characterisation and Disposal The DSI has identified the following waste streams based on *in situ* testing of fill material (Attachment 3): hazardous waste (HW); special waste – asbestos – restricted solid waste; general solid waste (GSW); and virgin excavated natural material (VENM). DP are to provide documented waste classifications in accordance with EPA (2014) *Waste Classification Guidelines* based on an inspection of the material and available analytical data. Further *ex situ* waste characterisation will be undertaken if considered necessary. Waste material is to be removed by a licensed contractor. Each load will be documented, including weighbridge slips, trip tickets and consignment disposal confirmation. Waste will be disposed of at a facility legally able to accept the material.	Acceptable. The Auditor will review the final waste classifications during review of the validation report.
Containment No requirement at this stage.	Acceptable.
Proposed Validation Testing Validation samples are to be collected following removal of waste with different classifications and fill material, as well as the footprint of stockpile areas. *Excavations (base <500 m^2):* Base – one sample per 25-50 m^2 with a minimum of 3 samples. Walls – one sample per 10 m length exposed with additional samples collected at depths based on observations. *Excavations (base ≥500 m^2):* Base – grid based sampling to meet the density recommended in the NSW EPA *Sampling Design Guidelines* (minimum of 10 samples).	The Auditor considers the validation sampling densities acceptable. The density of testing for imported material would need to be commensurate with the documentation provided, source, observations and the consistency of the results. VENM certificates based on the template available on the NSW EPA website should be provided.

Table 10.2: Evaluation of Remedial Action Plan	
Remedial Action Plan	**Auditor Comments**
Walls – one sample per 20 m length exposed with additional samples collected at depths based on observations. *Stockpiles:* In accordance with NEPM (2013). The RAP states that samples collected will be analysed for the contaminants of concern including OCP, lead, PAHs and asbestos. Observations and screening with a PID will be undertaken. Imported material is expected for temporary works such as construction of piling platforms. The RAP includes a material importation protocol and criteria for implementation. The protocol requires review and approval of documentation by the environmental consultant, inspection of the material at the source site, inspection during importation and additional testing (details not provided in the RAP).	
Interim Site Management Plan (before remediation) The RAP recommends a surface clearance for asbestos by an Asbestos Assessor prior to remediation.	Acceptable. No other interim management is considered necessary given the site is sealed with concrete and asphalt, fenced and occupied by JHCPBGJV.
Unexpected Finds The RAP includes a contingency plan for unexpected finds, including UST removal, stopping work and assessment of the find by an occupation hygienist, asbestos consultant or environmental consultant. The RAP includes contingencies in the event contaminated groundwater and/or HGG are detected during site works. Validation of unexpected finds should be undertaken in accordance with the procedures in the RAP.	The unexpected finds procedure (UFP) is considered acceptable.
Site Management Plan (operation phase) including stormwater, soil, noise, dust, odour and OH&S The RAP includes a site management plan for implementation during remediation and validation that covers asbestos air monitoring, fencing and signage, security and restriction of access, PPE, decontamination, disposal of wasters, clearance inspection and certificates.	The site management plan is considered acceptable for remedial planning.
Contingency Plan if Selected Remedial Strategy Fails The RAP states that in the event of validation failure, the remediation contractor will undertake further 'chase out' excavation and disposal, followed by validation sampling.	The remedial strategy has a low risk of failure, as validation failure would lead to further excavation which is required for the dive structure.
Contingency Plans to Respond to site Incidents The RAP includes a spoil contingency plan for the handling and disposal of material.	Acceptable.

Table 10.2: Evaluation of Remedial Action Plan	
Remedial Action Plan	**Auditor Comments**
Remediation Schedule and Hours of Operation Not provided in the RAP.	The hours of operation are to be governed by consent conditions.
Licence and Approvals The RAP notes that the development is approved as critical State significant infrastructure under the *Environmental Planning and Assessment Act 1997* (EP&A Act). SEPP55 does not apply to the development. Waste disposal is to be tracked, and the receiving facility is to be licensed to accept the material in accordance with the *Protection of the Environment Operations Act 1997*. Council approval will be required for disposal of groundwater in to the stormwater system if required during works. The RAP notes that an EPL will be in place for the disposal of water. Asbestos removal contractors are to be appropriately licensed. Air monitoring for asbestos to be conducted during remediation.	Acceptable.
Contacts/Community Relations Contacts were provided for the consultant and Auditor. The details of the project manager and remediation contractor are to be included following appointment. The emergency procedures and contact details are to be displayed at the site entrance. Direct community consultation is not proposed.	Acceptable.
Long-term environmental management plan No requirement at this stage.	Acceptable.
Validation Reporting The RAP included a validation plan which addresses the validation DQOs, QA/QC and DQIs in accordance with NEPM (2013). The validation requirements include: site inspections, sampling, documentation and reporting.	Acceptable.

It is considered that the remediation approach recommended by DP is largely appropriate. Staged remediation of the different waste streams would be feasible and considered appropriate for this site.

11.3 Auditor's Opinion

In the Auditors' opinion, the proposed remediation works should ensure that the site is suitable for the proposed land uses through: additional testing of HGG and groundwater; excavation and off-site disposal of contaminated fill material and natural soil; implementation of the UFP; and successful validation.

12. CONCLUSIONS AND RECOMMENDATIONS

The RAP concluded *"… that the site can be rendered suitable for the proposed development subject to implementation of this RAP"*.

Based on the information presented in the referenced reports and observations made on site, the Auditor concludes that the proposed process of further investigation and remediation is practical and that the site can be made suitable for the proposed land use if remediated in accordance with the following RAP:

> '*Report on Remediation Action Plan, Sydney Metro City & South West - Tunnel and Station Excavation Works Package, Proposed Marrickville Dive, Murray Street, Marrickville, prepared for John Holland CPB Ghella JV, Project 85608.15, April 2018*', report reference: Revision 0, dated 12 April 2018, prepared by Douglas Partners Pty Ltd.

At the completion of remediation of the site, a Section A Site Audit Statement and supporting Site Audit Report certifying suitability for the proposed use should be prepared.

Remediation and reporting can be conducted in stages provided suitable provisions are made to avoid cross-contamination.

* * *

Consistent with the NSW EPA requirement for staged 'signoff' of sites that are the subject of progressive assessment, remediation and validation, I advise that:

- This advice letter does not constitute a Site Audit Report or Site Audit Statement.
- At the completion of the remediation and validation I will provide a Site Audit Statement and supporting documentation.
- This interim advice will be documented in the Site Audit Report.

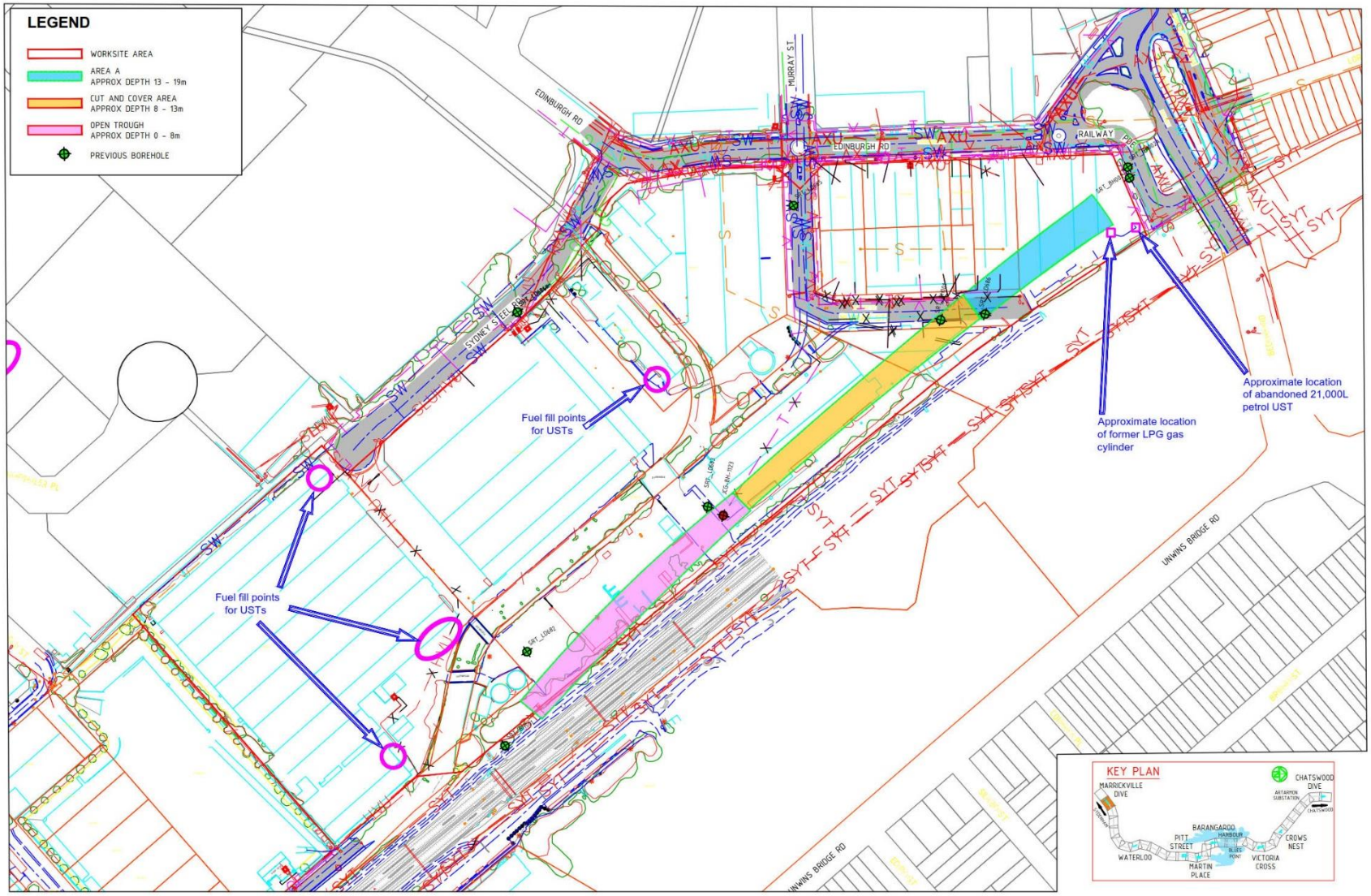
Yours faithfully
Ramboll Australia Pty Ltd

Tom Onus
EPA Accredited Site Auditor 1505

Attachments: 1 Site Locality

2 The DSI Sampling Location Plan

3 Waste Classification and Soil Disposal Plan



Douglas Partners
Geotechnics / Environment / Groundwater

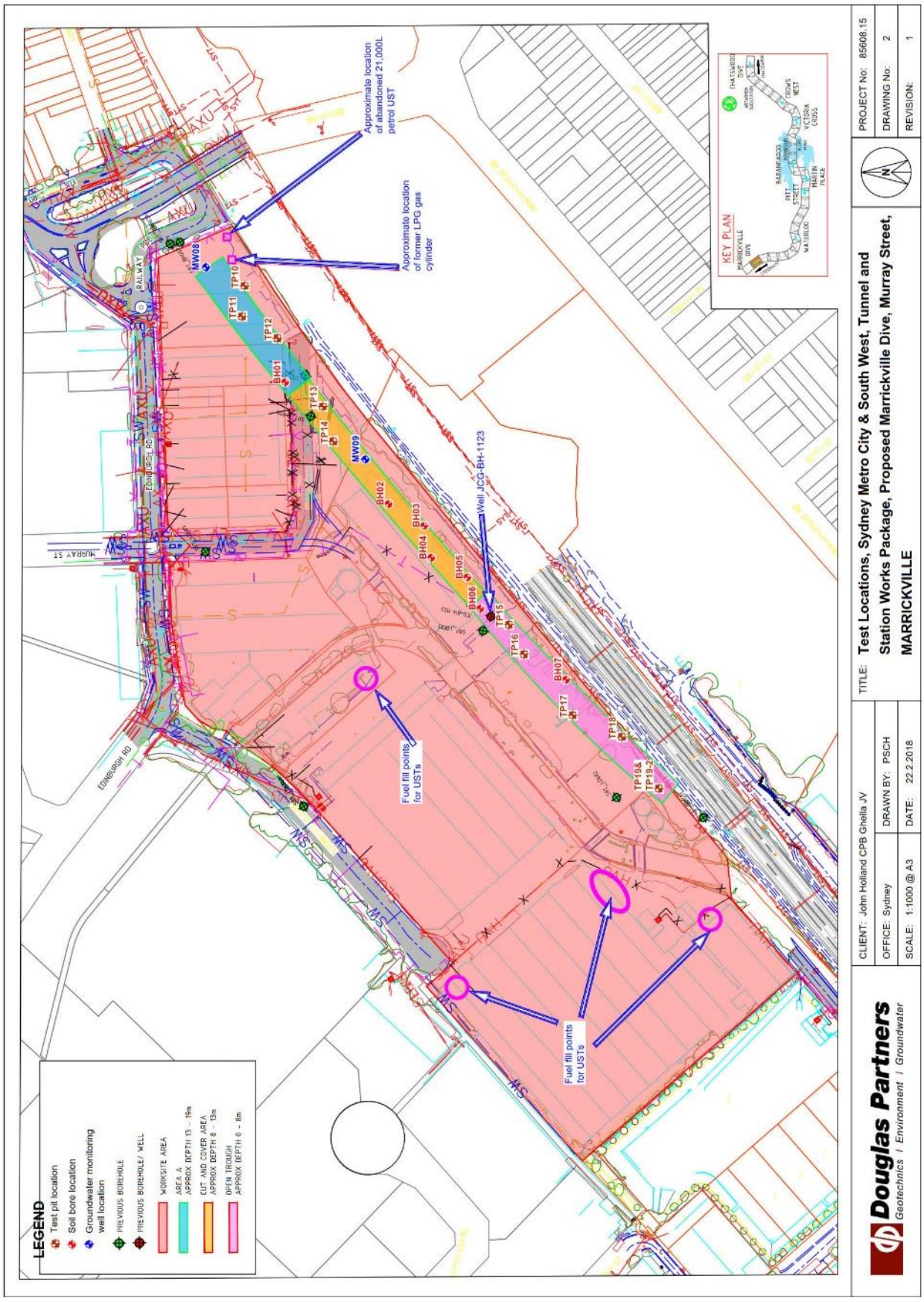
CLIENT: John Holland CPB Ghella JV		
OFFICE: Sydney	DRAWN BY: PSCH	
SCALE: 1:2000 @ A3	DATE: 21.9.2017	

TITLE: **Site Locations and Features, Sydney Metro City & South West, Tunnel and Station Works Package, Proposed Marrickville Dive, Murray Street, MARRICKVILLE**

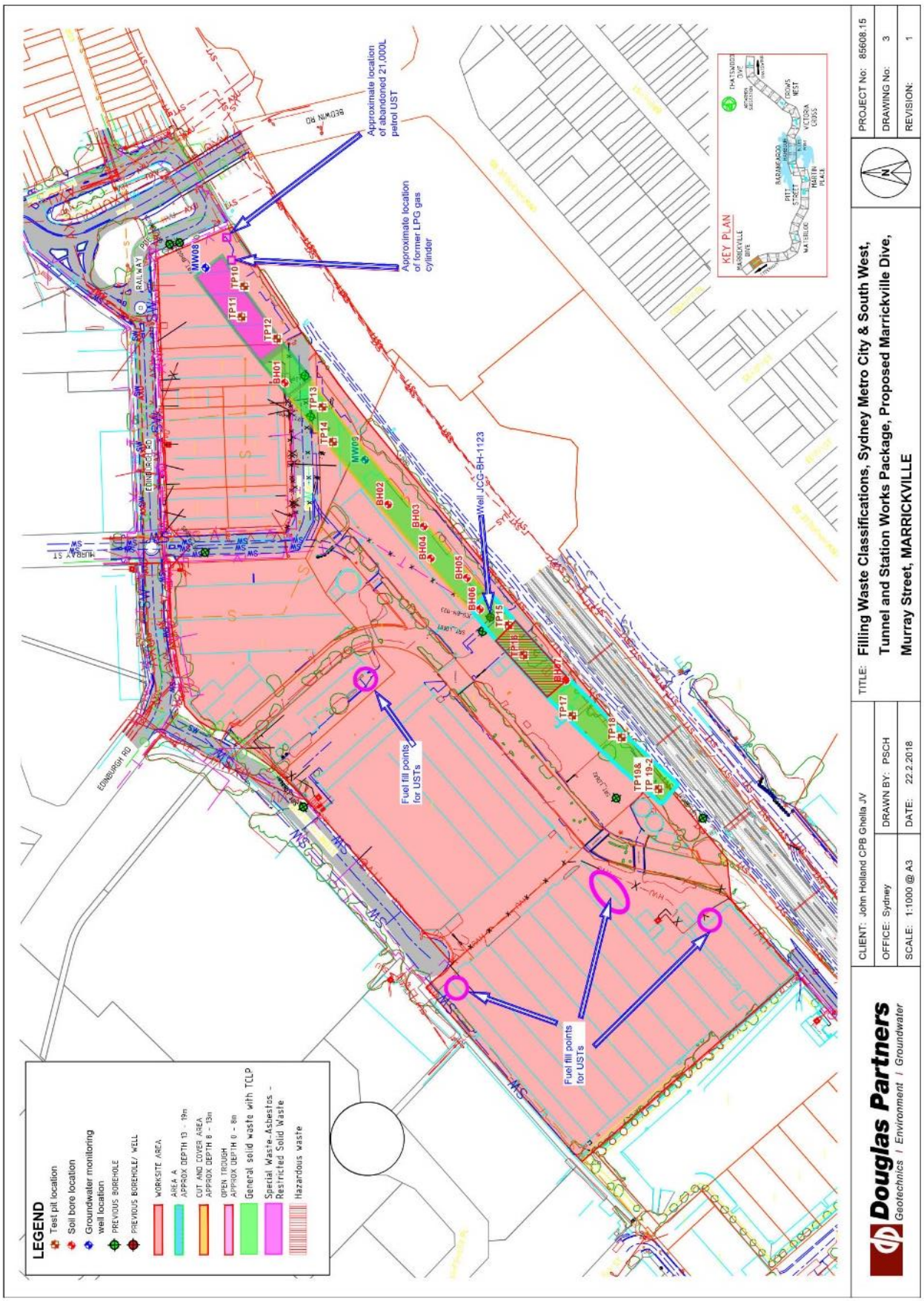
PROJECT No:	85608.15
DRAWING No:	1
REVISION:	0

Attachment 1: Site Locality Plan

Attachment 2: The DSI Sampling Location Plan



Attachment 3: Waste Classification and Soil Disposal Plan



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