Aqualand
Remedial Works Plan EWDA-02
Central Barangaroo

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EXECUTIVE SUMMARY

This report details the Remediation Works Plan (RWP) for the Early Works Development Application 02 (EWDA-02) area of the Central Barangaroo development located at Hickson Road, Milsons Point, NSW. This RWP was commissioned by Aqualand Projects Pty Ltd (Aqualand). The EWDA-02 comprises the excavation of fill material to an approximate depth of -11.2 RL (except Sydney Metro Station Southern entrance) for the construction of a perimeter retention wall and hydrostatic slab to support the eventual construction of basement carpark with mixed residential and commercial building.

Specifically, the EWDA-02 includes:

- Establish the site and installation of temporary plant and machinery, including dewatering and bentonite slurry plant and ancillary services,
- Construction of perimeter retention wall, including any required excavation, associated rock anchors and PRW capping beam construction,
- Associated remediation and Archaeological investigations in the area of excavation and works;
- Provision for future services,
- Associated "tie-in" works to Metro Interface Wall and the secant pile wall proposed by the applicant under SSD-39587022,
- De-stressing and removal of existing anchors supporting Sydney Metro pile wall,
- Bulk excavation for the provision of a future basement and associated rock anchors (including anchors to support the secant pile wall approved inSSD-39587022 ,
- Construction of foundation piling,
- Installation of waterproofing membrane,
- Construction of hydrostatic slab, and
- Structure and waterproofing for the Barangaroo Metro station southern entrance interface next to the existing Sydney Metro pile wall.

The objective of this RWP is to provide a specification that provides specific detail of the work that must be completed to facilitate delivery of the remediation works prescribed by the JBS Environmental Pty Ltd (JBS) Remediation Action Plan (RAP) (JBS 2013, herein referred to as the JBS RAP), throughout EWDA-02, and to provide information regarding the proposed staging, sequencing and planning of remediation works.

An independent Site Auditor, Rowena Salmon of Ramboll Australia Pty Ltd (Ramboll), has been appointed by Aqualand to review this RWP.

Central Barangaroo (and the greater Barangaroo Development Area) has been investigated for environmental contamination extensively, with subsurface contamination requiring remediation and management during the proposed development.

Previous environmental investigations conducted on the Central Barangaroo Site have identified soil as being contaminated with total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs), metals and asbestos-impacted fill material. No significant contamination has been identified on the Central Barangaroo Site, with the exception of tar impacted material and associated groundwater impact on the boundary of the Declaration Area, and an area of asbestos impacted fill material. The Declaration Area has been remediated by others, with remediation extending into Block 5, that forms part of the work area of this RWP. A region of virgin excavated natural material (VENM) has also been realised within the previously remediated areas of Block 4 (within the former sheet pile ribbon walls)

This RWP has been prepared specifically for the EWDA-02 area of Central Barangaroo in accordance with the existing JBS RAP (applicable to the entirety of Central Barangaroo), as required for the staging of development works. It is considered that the site would be suitable for residential, commercial (retail) land-use, following proposed remedial works undertaken as detailed in this RWP and future RWPs.

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1. INTRODUCTION AND BACKGROUND

EDP Consultants Pty Limited (EDP) was engaged by Aqualand Projects Pty Ltd (Aqualand), to prepare a Remedial Works Plan (RWP) for portions of Central Barangaroo to facilitate Aqualand's Early Work Development Application - 02 (EWDA-02) submission. The primary focus of this RWP is to outline the remedial approach for EWDA-02 which broadly involves the construction of perimeter retention walls (including associated "tie-in" works to Metro Interface Wall and the secant pile wall proposed under EWDA-01), bulk excavation, dewatering, foundation piling, construction of the hydrostatic slab, and Metro Station Southern Entrance coordination.

This RWP has been prepared in accordance with the existing JBS Environmental Pty Ltd (JBS) Remedial Action Plan (RAP) (JBS 2013, herein referred to as the JBS RAP). This RWP summarises previous investigations and remedial designs for the site and presents the selected remedial approach that will be implemented.

Refer to **Figure 1** for the site location provided in **Appendix A**.

The following subsections provide an overview of the remediation and development application evolution at Central Barangaroo as context to this RWP in support of upcoming EWDA-02 lodgement.

1.1 Concept Application MP06_0162

The Barangaroo Concept Plan was approved on 9 February 2007 under Part 3A of the EP&A Act 1979. It has been modified several times since 2007.

The original Concept Plan was facilitated through an amendment to Schedule 3 of *State Environmental Planning Policy (Major Development) 2005* now consolidated into *State Environmental Planning Policy (Precincts – Eastern Harbour City) 2021* (PEHC SEPP). The SEPP establishes the land use, height, GFA and other provisions relating to the planning and development of Barangaroo.

1.2 Remediation Action Plan – Central Barangaroo

In May 2013, JBS prepared the JBS RAP for Barangaroo Central including the current site area. The JBS RAP was subsequently subject to NSW EPA Site Auditor Review and considered appropriate to render the site suitable for the proposed use as public open space with potential for future mixed commercial and residential use, as listed in the Site Audit Statement (SAS) (GN 439B-5) and Site Audit Report (herein referred to as SAR) prepared by ENVIRON Australia Pty Ltd (AS121473, ENVIRON 2013). The provision in the RAP was that more detailed RWPs be prepared to cater for the specifics design and construction detail of future developments.

Remediation has previously occurred in Block 4 and part of Block 5 by LendLease (completed in 2019) prior to Aqualand ownership of the site. Since Aqualand's ownership, one RWP under the JBS, 2013 RAP has been developed to support submission of EWDA-01. EWDA-01 involved the installation of secant pile wall around a portion of the future basement perimeter.

Construction works under EWDA-01 have not yet commenced at time of writing this RWP. As such no further remedial works under the JBS, 2013 RAP have been undertaken at the site since LendLease.

1.3 Applicability of JBS RAP 2013 to MOD 9

The amended MOD 9 included variations to the basement design and eventual land-use which were contemplated in the JBS RAP. EDP prepared a comparison document between the JBS RAP and the amended MOD 9 to determine the applicability of the RAP to the revised development. This comparison and conclusion on applicability of the RAP to the amended MOD 9 in included in EDP report "JBS, 2013 Remedial Action Plan Applicability for Concept Plan MP06_0162 MOD 9" (ref: S-04478.AQL.010-MP06_0162MOD9_RAPApplicability).

Rowena Salmon of Ramboll Pty Ltd (NSW EPA Accredited Site Auditor 1002) conducted a review of the EDP comparison document and confirmed that the JBS RAP and the Central Barangaroo SAS/SAR are considered

applicable to the proposed amended MOD 9 Concept Plan on the provision the follow additional reports are prepared for the MOD 9 development:

- Revised remedial works plan (RWP);
- Materials Compliance Management Plan (MCMP);
- Validation Sampling and Analysis Quality Plan (VSAQP);
- Asbestos Management Plan (AMP); and
- Further risk assessment to address retail usage (where planned) within the basements.

2. SCOPE OF REMEDIAL WORKS PLAN

The scope of this RWP is to provide:

- Provide a summary of the approval status and context of this RWP with respect to the exiting JBS, RAP, and overview of the EWDA-02 project (refer **Section 1** and **Section 6**);
- Provide a summary of previous relevant reports and recent investigations undertaken at the site since JBS, 2013 and confirm the site identification and environmental setting detail (refer **Sections 3, 4 and 5**);
- Provide a revised site acceptance criteria and ensuing conceptual site model to which reflects the investigations and risk assessments undertaken, specific to the EWDA-02 project (refer **Section 7** and **Section 8**);
- Presentation of the remedial objectives, remedial options and preferred remedial approach **(Section 9)**;
- Overview of remedial methodology and sequencing to complete the EWDA-02 project **(Section 10)**;
- General construction management requirements during remediation works to demonstrate that the works are protective of the environment, the surrounding community and health and safety requirements for on-site workers (refer **Section 14**);
- Details of materials handling requirements (MCMP), including stockpiling requirements and hold points as required for the classification of material for re-use or offsite disposal (refer **Section 11**);
- Details of the validation and reporting requirements (VSAQP) necessary to demonstrate the success of the remediation program. refer **Section 13**);

3. PREVIOUS INVESTIGATION AND REPORTS

3.1 Pre-Aqualand Ownership Investigation and Report Overview

The key documents considered in this RWP are:

- JBS – *Remedial Action Plan, Barangaroo Delivery Authority – Barangaroo Central, Hickson Road, Sydney, NSW*. Report Ref: JBS 42021 – 51725 (Rev H), dated May 2013 (JBS RAP 2013);
- Environ – *Site Audit Report, Remedial Action Plan, Barangaroo Central*. Report Ref: AS121473, Audit Number GN 439B-5 (Environ 2013, SAR);
- Environmental Resources Management Australia Pty Ltd (ERM) – *Block 5 Summary Validation Report*. Report Ref: 0337165L042_Block 5 Validation Summary_V4, dated 06 February 2019 (ERM 2019); and
- Ramboll Environ Australia Pty Ltd (Ramboll) – *Site Audit Report, Block 5 VMP Remediation, Barangaroo*. Report Ref: 318000117 (AS121909A), Audit Number RS 091-1, dated 18 March 2019 (Ramboll 2019).

Previous environmental investigations conducted on the Barangaroo Central Site have identified soil as being contaminated with total petroleum hydrocarbon (TPH), polycyclic aromatic hydrocarbons (PAH), metals (specifically copper, lead and zinc) and asbestos-impacted fill material. No significant contamination has been identified on the Site, with the exception of:

- Tar impacted material and associated groundwater impact within the southern end and immediately south of the site into the former EPA declaration area. This tar impacted soil material was subsequently remediated by Lendlease throughout 2017 and 2018; and

- An area of asbestos containing material (ACM) impacted fill soils also towards the southern end of the site.

The contaminants of concern identified through previous investigations are summarised in Table 4.1 of the SAR. ENVIRON 2013 note that the most common contaminants are PAHs, which were detectable in around 85% of fill samples in Barangaroo Central, with the samples containing elevated PAHs and total recoverable hydrocarbons (TRH). The most common heavy metal contaminant was lead, with around 8% of samples exceeding the screening criteria used by the Auditor.

Asbestos fibres were only identified in one fill sample (BH401 at a depth of 9.0-9.4 metres below ground level (mbgl)) located within the southern end of the site. The SAR noted that the investigation methodology employed by all previous assessments limited the ability to assess the composition of fill material, resulting in a potential for asbestos to be present in the fill material at a higher frequency than suggested by the site investigations.

Tar was observed in natural soils to the south of Block 7, within the western portions of Block 5 and 6 (BH70, BH400, BH401, BH402 and BH403) and in shallow fill material in BH70 (2.5-4 mbgl) and BH74 (1-2.5 mbgl). The majority of these areas were included in the Block 5 remediation of the Declaration Area. During EDP's field investigation carried out on 19 September 2022, tar was observed in the fill within one borehole (WV21) located in the southern end of the site, in close proximity to the remediation zone.

3.2 EDP, 2022 In-Situ Waste Classification

EDP was commissioned by Aqualand to conduct a waste classification assessment of the in-situ material of all areas planned for bulk excavation as part of the proposed development of Central Barangaroo, Hickson Road, Millers Point, NSW. The report is detailed in EDP report – *Waste Classification of In-Situ Material, Central Barangaroo, Hickson Road, Millers Point NSW*. Report Ref: S-04478.WC.003, dated 07 March 2023 (EDP 2023).

The waste classification involved in-situ soil sampling within Blocks 5, 6 and 7 forming the proposed basement footprint. Additional samples were collected from the potential future harbour heat rejection (HHR) pumping chamber and pipelines, kiosk and public domain (PD) areas. These areas will not be were not classified under this report. The in-situ assessment targets the proposed excavation depth of approximate -12.7 RL with samples collected approximately 1 m beyond the proposed final depth, or into sandstone. EDP advanced a total of 104 boreholes to a maximum depth of 16 mbgl.

Fill materials were observed across the entire site with no discernible horizons or homogenous regions. Fill soils were followed by alluvial materials underlain by natural residual soil and bedrock. Depths fluctuated between boreholes however the extent of the fill layer was observed to increase from the eastern end towards the western end of the site.

A total of six TPH, seven BTEXN, 25 benzo(a)pyrene, 38 PAH and six lead samples were in exceedance of the adopted waste classification criteria. Statistical assessment was completed for the whole data set excluding outliers (samples 2.5 x the criteria) and the calculated 95% upper confidence limit (UCL) for all exceeding analytes fell below the SCC and TCLP waste classification criteria. Asbestos in the form of fibre bundles, fibrous mass, fibre cement sheets and bituminous materials was reported in 56 soil samples collected from the fill profile across the site. Chrysotile and amosite asbestos was identified in six ACM fragments analysed. In addition, a total of 78 samples in the fill profile and 44 samples in the alluvial/natural soil profiles reported results in exceedance of the acid sulfate soil (ASS) trigger values, with no clear pattern of distribution observed.

Based on the visual assessment and analytical results, the in-situ fill materials are classified as Special Waste (asbestos) conservatively considered to be friable in nature. Chemical classification of the in-situ soils falls under three types: General Solid Waste (~373,800 m^3), Restricted Solid Waste (~8,400 m^3) and Hazardous Waste (~4,800 m^3). In addition, the fill and natural profiles are anticipated to contain Acid Sulfate Soils and will require treatment with agricultural lime and neutralisation assessment prior to offsite disposal.

It should be noted that the total waste classification volume of 387,000 m^3 was provided, based on an investigation which was undertaken to classify materials for a larger basement scheme relating to the previous MOD9, which proposed a much deeper and wider excavation. The updated MOD9 proposal anticipated an revised excavation volume of 277,400 m^3.

3.3 EDP, 2024 In-Situ VENM Assessment

EDP was commissioned by Aqualand to conduct a Virgin Extracted Natural Material classification assessment of the in-situ material of Block 5 which is planned for bulk excavation as part of the proposed development of Central Barangaroo, Hickson Road, Millers Point, NSW.

This area is referred to as the LendLease remediation area and is known to have been remediated and backfilled with VENM. It is understood that backfill materials could be reclassified as VENM following appropriate in-situ or ex-situ assessment to verify the quality of the material.

In order to fulfil the objectives and prepare a waste classification of the in-situ material at the site, a total of 4 boreholes were advanced using a sonic drilling rig to the maximum target depth of 10 mbgl. Generally, no visual evidence of contamination such as staining, discolouration or 'oily' patches were noted in any of the boreholes. Hydrocarbon odour was minor and generally limited to the surface soils. Foreign materials were observed in minor quantities in the between 0 and 2m. These foreign materials generally consisted of building rubble including bricks, concrete, metal, terracotta and wires.

The field investigation and chemical analysis results demonstrate that there is a distinct horizon of material that meet the definition of VENM and are characteristic of recorded VENM imports. This layer exists approximately between 2.5m to 9.5m with some isolated exceptions. The estimated volume of in-situ fill and natural materials across the site can were 4,520 m^3 or 8136 tonnes.

3.4 EnRisks, 2024 Human Health Risk Assessment

EnRisks prepared a human health risk assessment (HHRA) for the basement construction of EWDA-02 to

- assess the potential human health risks to construction workers and future users of the proposed development of the site; and
- identify requirements for risk mitigation measures to be implemented within the proposed development, where required.

The approach utilised existing available data and structural designs for the site to develop a conceptual site model (CSM), undertake an exposure assessment, a toxicity assessment and then risk characterisation. The risk assessment contemplated exposure groups which would occupy portions of the basement under various scenarios, such as; future residents, future commercial/retail workers, construction workers and future basement maintenance workers.

The most appropriate media to assess potential risks to exposure groups is groundwater, and groundwater derived vapours. Input parameters around the toxicity of contaminants at recorded concentrations and the size, age, weight and exposure duration of specific groups were calculated based the understood use and layout of the future basement levels. Assumptions on perimeter retention wall thicknesses and membranes were also incorporated.

The risk assessment conclusions regarding future uses and occupancy of the basement are provided in the *Human Health Risk Assessment, Block 5, 6 and 7, Barangaroo Central, NSW (ref EDP/24/BANR001), April 2024* (EnRisks, 2024).

Regarding construction phase works associated with EWDA-02, while some potential risk may be posed to workers if exposed to groundwater during excavation of the basement (inhalation and dermal contact), these risks can be adequately managed through future Workplace Risk Management Plan.

4. SITE INFORMATION

4.1 Site Identification

Site identification details are summarised in **Table 1** and the location and layout of the site is shown on **Figure 1** and **Figure 2**, respectively, provided in **Appendix A.**

Table 1 – Site Identification

Site Identification	
Site Address:	Hickson Road Millers Point NSW
Legal Identification:	Lot 52 in DP 1213772
Local Government Area:	City of Sydney
Site Description:	The site is located in Central Barangaroo, which forms part of the wider Barangaroo Precinct comprising a total area of 22ha. It is located in the north-western edge of Sydney CBD and falls within City of Sydney Local Government Area (LGA). Barangaroo Precinct interfaces with Hickson Road in the east, the foreshore in the west, Walsh Bay to the north and Darling Harbour in the south. ▪ **Barangaroo South (approx. 7.5ha)** – Located at the southernmost end of Barangaroo Precinct. Progressively built over the last six years and includes mixed-use neighbourhood comprising commercial office buildings, mixed use buildings, shops, cafes, hotel and community uses. ▪ **Central Barangaroo (approx. 5.2ha and area subject of SSDA)** – Located between Barangaroo South and Barangaroo Reserve. Currently vacant and undergoing site preparation works to facilitate a mixed-use area with a focus on retail activation, residential and community uses. ▪ **Barangaroo Reserve (approve 6.1ha)** – Located in the northern end of the Precinct featuring Barangaroo Reserve. Featuring open space and lookout points to Sydney Harbour, Nawi Cove and Marrinawi Cove. Barangaroo Reserve features the Cutaway – a future arts and cultural entertainment space. The above results in a total area of 18.8ha. The residual 3.2ha is represented by the reshaping of the former industrial headland into Barangaroo Reserve and the creation of Nawi Cove as a substantial water body within the Barangaroo site, forming the original 22ha.
Site Area	5.2ha (approx.) of the 22ha Barangaroo Precinct
Current Zoning:	B4 Mixed Use and RE1 Public Recreation
Site Elevation:	Approximately 2 to 4 m Australian Height Datum (AHD)

4.2 Site Description and Surrounding Land Use

The area currently features a large concrete hardstand area/construction site that is occupied by temporary structures for site preparation works, machinery, materials and vehicle parking for site workers. Hoarding is currently erected around the Central Barangaroo site.

The site is also subject to current improvements such as remediation works, works to facilitate the Barangaroo Metro Station and a temporary road which runs off Hickson Road around the southern portion of the site. Tunnelling and activities for the Barangaroo Metro Station have been completed.

4.3 Site History

Based on a review of the JBS RAP, the wider Barangaroo precinct was occupied by shipping and related merchants during the 1900s. Between 1840 and 1921, a gasworks operated by Australian Gas Light Company (AGL) was located within the southern end of site and extended east to what is currently Hickson Road. During this time, the original shoreline was altered to enable the construction of wharves which commenced from the mid-1920s. Over the past 20 years, the wider Barangaroo precinct was used primarily for stevedoring purposes until the majority of buildings were demolished and the land was prepared for redevelopment in the five years prior to the JBS RAP.

Priority was set to understand the conditions associated with the former gasworks area, referred to as the "Declaration Area" located within the southern end of the site. The gasworks were decommissioned between 1922 and 1925 and included the demolition of the surface of the gas holders, purifiers and other facilities and

generated during decommissioning were placed within the boundaries of the Barangaroo Central Site. Investigations within the Barangaroo Central site did not identify gasworks structures of waste materials.

Based on the timing of the gasworks decommissioning (between 1922 and 1925) and the commencement of site filling (between 1951 and 1972), JBS considered it highly unlikely that locally sourced gasworks waste or demolition material was used as fill during the reclamation works at Barangaroo Central.

5. ENVIRONMENTAL SETTING

5.1 Topography

A review of the NSW Government National Map online database (http://www.nationalmap.gov.au/) accessed in August 2022, indicated that the site was generally flat and was located at an elevation of approximately 2 to 4 m AHD.

5.2 Geology and Soils

According to the 1:100 000 Geological Survey of NSW (Sydney) Sheet 9130 (Edition 1) 1983 and numerous site investigations, the Barangaroo Central Site is underlain by man-made fill materials that have been placed over marine sands over Hawkesbury Sandstone. The stratigraphic summary provided in the SAR is presented in **Table 2.**

Table 2 – Summary of Stratigraphy of Barangaroo Central (Environ SAR 2013)

Thickness (m)	Material	Location	Description
0.5	Pavement	Whole of site	Hard surfacing, bituminous concrete except for 20 m concrete strip along the shoreline Gravel, occasionally concrete slab
6 – 18	Fill	Shallowest on eastern side near Hickson Road, increasing in thickness towards Darling Harbour	Variously described as sand or clay but mainly sandy, gravelly, silty or clayey in places. Possibly broken sandstone. Contains some brick, concrete, tile, but appears minor
0–2	Alluvial soil	Overlying bedrock or residual soil, absent in places on eastern side	Alluvial sediments consisting predominantly of dark silty clay
0 – 20	Residual soil	Overlying bedrock, absent in places on eastern side	Sandy clay residual, highly weathered rock
-	Bedrock	Whole of site	Sandstone, some shale. Weathering and fracturing decreasing with depth

Based on information available in previous reports, the depth of fill and alluvial soil was determined based on the identified depth of bedrock. The rock contours range from less than -2 mAHD in the eastern area to -23 mAHD, with a steep decline from the east to west of the site.

Based on historical information and a brief assessment at the site, the fill profile did not show any distinct and predictable layers, rather a widespread heterogenous fill layer followed by alluvial soil then sandstone bedrock.

5.3 Hydrogeology

Groundwater across the site is shallow, generally reflective of sea level at a depth of approximately 2 metres below ground level (mbgl). Previous investigations and experience in the greater Barangaroo area show the groundwater to be tidally influenced. The SAR notes that tidal studies at the southern end of Barangaroo indicate a high degree of connectivity between groundwater and the adjoining waters of Darling Harbour, decreasing towards Hickson Road.

Due to the presence of fill materials, hydraulic conductivity is expected to vary locally, however is expected to be high due to the prevalence of sand in the fill layers as identified in previous field logs and site observations.

Due to the tidal influence, groundwater is expected to be saline. The overall groundwater flow direction is expected to be to the west towards Darling Harbour however, will vary due to preferential flow paths within the fill body and tidal influence interacting with inflow from the east.

6. EWDA-02 PROJECT SUMMARY AND SCOPE OF RWP

The proposed SSDA will seek approval for early works associated with the future mixed-use development of Central Barangaroo (set out under MP06_0162). The proposal sees to undertake bulk excavation and site establishment works for the installation of the perimeter retention wall, and conduct remediation and archaeological investigations within the site.

These works will facilitate the provision of future basements, consistent with the parameters set out under the approved Concept Plan for Barangaroo under MP06_0162. The works subject of the SSDA include the following:

- Establish the site and installation of temporary plant and machinery, including dewatering and bentonite slurry plant and ancillary services,
- Construction of perimeter retention wall, including any required excavation, associated rock anchors and PRW capping beam construction,
- Associated remediation and Archaeological investigations in the area of excavation and works;
- Provision for future services,
- Associated "tie-in" works to Metro Interface Wall and the secant pile wall proposed by the applicant under SSD-39587022,
- De-stressing and removal of existing anchors supporting Sydney Metro pile wall,
- Bulk excavation for the provision of a future basement and associated rock anchors (including anchors to support the secant pile wall approved inSSD-39587022 ,
- Construction of foundation piling,
- Installation of waterproofing membrane,
- Construction of hydrostatic slab, and
- Structure and waterproofing for the Barangaroo Metro station southern entrance interface next to the existing Sydney Metro pile wall.

The proposal does not seek approval of any buildings, or the design, construct and use of the basement. These will be subject to future detailed SSDAs for Central Barangaroo, consistent with the outcomes of MP06_0162.

The proposed early works can be submitted under the current approved Concept Plan. The approved Concept Plan does not establish any express parameters on the extent of excavation or early works within the site. The application is capable of satisfying the requirement for consistency with the approved Concept Plan (s4.24(2) of the Environmental Planning and Assessment Act 1979 (EP&A Act 1979).

Depiction of the architectural drawings showing the concept design for the wall and slab construction including sections is included in **Appendix B**.

7. SITE ACCEPTANCE CRITERIA

7.1 Health and Environment Criteria

Following review of the JBS RAP against the proposed design and remedial approach for the site, EDP have revised the Site Assessment Criteria (SAC). Due to the proposed bulk excavation and offsite disposal of all soils within the site, the only applicable criteria would include direct contact with seeping groundwater through the perimeter retention wall or health screening levels (HSLs) for indoor occupants or maintenance workers for vapours emanating through the walls or hydrostatic basal slab.

As the horizontal and vertical boundaries of the site are the finished concrete and wall and slab with all internal fill materials to be excavated, the site is not considered to have any ongoing environmental impact. The site at

completion of EWDA-02 is considered to have a net benefit on surrounding environment given the primary source (contaminated fill) removal. In this way, environmental assessment criteria are not considered.

A Human Health and Environment Risk Assessment (HHRA) has been prepared by EnRisks for EWDA-02. The HHRA utilised soil and groundwater data from EDP's previous investigations with the following general assumptions around the wall and slab construction:

- Construction of a reinforced perimeter retention wall with a thickness of approximately 1000 mm; and
- Construction of a hydrostatic slab for the basement floor with an affixed waterproof membrane and approximate thickness of 1,400 mm subject to structural design.

Although the HHRA was undertaken on structures which do not represent the finished construction form of the overall development, the conclusion of Low Risk to human receptors at this stage negates the need for further specific design requirements or remediation activites to mitigate human health and environmental risk. Because of the site specific HHRA and its conclusion, most criteria provided in Section 5 of JBS, 2013 are not applicable to the site.

To ensure the conclusions in the HHRA remain applicable to the future basement construction the SAC will be primarily based upon confirmation of the following:

- The walls and base construction meet or improve upon the HHRA model input assumptions
- Visual inspection of the base and walls demonstrating no residual contaminated soil inside the finished walls or on top of the finished hydrostatic slab is evident
- Confirmation the walls and base have been installed in accordance with design.

For specific details on validation criteria, refer to **Section 13**.

8. PRELIMINARY CONCEPTUAL SITE MODEL

EDP has reviewed the conceptual site model (CSM) in the JBS RAP and considered its applicability for the proposed development at the site. The preliminary conceptual site model provided in **Table 3** relates to the construction phase of works and the preliminary CSM in **Table 4** relates to the future site users, occupants and maintenance works upon project completion. This post-construction CSM is based on the outcomes of the HHRA prepared assuming the basement construction will be completed according to the assumptions detailed in **Section 7**.

Table 3: Preliminary Conceptual Site Model – Construction Phase

Source and Location	Contaminants	Pathway	Receptor	SPR[1] Link / Risk
Historical filling (widespread) Former gasworks (east and south of the site)	• Heavy metals (arsenic, cadmium, copper, lead, nickel and zinc); • Total petroleum hydrocarbons (TPH); • Polycyclic aromatic hydrocarbons (PAHs); • Monocyclic aromatic hydrocarbons (MAHs) such as benzene, toluene, ethylbenzene and xylenes (BTEX); • Naphthalene • Asbestos; and • Ammonia (groundwater only).	• Inhalation of vapours during excavation of in-situ impacted soils • Inhalation of vapours during dewatering of impacted groundwater.	• Visitors to site • Construction or maintenance workers • Visitors to site	• Potentially complete pathway – possible vapour accumulation into basement plant rooms, and utility or infrastructure service pits or trenches.
		• Inhalation of dusts or airborne contaminants from contaminated soils during excavation	• Visitors to site • Construction or maintenance workers • Users of neighbouring sites or pedestrians using surrounding public roads	• Potentially complete pathway – possible exposure to airborne dust during excavation and stockpiling
		• Direct contact with impacted soils during excavation, or residual soils around edges of PRW post-completion of excavation • Direct contact with impacted groundwater	• Visitors to site • Construction or maintenance workers	• Complete pathway – exposure to impacted soils and groundwater likely during excavation works.
Presence of acid sulfate soils	• Actual and potential acid sulfate soil.	• Direct contact with acidic / mobilised metal water	• Construction or maintenance workers • Site visitors	• Complete pathway – site workers and visitors may have direct contact during excavation and stockpiling of actual and potential acid sulfate soils
		• Inhalation of hydrogen sulfide / mobilised metal dust	• Construction or maintenance workers • Site visitors • Users of neighbouring sites or pedestrians using surrounding public roads	• Potentially complete pathway – human health receptors onsite or offsite may be exposed to dust if dust suppression techniques are not utilised
		• Migration of acidic / mobilised metal runoff to surface water or infiltration to groundwater	• Groundwater • Neighbouring surface water (Darling Harbour)	• Potentially complete pathway – environmental receptors may be exposed if acid sulfate soil excavation is not undertaken according to CEMP and ASSMP

Notes to Table 3
1. SPR: Source-receptor-pathway link.

Table 4: Preliminary Conceptual Site Model – Post Completion

Source and Location	Contaminants	Pathway	Receptor	SPR1 Link / Risk
Historical filling (widespread) Former gasworks (east and south of the site)	• Heavy metals (arsenic, cadmium, copper, lead, nickel and zinc); • Total petroleum hydrocarbons (TPH); • Polycyclic aromatic hydrocarbons (PAHs); • Monocyclic aromatic hydrocarbons (MAHs) such as benzene, toluene, ethylbenzene and xylenes (BTEX); • Naphthalene; and • Ammonia (groundwater only).	• Inhalation of vapours seeping through the perimeter retention wall, wall joints or floor	• Site workers and visitors • Users of the car park • Construction or maintenance workers.	Incomplete pathway – **low and acceptable,** potential inhalation risk from vapour intrusion into indoor air spaces. However a low exposure risk identified in HHRA based on the presence of a perimeter retention wall and hydrostatic slab
		• Direct contact with groundwater seepage on perimeter retention wall or floor	• Site workers and visitors • Users of the car park • Construction or maintenance workers.	Potentially complete pathway – **low and acceptable,** possible groundwater seeps from joins or rock anchors in perimeter retention wall however quantities are minimal, and a low exposure risk identified in HHRA based on the presence of a perimeter retention wall and hydrostatic slab

Notes to Table 4
1. SPR: Source-receptor-pathway link.

9. REMEDIAL PLAN

9.1 Remedial Objectives

The objective of this RWP is to provide detail on the specific remedial works being undertaken as part of EWDA02 to meet the overall remedial objectives of the JBS RAP and the SAC detailed in **Section 7**.

The objectives of this RWP include:

- Ensure the Site at the completion of the EWDA02 scope will not pose an unacceptable risk to future users of the eventual basement construction which will include sublevel car parking and retail spaces; and
- Ensure no unacceptable risk is posed to the natural environment, including groundwater and the water of Darling Harbour.

9.2 Planning and Approval Context

The JBS RAP was prepared in accordance with the Director General requirements (DGRs) relating to the Project Application SSD_5374. The Barangaroo Site is listed as a State Significant Site within Schedule 3 of the State Environmental Planning Policy (Major Projects) 2005. As such, development approval for the project falls under the provisions of Part 3A of the *Environmental Planning and Assessment Act 1979*. Since the works have been assessed under Part 3A of the EP&A Act, the remediation works are ancillary to other development, and the consent authority is the Director General of the NSW Department of Planning and Infrastructure.

9.3 Remediation Extent

The remediation area is considered to comprise the EWDA-02 area as defined by the site boundary in the site plans in **Appendix B**. It is noted that the design may be subject to change, which could vary the current boundaries of the site basement and excavation depths. If there are any substantial design changes, this RWP will be reviewed against the new design to establish whether any update/addendum is required.

The extent of remediation is the in-situ materials proposed for removal during basement wall construction, piling and bulk excavation or earthwork activities associated with DA-02. Preliminary details of the construction and excavation depths and extents for EWDA-02 are provided in **Section 6**. The extent of remediation will only be to the limit of the development design, including the base of service trenches and pits. No chase out of any contamination impact (including tar impacted soils or otherwise) as part of this RWP is envisaged. Remediation under this RWP is presented for soil media only. Groundwater remediation is not expected.

9.4 Remedial Options and Preferred Approach

Several remedial options were considered by JBS and discussed in Table 6.3 and in Section 6.3 of the JBS RAP. The DA-02 area offers limited opportunity for soil reuse or filling. However, pursuant to recent EDP investigations and nature of contamination, the fill material is considered unsuitable for re-use without remediation or management. While EWDA-2 involves bulk excavation and off-site disposal for a future basement construction, there is still opportunity for potential over-excavation beneath the current planned slab for isolation and containment of more contaminated materials. Given this, remedial Options 3 and 4 as described in Table 6.3 of JBS, 2013 have been adopted. EDP have represented these Options in **Table 5** with revised conclusions of applicability for this RWP.

Table 5: Proposed Remediation Options (JBS 2013)

Option	Discussion (JBS 2013)	Conclusion (JBS, 2013)	EDP Consideration
Option 3 (preferred) Excavation and off-site removal of the impacted material.	Impacted fill materials There are currently suitably licensed waste facilities in the Sydney Metropolitan region capable of accepting the identified contaminants within fill materials which have not been impacted by the former gasworks activities at the site.	A potentially applicable option but inferior to on-site reuse/retention (option 4) due to additional costs and environmental impacts	This is the preferred option as there is limited opportunity for re-use based on the design plans. EDP agrees that licenced landfills in Sydney can accept asbestos and non-tar impacted wastes. Where tar is encountered, facilities licenced to accept and treat tar impact waste (even outside NSW) may need to be sourced. Stabilisation of the tar impacted material should be prioritised to take place at the receiving facility, if capable of doing so. If a suitable facility cannot be found, stabilisation as detailed in **Section 12.4** should be conducted. It should be noted that facilities in Sydney were used during the earlier stages of the wider Barangaroo precinct that were EPA approved for stabilisation/immobilisation methodologies. Fill material at the site has been determined to be asbestos contaminated and requires disposal at an appropriately licenced facility.
	Shallow tar impacts Tar impacted materials can be stabilised in order to facilitate disposal to landfill under an immobilisation permit issued by NSW EPA and, in certain cases. It is noted that highly impacted materials require treatment prior to landfilling, due to the waste classification of such materials.	The preferred option for highly impacted soils.	
	Asbestos fibres containing materials There are currently suitably licensed waste facilities in the Sydney Metropolitan region capable of accepting the identified contaminants within fill materials. The asbestos fibres impact is at a depth of 9.0-9.4 m bgs which lies within the proposed lateral and vertical extent of the proposed basement. As such, excavation and off-site removal is the preferred option as the material will be excavated in any event to facilitate the construction of the proposed basement	The preferred option for asbestos impacted materials at this location given the impact lies within the proposed basement footprint and requires excavation	
Option 4 (preferred / alternate) Consolidation and isolation of the soil by on-site containment within a properly designed barrier and ongoing management.	Impacted fill materials Based on risk-based criteria established in the Barangaroo Central HHRA (JBS 2012b), the Barangaroo Central materials are generally suitable for retention within the Barangaroo Central Site, subject to placement details. Barangaroo Central material can be managed with imported fill used as a growing media instead of the current surface soil.	This is the preferred option as soils are suitable for retention onsite with imported fill as growing media.	This option is considered acceptable as tar impacted material has been identified in at least two locations (WV21 and WV23 from EDP, 2023) which will have tar impacts on the immediate exterior of the perimeter retention walls. Where shallow or deep tar is identified, the impacted

Option	Discussion (JBS 2013)	Conclusion (JBS, 2013)	EDP Consideration
	Shallow tar impacts Tar Impacted Materials (i.e., heavily impacted) are not suitable for reuse/placement in the Barangaroo Central Site without additional capping/containment and ongoing management requirements. In addition, on-site treatment of certain materials may be required prior to reuse in specific parts of the Barangaroo Central Site.	Not a suitable option due to treatment required.	material will be excavated to the limit of the proposed design and managed either: ▪ by Option 3, with remaining impacts left in-situ, but isolated/retained by walls, lined service trenches or hydrostatic slab. Or ▪ placement in an area of over excavation (burial pit) beneath the design level of the hydrostatic slab. Should a burial pit option be considered, an addendum to this RWP will be required to provide detail of the burial pit,. A review of the applicability of the current HHRA and a revised HHRA will likely be required to further assessment and confirm acceptable risks associated with this option. Where imported material is required, the subject material must meet the SAC in accordance with **Section 6.2.**
	Asbestos fibres containing materials The asbestos fibres materials will not pose a potential groundwater risk and will not pose a potential inhalation risk if retained and undisturbed at its current location beneath the site. On this basis, the asbestos fibres materials are suitable for retention on the site below the anticipated future depth of site excavation, which is typically 0.5m below the proposed site level.	Not the preferred option for the identified asbestos impact, given its location within a proposed basement footprint which requires excavation and removal from the site (the preferred option). However, this may be a suitable option if additional asbestos contamination is identified, and will be dealt with in accordance with the unexpected finds protocol (Section 7.1).	

10. REMEDIATION SEQUENCING AND METHOD

The following sub-sections outline the remediation sequencing and methodology envisaged for EWDA-02.

10.1 Site Establishment and Enabling Works

10.1.1 Site Establishment

Prior to commencement of remedial works the following would be undertaken:

- Finalisation of Construction Environment Management Plan (separate document);
- Survey and ground marking of the EWDA-02 boundary;
- Establishment of site including mobilisations of offices, amenities, fences and hoarding;
- Setup of all appropriate safety and environmental controls; and
- Commence contractor briefing and inductions.

10.1.2 Termination and re-location of in-ground services

The location of all site services shall be identified and relocated as necessary if expected to be impacted by the proposed works. The requirement for site services to be connected to new site sheds shall be assessed and connected as required. It is expected that stormwater diversion works will be required to re-direct services.

10.1.3 Removal of Concrete

The site is currently overlain with concrete and aggregate hard stand. It is envisaged that concrete and hard stand break will be required before bulk excavation works can occur. Concrete will be temporarily stored in stockpiles ahead of a disposal at a facility licensed to receive. An inspection protocol is to be followed to verify concrete is free from asbestos.

Concrete will be progressively removed as required throughout the remediation and construction program. Initial concrete removal will be to facilitate the construction of the perimeter retention wall, and other concreted areas will remain as hardstand stockpiling areas. Following completion of perimeter retention wall, other concrete areas will be removed in preparation for bulk excavation.

All waste will be managed in accordance with the MCMS.

10.2 Perimeter Retention Wall

The current basement retention system for the site is a full perimeter retention wall (e.g. diaphragm wall or similar) with tie-in to Barangaroo Metro Station in the north east. Perimeter retention walls are a re-enforced concrete wall installed with in-situ panel segments keyed into bedrock.

The perimeter retention wall excavations are typically advanced using rotating cutters or grad/clamshell bucket. The excavation process will utilise a support fluid (i.e. bentonite) for the during the wall excavation, to prevent collapse prior to concrete casting, and help remove excavation cuttings through the bentonite slurry. Once depth of excavation is reached, steep reinforcement cages are lowered into the trench. With the reinforcement installed, the concrete is poured in-situ which displaces the slurry.

The use of bentonite slurry necessitates the need for a bentonite slurry plant to recycle and reuse the material. The recycling process generates a dewatered waste soil consisting of the excavated soils from the panel excavation removed during the recycling of the slurry. This spoil will require validation in accordance with MCMS **Section 11** and VSAQP **Section 13.**

As part of the early works, construction of a concrete guide wall along the perimeter retention wall alignment will be undertaken to support the unconsolidated near surface material and control the panel excavation azimuth.

The perimeter retention wall panel design will be confirmed by a structural engineer though is expected to include panels of approximately 1,000 mm in thickness and up to 6-8m in lineal length. Current architectural design plans are presented in **Appendix B**.

All wet panel excavation spoil will be managed in accordance with the MCMS in **Section 11**.

10.3 Bulk Excavation

Preliminary bulk excavation is proposed to commence once perimeter retention wall construction is complete. Due to the shallow nature of groundwater and the need for a hydrostatically sealed basement, the bulk excavation will not commence in full until the completion of the perimeter retention wall and capping beam.

Bulk excavation will utilise bulk excavation equipment including excavators and dozers etc. bulk excavation will involve the temporary short-term stockpiling of materials for further classification (if required) and handling in accordance with the MCMS.

As the fill and natural profiles are anticipated to contain Acid Sulfate Soils, excavated materials will require treatment with agricultural lime and neutralisation assessment prior to offsite disposal. Treatment of soils will be undertaken in accordance with the Acid Sulfate Soil Management Plan (ASSMP) included in **Appendix D.**

The EDP, 2022 report its subsequent revisions provided a statistically based in-situ waste classification for all spoil which would be generated from the perimeter retention wall (and secant pile wall, refer EWDA-01) and bulk excavation stages. The outcome was a waste classification grid to the horizontal extents of the site, with ~ 1 m vertical intervals corrected to site relative levels (RLs). The EDP, 2022 report allows for horizontal and vertical survey boundaries of waste classification grid cells to be modelled by Aqualand and guide the excavation process.

The envisaged process is the excavation will be undertaken in meter-by-meter intervals with materials of 'like' classification stockpiled in pre-determined stockpile treatment locations i.e. excavated *"Special Waste (asbestos) – Chemically General Solid Waste"* material maintains separation from *"Special Waste (asbestos) – Chemically Restricted Solid Waste"*.

Ideally, treatment of stockpiles for neutralisation of PASS would occur in treatment areas for the same classification, i.e. chemically general solid waste (GSW) material is treated on a GSW liming pad. The avoids the potential for having to validate the successful removal of otherwise restricted solid waste (RSW) material from a liming pad before further GSW material can be received.

The EDP, 2022 report was unable to classify all material to the target investigation depth of approximately 16 mbgl during the assessment. Where classifications do not exist, excavated material will require further assessment to determine the classification (in-situ or ex-situ).

Refer to Section 11 for further details on all material handling and tracking requirements during excavation and loadout.

10.4 Dewatering

Due to the shallow (approximately <1.5 mbgl) groundwater level, dewatering is required during bulk excavation. To ensure the safe disposal or discharge of dewatered groundwater, a water treatment plant will need to be established. The specifications of the water treatment plant are to be established, though the design must ensure that water is treated to a level suitable for discharge either to stormwater and subsequently to Darling Harbour or to sewer. Discharge approval is required for both options, from NSW EPA and Sydney Water respectively.

Treated water is also expected to include site captured surface water, and leachate water from any temporary stockpiles created from the perimeter retention wall or bulk excavation works. Dewatering is expected to continue until the hydrostatic slab at the base of the excavation is installed or later.

10.5 Piling and Rock Anchors

The exact number, size and depth of the required piles will be determined following completion of geotechnical assessments and on finalisation of the basement design. Rock anchoring is required as a temporary support to the perimeter retention wall prior to basement slab construction. Rock anchors will be installed progressively into surrounding fill material and rock in the exterior of the perimeter retention walls as the bulk excavation advances.

Any spoil from pile and rock anchors spoil is expected to be beyond the lateral and vertical extents of assessment in EDP, 2022. Piling and rock anchor spoil will be required to be assessed ex-situ prior to disposal and managed in accordance with MCMS outlined in **Sections 11** and VSAQP **Section 13**.

10.6 Hydrostatic Slab

Once excavation has reached the design basement excavation level and piling in the area is complete and waterproofing membrane is laid on the blinding, commencement of the installation of the hydrostatic slab will commence. The hydrostatic slab will be poured on top of the membrane. The concrete pours for the slab will be undertaken in sequential batches with the finished hydrostatic slab being approximately 1,400 mm thick.

11. MATERIALS COMPLIANCE MANAGEMENT SYSTEM

The purpose of the MCMS is to ensure all materials imported or disposed during the site works meet the SAC, and that disposed materials are appropriately classified and disposed of at appropriately licensed facilities. Further, this MCMS provides a system for tracking and control of intra-site material movements.

Material classification and verification will be undertaken prior to materials being removed from or imported to the site. All classification and verification processes will be conducted and recorded by the Remediation Consultant. This MCMS is divided into the following Sections:

- Roles and Responsibilities.
- Grid Based Categorisation.
- Stockpile Inspection Tests.
- Ex-Situ Stockpile Testing (undefined waste classifications) and ASS Testing.
- Imported Material.
- Slurry and Dewatering.
- Material Tracking.
- Material Handling.
- Non-Conformances

11.1 Roles and Responsibilities

Table 6 below outlines the roles and responsibilities for the implementation of this MCMS.

Table 6 – Roles and Responsibilities for MCMS

Role	Responsibilities
Remediation Contractor	• Implementation of on-site procedures and protocols outlined in this MCMS document. • Ensure all subcontractors and consultants involved in the works are made aware of the processes and procedures within this MCMS. • The movement of material after verification from the remediation consultant is received. • Obtain, retain and manage all documentation for waste disposal, imported materials, material movements and stockpile management. All material movements are to be managed in a single or series of registers which can reconcile dates, quantities, material types, etc to a particular waste disposal, importation or intra-site movement event.

Role	Responsibilities
	• Provision of all reconciled waste, importation and intra-site material movements to the remediation consultant for review and incorporation in the final validation report.
Remediation Consultant	• Where classifications are not provided, further testing and classification of materials to be disposed off-site disposed. • verification of neutralisation of PASS in excavated material prior to disposal (or potential re-use onsite under remedial Option 4). • Verification and approval of imported materials in accordance with **Section 11 and 13.2**. • Visual inspection and supervision of excavation in areas of tar impact to confirm instances of presence (or absence following dig out) with verification testing. • Audits of the effectiveness of the waste disposal, imported material and intra-site movement tracking system. • Review of waste, importation and intra-site material movement data and incorporation into the validation report
Site Auditor	• Review and approve the MCMS. • Review and approve any ongoing amendments made to the MCMS. • Audits of the effectiveness of the waste disposal, imported material and intra-site movement tracking system to achieve site audit outcomes. • Review and endorsement of the validation report

11.2 Grid Based Categorisation

Material classifications for site materials has been completed in-situ with all materials within the basement footprint assessed in accordance with the Sampling, Analysis and Quality Plan (SAQP) ref *S-04478-AQL-SAQP-002* (EDP, 2022). The assessment methodology and waste classification outcomes are detailed in EDP 2023.

As alluded to in Section 10.3, a methodology for maintaining control of excavation progress is dividing the site into excavation 'grids' to aid in the tracking process. Each excavation gird would represent a single grid cell as defined in EDP, 2023 (grid cells ranged from 16 m to 20 m squares at up to 1 m depth intervals).

Based on the distribution of the EDP, 2023 locations a systematic sampling pattern reflecting a broad grid of boreholes was undertaken across the site. As an outcome of site access constraints, some points were moved marginally off-centre from a grid centroid. The majority of the site has been chemically classified as GSW with specific locations (hot spots) of chemically RSW or hazardous waste (HAZ).

A georeferenced excavation grid is to be placed over the site with a maximum 20 m square. Classified materials are to be excavated based on the grid and to the grid cell x, y and z extents. Error! Reference source not found. below describes an example of the naming convention for the gird cells excavations.

- X-Axis = Alphabetic
- Y-Axis = Numeric
- Z-Axis = Centre depth
- Classification = chemical classification and/or asbestos / undefined

Table 7 – Example Basement Bulk Excavation Lot Naming Nomenclature

Location	Description
X-Axis	Alphabetic (A, B, C…)
Y-Axis	Numeric (1, 2, 3…)
Z-Axis	Centre Depth (m)
Classification	As per EDP, 2023, or 'unconfirmed' (UNC)

An additional unique identifier may also be added for material excavation purpose, as the perimeter retention wall construction, piling, or dewatering, alternate identifiers are required. The following **Table 8** outlines the naming of various material types.

Table 8 – Unique Material Identification IDs

Material Source	Unique Identifier
Perimeter retention Wall	Perimeter retention wall panel number; eg DW10
Piling	Pile location number; eg PL11
Other Stockpile	Unique stockpile identifier

The nomenclature for a specific excavation cell with a confirmed classification from the bulk excavation may therefore be: "*A1-3.0-GSWA-BE*". The nomenclature for excavation from a specific excavation cell without a confirmed classification may be "*B2-13.0-UNC-BE*".

Hold Point 1: Application of georeferenced grid across investigation locations.

11.3 Stockpile Inspection Tests

Notwithstanding the classifications and excavation grid cell categorisations per Section 11.2. Each stockpile of excavated material will be assigned a unique stockpile ID or as defined by the in-situ grid number based upon the procedure in 11.2. This ID will track the movement of the stockpile while on site, and through to final disposal or placement.

The inspection process will commence at the beginning of excavation through to stockpile creation. The visual assessment will observe the nature of the excavated materials, noting colour, odour and any evidence of gross contamination which may differ from the in-situ classification (where available). The inspection will note the quantity (approximate percentage) and type of foreign materials present and the presence of asbestos, tar-impacted materials or any unexpected finds. All observations will be recorded on the stockpile Inspection and Test Protocol (ITP).

If the inspections identifies evidence of expected or unexpected finds, the protocols outlined in **Section 12.2** and **Section 12.3** should be followed

Hold Point 2: All stockpiles must be allocated a stockpile ID and noted on the stockpile ITP before any testing, treatment or movement can commence.

11.4 Ex Situ Stockpile Classification and Acid Sulfate Soil Verification

Materials that do not have an *in-situ* pre-classification are to be stockpiled onsite to allow sampling, analysis and subsequent classification by the Remediation Consultant in accordance with current guidelines. A stockpile ITP must be completed prior to disposal as per Section 11.3.

Once sampling and analysis has been completed (in accordance with the VSAQP, **Section 13**), all materials will be assigned an appropriate waste classification, as detailed below.

Table 9 – Waste Classifications

Waste Classification	Description
General Solid Waste	Materials classified as General Solid Waste (GSW) in accordance with the NSW EPA Waste Classification Guidelines (2014) will be transported to and disposed of at a lawfully licensed facility to accept this waste. Materials classified as General Solid waste must either have all results less than the Contaminant Threshold (CT) 1 criteria of Table 1 of the waste classification guidelines, or less than the specific contaminant concentration (SCC) 1 and associated toxicity standard leachate procedure (TCLP) in accordance with Table 2. Some general solid waste materials may be considered suitable for the licensed facility to recycle them. This is only if the materials meet the chemical criteria of CT1, plus the additional analytical criteria and acceptance limits of the environmental protection license held by the facility.
Restricted Solid Waste	Materials classified as Restricted Solid Waste (RSW) in accordance with the NSW EPA Waste Classification Guidelines (2014) will be transported to and disposed of at a lawfully licensed facility to accept this waste.

Waste Classification	Description
Hazardous Waste	Materials classified as Hazardous Waste (HW) in accordance with the NSW EPA Waste Classification Guidelines (2014) will be transported to and disposed of at a lawfully licensed facility to accept this waste. HW materials must be disposed to a facility with treatment capacity to stabilise the waste, after which a lower classification can be assigned prior to landfill disposal. HW materials cannot be directly placed in landfill cells.
Tar Containing Waste	Coal tar or coal tar pitch waste (being the tarry residue from the heating, processing or burning of coal or coke) comprising of more than 1% by weight of coal tar or coal tar pitch waste has been pre-classified by the EPA as Hazardous Waste in accordance with the Waste Classification Guidelines (2014). This material will be transported to and disposed of at a lawfully licensed facility to accept this waste, with proven expertise and capacity to stabilise tar contaminants prior to disposal.
Special Waste (Asbestos Waste)	Materials confirmed to contain asbestos (bonded or friable) will be classified as special waste (asbestos waste). In accordance with the Waste Classification Guidelines (2014), this material must also have a chemical classification, as outlined above. The chemical classification will determine the offsite disposal location of the material. All materials will be transported to and disposed of at a lawfully licensed facility to accept asbestos waste.
Virgin Excavated Natural Material (VENM)	VENM is defined by the Protection of the Environment Operations Act 1997 (POEO Act) 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 and that does not contain any sulfidic ores or soils or any other waste. It is expected that some sandstone rock materials underlying the site may meet this definition, with greater sandstone volumes expected within the eastern portion of the site.
Excavated Natural Material (ENM)	Excavated natural materials include naturally occurring rock and soil that has been excavated from the ground, contain at least 98% (by weight) natural materials and do not meet the definition of VENM. Fill materials meeting this description, may be suitable for classification as ENM. ENM materials must be assessed in compliance with and as compliant to the NSW EPA Excavated Natural Material Order 2014.
Site-Specific Resource Recovery Exemption	Materials that do not meet an existing resource recovery order (RRO) though might be considered to have a beneficial land application, may be considered for a site-specific resource recover order and exemption. This requires consideration of the physical and chemical status of the waste, and an application made to NSW EPA outlining the proposed reuse opportunity, risk assessment and demonstrated beneficial reuse characteristics.

Once each stockpile is formed and has a waste classification, it is to undergo ASS treatment in accordance with the ASSMP included in **Appendix D**. Verification testing will need to be undertaken by the remediation consultant to confirm the net acidity has been sufficiently neutralised to enable the stockpile to be disposed or placed.

A stockpile will not be removed from site until the ITP has been completed and verifies the material is as per the original (or new) classification, and the stockpile has an accompanying verification letter confirming ASS has been neutralised.

Hold Point 3: Stockpile ITP and ASS Verification Letter prior to disposal.

11.5 Imported Material

Prior to the importation of any materials onto site, they must first be confirmed as fit for purpose. Materials proposed for importation must be compared against set criteria before they can be considered fit for purpose.

Only material which meets the SAC for imported materials under **Section 7** and verified by the Remedial Consultant is considered approved for import. Details of the validation requirement for different types of imported materials is presented in **Sections 13.2.2** and **13.2.3**.

Any requirements, such as specific sampling/analytical requirements in accordance with the applicable NSW EPA RRO, must be reviewed by the Remediation Consultant, to ensure compliance with the relevant regulations. If the data is insufficient in accordance with the relevant DQIs (refer to **Section 13.4.3**), the materials will not be accepted onto site until additional data has been collected in accordance with the requirements of this RWP, and relevant regulatory requirements have been achieved to the satisfaction of the Remediation Consultant.

For all source sites or suppliers producing a blended product (such as an recycled aggregate), and importation verification certificate must be prepared which confirms material form a particular source site, or product from a particular supplier batch is acceptable for importation. The importation verification certificate must assess the materials compliance with the respective VENM, ENM or RRO requirements and confirm any further testing or inspections at the source site or supplier site meet the material descriptions.

Inspections of all imported materials accepted for importation onto site shall be undertaken by the Remediation Contractor or Remediation Consultant. This is required to ensure that imported materials meet the description of the material classification documentation. In the event that imported materials are observed by the Remediation Consultant to be inconsistent with that described in the documentation and/or that observed by the Remediation Consultant at the source site, the importation of soils from the specific source site(s) shall be suspended until such time as confirmatory sampling/analyses is to confirm the suitability of the materials for acceptance onto site.

Should the imported materials be rejected or suspended from use, the supplier will be contacted, and alternative sources will be sought.

Hold Point 4: Imported Material Verification Letter (prior to allowing imported material)

11.6 Slurry and Dewatering

Slurry produced from the perimeter retention wall installation will likely undergo settlement on-site prior to treatment. The solid settled portion may be waste classified in accordance with **Section 13.2.1**. Liquid components from the slurry may be direct disposed with a waste classification certificate or treated on-site through the treatment plant and discharged at an approved discharge location.

It is expected that spear pumps, or pumping from a drainage sump will be the primary dewatering methods. All pumped water will undergo treatment via the water treatment plant to meet the adopted discharge criteria whether to stormwater or a sewer connection.

11.7 Material Tracking

All materials removed from or imported to site as part of the remedial works must be tracked in order to verify that all materials are fit for purpose, appropriately classified and handled correctly. The material tracking system will detail origin, destination and quality of all materials handled as part of the required remediation.

For material disposal, the system will include tracking of:

- Waste classification of the material and report reference number
- Estimated volumes per load;
- Stockpile ITP and ID number (and corresponding grid cells IDs from which the pile was formed)
- ASS verification letter
- Tip dockets;
- Landfill recorded volumes; and
- Disposal information including dates, company, haulage registration numbers etc.
- Authorised transporters and reporting of information through Integrated Waste Tracking Solution (IWTS) for any disposal of hazardous wastes.

For material importation, the system will include tracking of:

- Estimated volumes per load;
- Supplier or Source site with appropriate supporting compliance documentation.

- Imported material verification letter confirming appropriateness of compliance documentation
- Placement details (where the imported material was placed on-site)

For intra-site movements, the system must be robust enough to document and control movements of material around the site for material destined for disposal. This is to avoid risks of cross-contamination. It is expected the most likely intra-site movement is from the following two scenarios:

- Movement of soil from a lime treatment pad to a particular stockpile bay of already treated and 'like' classified material. Or
- Movement of VENM classified within the LendLease remediation area to a location for future on-site re-use.

For water discharge, the system will include tracking of

- Discharge volumes
- Flow rates
- Recurrence of monitoring and compliance outcomes
- Dates of specific discharge events and durations

All soil and liquid materials handled will be tracked on a job specific Waste Tracking Register.

Hold Point 5: Establish a Waste Tracking Register prior to excavation, importation, disposal or discharge

11.8 Material Handling

11.8.1 Stockpiles

A designated stockpiling area must be established at the site for the wet perimeter retention wall spoil. This area should be within an area of existing hardstand surface that is clear of rubbish, rubble, structures and vegetation. Appropriate drainage systems as well as sediment and erosion control measures should be installed within this area, and maintained throughout the wall installation. These measures should include diversion drains and bunds, as well as silt fencing and hay bales where necessary.

As bulk excavation commences, designated stockpile areas must be established for different waste classification categories and liming treatment pads. These may be stockpile bays which receive ASS treated material. Stockpile bays must also have appropriate sediment and erosion control measures. Remaining stockpiles at the end of each day should be covered, weighted down and signposted.

A buffer zone must be established around each stockpile to enable easy access and prevent cross contamination between stockpiles.

11.8.2 Asbestos Decontamination and Cross-Contamination

As the majority of the spoil material to be excavated from the site has been classified as asbestos contaminated, engineered and administrative controls will need to be in place to maintain separation of asbestos and non-asbestos containing materials. Decontamination areas will be required to maintain this separation. Decontamination will be required of people and plant when crossing from an asbestos contaminated area into a non-asbestos contaminated area. These measures must be adopted to minimise exposure risk to workers and and avoid cross-contamination of excavated materials. All handling of asbestos contaminated material must be done in accordance with the protocols outlined in the AMP in **Appendix C.**

11.9 Disposal and Importation Criteria and Requirements

The following two subsection should be read in conjunction with **Section 13.2**, which outlines the appropriate sampling and analysis requirements to satisfy the criteria outlined below.

11.9.1 Off-Site Disposal

Materials that are required to be disposed off-site during the excavation works are to be classified for off-site disposal in accordance with NSW EPA (2014) Waste Classification Guidelines and managed in accordance with NSW EPA legislation. The relevant Waste Classification Guidelines include *Part 1: Classifying Waste 2014 and Addendum 2016; Part 2: Immobilisation of Waste and Part 4: Acid Sulfate Soils.*

11.9.2 Imported Materials

All imported materials must meet appropriate regulatory classifications to allow the lawful placement of the materials onsite. This is expected to include, but not limited to the following:

- Naturally quarried products.
- Virgin Excavated Natural Material (VENM) (as defined in POEO Act 1997).
- Excavated Natural Materials (ENM) Order 2014 (as defined by NSW EPA, 2014).
- Recovered Aggregate Order 2014 (as defined by NSW EPA, 2014).

The JBS RAP stipulated a minimum sampling density for the validation of imported material, requiring a minimum of ten samples per source site to be collected from exempted imported material. This level of sample may be onerous and not commensurate with the risk profiles of some materials to be imported. EDP propose a revised approach outlined below:

- Naturally quarried materials: visual inspection of the imported material at delivery to ensure compliance with associated certificates / report and completion of a waste tracking register;
- VENM: All imported materials classified as VENM must be accompanied by a classification report developed by a reputable Environmental Consultant with a supporting chemical analysis with defensible sampling rationale. The report must include clear address of the definition of VENM and how the VENM is clear of manufactured chemicals, process residues or sulfidic ores.
- ENM: All imported materials classified as ENM must be accompanied by a classification report developed by a reputable Environmental Consultant with compliant chemical testing in accordance with Table 1 of the NSW EPA Excavated Natural Material Order, 2014 (ENM Order).
- RRO: All imported RRO or EPA exempt materials must include visual inspection of the imported material either at the source site or upon delivery, either by the Remedial Contractor or Remedial Consultant. The material must be accompanied by a classification report developed by a reputable Environmental Consultant or the material producer confirming compliance with the RRO. In addition, waste derived materials must also undergo chemical assessment and compared to the **unsaturated soil** imported material SAC as provided in Table 5.8 of Section 5.6 of JBS, 2013. A snip of the image is provided in below. The acceptance criteria for asbestos is 0.00% for in-field weigh/weight screening assessments and laboratory quantitative analysis.

This criteria has been adopted as it provides an appropriately low level of contaminant concentration which upholds the desired quality of the material. This criteria is to be used as a guide and exceedances do not automatically mean a material is not acceptable onsite. Subjective risk based discussion can be provided by the remedial consultant to determine a material is ultimately acceptable and low risk for importation. The testing suite is not exhaustive, not do all analytes require testing, and subject to source site history or input materials during the production of the RRO material.

Table 5.8: Summary of Ecological Risk Based Criteria for Imported Fill to be Used at Barangaroo Central

Constituent	Ecological Investigation Level Protective of Surface Water	
	Saturated Soils	Unsaturated Soils
	mg/kg	mg/kg
Arsenic	4.6	18
Cadmium	0.1	0.2
Chromium (VI)[1]	18	70
Cobalt	1.7	6.7
Copper	6.8	27
Lead	46	190
Mercury	0.2	0.9
Nickel	210	850
Vanadium	300	1200
Zinc	20	79
Cyanide (free)	0.4	1.6
Ammonia	<LOR	<LOR
Benzene	0.1	0.3
Toluene	<LOR	0.1
Ethylbenzene	<LOR	0.1
Xylene	<LOR	0.1
Styrene	<LOR	0.4
Acenaphthene	0.4	1.5
Acenaphthylene	0.7	2.7
Anthracene	<LOR	<LOR
Fluorene	1.2	4.7
Naphthalene	1.6	6.4
Phenanthrene	0.1	0.5
2-methylnaphthalene	<LOR	<LOR
Benzo(a)pyrene	0.2[1]	0.7[1]
Fluoranthene	1.2	4.7
Pyrene	<LOR	0.1
Dibenzofuran	<LOR	<LOR
Cresols	<LOR	<LOR
2,4-dimethylphenol	<LOR	<LOR
TPH C_6-C_9	<LOR	<LOR
TPH C_{10}-C_{14}	<LOR	<LOR

1. To be assessed as per equivalent toxicity equivalence factor (TEF) to benzo(a)pyrene. Sum of carcinogenic PAHs to be summed, with multiplication of TEF, and assessed to benzo(a)pyrene criteria. As per WHO (2003) 'Polynuclear aromatic hydrocarbons in Drinking-water' relative potencies of Benz(a)anthracene – 0.1; Benzo(a)pyrene – 1.0; Benzo(b)fluoranthene – 0.1; Benzo(g,h,i)perylene – 0.01; Benzo(k)fluoranthene – 0.1; Chrysene – 0.01; Dibenz(a,h)anthracene – 1.0; and Indeno(1,2,3-c,d)pyrene – 0.1.

11.10 Non-Conformances

Although this MCMS has been developed to ensure compliance with site criteria and regulatory guidelines, non-conformances may occur due to the incorrect classification, disposal or placement of materials. Should review of tracking information identify that a breach of the MCMS has occurred, actions described **in Section 12.2.**4 of the RWCP will be implemented.

12. REMEDIATION WORKS CONTINGENCY PLAN (RWCP)

12.1 Overview

The purpose of the Remediation Works Contingency Plan (RWCP) is to outline procedures for the identification and management of unexpected issues or events that may occur during the remediation works.

This section outlines both expected and unexpected finds. Expected finds include encountering those substances identified through historical account for the site, and experience in the greater Barangaroo area. Unexpected finds include events that have not been previously encountered in other areas of the greater Barangaroo area or through environmental investigations.

Expected finds can be managed with minimum disruptions by appropriate planning. As unforeseen sub-surface conditions impose a degree of uncertainty for the remediation works, potential risks and/or unexpected issues or events have been identified as follows:

- Unexpected finds, including extensive liquid chemical contamination;
- Variation of contaminant characteristics or identification of unanticipated contaminants and materials;
- Generation of unacceptable levels of dust;
- Release of unacceptable levels of volatile gases during the excavation works;
- Generation of unacceptable odours from the excavation works;
- Generation of unacceptable noise and/or vibration levels during site works; and
- Spills and leaks of hazardous materials.

If any of the above or other events occur, the contingency procedure to be adopted is as follows:

- Remediation Consultant would undertake a preliminary assessment and determine if works could continue or would need to cease in order to determine changes to methodologies;
- Remediation Consultant would notify Aqualand and provide details of any changes to work methods required;
- If required, Remediation Consultant would conduct a detailed assessment (including sampling and analysis if required) and determine remedial/management actions;
- Remediation Consultant would direct Contractors to undertake any works required to secure the area, changes to methods or to continue.

12.2 Expected Finds/Events

The following sections outline those situations that have a likelihood of occurring during the remediation works.

12.2.1 Identification of Tar Impacted Materials

Any suspected tar impacted materials (i.e. based on odours, texture, consistency and discolouration) must be segregated from other excavated materials and placed in a designated area with appropriate odour controls until such time as an appropriate assessment and methodology is confirmed for their appropriate management. Tar impacted materials are considered Hazardous Waste in accordance with the NSW EPA Waste Classification Guidelines 2014, and will require disposal at a licensed waste facility with demonstrated ability to immobilise the waste prior to landfill disposal. This must be in accordance with an immobilisation approval from NSW EPA. Details of an example stabilisation trial required to demonstrate appropriate immobilisation and gain the NSW EPA approval is outlined in **Section 12.4**.

Should tar be encountered at the base of the proposed excavation or at wall edges during perimeter retention wall installation or bulk excavation beyond the proposed design limit, these will remain in-situ.

As coal tar is pre-classified as Hazardous Waste, it is not proposed that verification analysis be performed prior to removal to the licensed treatment facility. Following the stabilisation of the coal tar by the appropriate facility, confirmation analysis will be required prior to landfill disposal. Although the materials are in control of the licensed facility, the Remediation Contractor is responsible to ensure verification analysis and sign off occurs prior to disposal.

12.2.2 Identification of Asbestos Materials

The majority of fill material at the site has been pre-classifies as Special Waste (Asbestos). However, there are portions of the site (e.g. the general upper 1 m profile and within the former Block 5 remediation area) which have not identified asbestos. In the event that asbestos containing materials or materials that potentially contain asbestos are encountered in these portions, the materials will be characterised and validated as a hotspot (if possible) in accordance with **Section 13.2.1**.

As asbestos contaminated soils are pre-classified as Special Waste, no further chemical assessment is required should an appropriate pre-classification be in place. If the material has an undefined waste classification, ex-situ chemical analysis will be undertaken in accordance with **Section 13.2.1.**

All works will be controlled under the guidance of the site-specific AMP included in **Appendix C**, which will detail the controls required to be protective of human health throughout the remediation project.

Should asbestos be encountered at the base of excavation, or at wall edges during perimeter retention wall installation or bulk excavation beyond the proposed design limit these will remain in-situ and will be managed as determined through the validation and SAR process.

12.2.3 Materials Containment Breach

In the event that any materials storage containment controls are breached and stockpiled materials (including spoil leachate) have escaped or have the potential to escape, then the breach is to be corrected as soon as practicable. The management controls shall be rectified and investigations undertaken to review the adequacy of the controls and any improvements implemented. The CEMP must include a documented process for identifying, responding to, reporting and recording such incidents.

12.2.4 Placement of Inappropriate Materials

In the event that any part of site incorrectly receives material unsuitable for placement within it, then the following action shall be undertaken:

- Placement of material within the site shall be halted;
- The location of the incorrectly placed material shall be located using the GPS co-ordinates recorded at the time of placement;
- The area of the incorrectly placed material shall be dug out and stockpiled separately.
- The resulting excavation shall be validated as a hotspot in accordance with the VSAQP (**Section 13**) to demonstrate the remaining soils within the zone are compliant with the SAC, or the extent of the incorrectly placed material is visually verified to be removed.
- The recovered material shall be stockpiled separately on site, so a Stockpile ITP and Stockpile Release can be obtained;
- The stockpile can then be provided an stockpile ID and ITP, have further testing performed if required, waste classified and removed offsite;
- A review of management controls, communication plans and investigations shall be undertaken to assess the adequacy of the MCMS in view of the system failure; and
- Filling works shall recommence once any recommendations for improvements have been implemented.

The CEMP shall include a documented process for identifying and responding to such incidents. Details of each incident and of corrective actions are required to be documented in the Validation Report.

12.2.5 Emissions Complaints

Due to the nature of the activities and type of contaminants identified at the site, there is a potential for complaints to be received from members of the public relating to environmental emissions including:

- Odour emissions arising from handling of malodorous soil/groundwater;
- Noise and vibration arising from excavation and other works;
- Dust emissions arising from excavation, material handling and placement; and
- Silty water discharging to Darling Harbour.

Monitoring of all environmental emissions shall be undertaken during the works as detailed in the CEMP and appropriate actions taken to further control emissions following receipt of a complaint. Such additional controls may include the following actions, as appropriate, which are required to be detailed in the CEMP:

- Notification to the Client at the earliest opportunity;

- Notification to the Remediation Contractor at the earliest opportunity;
- Application of odour-masking chemicals on odorous materials to minimise odour emission;
- Disturbance of soils during meteorologically favourable periods only;
- Covering highly impacted soils which are generating excessive odours; and/or
- Ceasing discharge of water to Darling Harbour until remediation contractor remediate water with approved level.

12.2.6 Acid Sulfate Soils

Acid sulfate soils have been confirmed through the majority of the fill material at the site. ASS are to be managed in accordance with the 'Acid Sulfate Soil Management Plan' presented in **Appendix D**.

12.3 Unexpected Finds/Events

As a precautionary measure to ensure the protection of the workforce and the surrounding community, should any other unexpected potentially hazardous substance/event be identified, the procedure summarised in **Table 10** are to be followed.

The sampling strategy for each unexpected find shall be designed by a suitably qualified environmental consultant but would typically require testing at least 1:25 m^3. The required analysis will depend on the nature of the find and is to be determined by the Remediation Consultant.

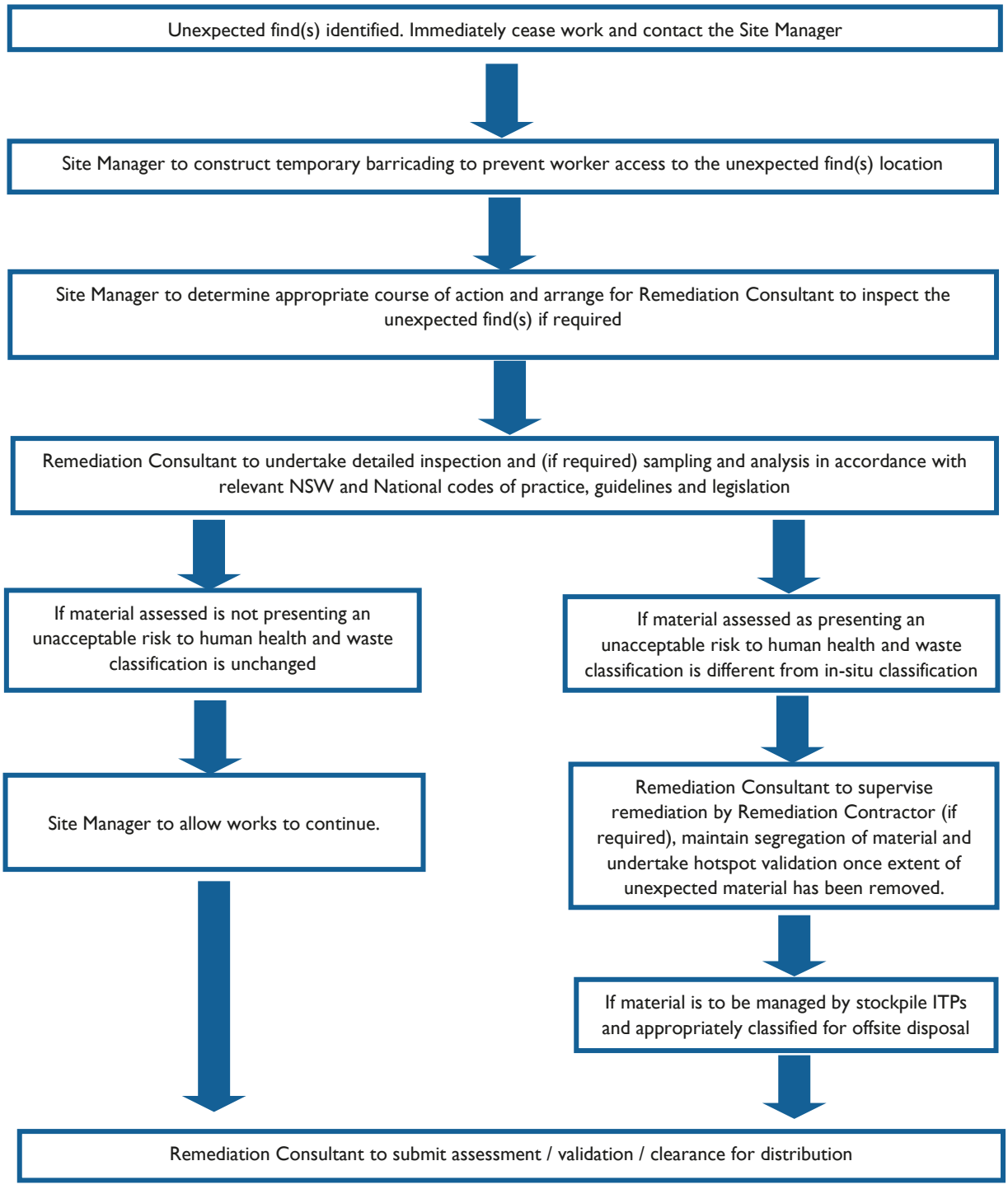
The strategy will, however, be aimed at determining the nature of the substance to understand

- if it is potentially hazardous and, if so, would further controls be required to protect human health during handling / disposal of the material?
- If the material chemical composition varies from existing in-situ waste classification assigned to it?

Whether the substance if hazardous or has a varying waste classification, shall be determined by collection and chemical analysis of representative samples of the substance by the Remediation Consultant. The sampling frequency of the identified substance/materials shall meet the minimum requirements set out in **Section 13.2.1**.

Validation following removal of an unexpected find must follow all quality protocols outlined in the VSAQP. Once the material is visually anticipated to be removed, the walls and excavation base will require validation, or that material classification is adopted until the horizontal and vertical extents of that grid cell.

Table 10 – Unexpected Finds Procedure



12.4 Example Stabilisation Trial

Coal tar materials are known to be present in the southern portion of Central Barangaroo, and it is possible for tar to be identified at the site. Stabilisation trials and *ex situ* stabilisation has been successfully achieved for early works in the Barangaroo area. Prior to the adoption of previously confirmed methodology, EDP propose that coal tar materials are disposed of at a waste contractor with existing approvals to treat coal tar as a priority. However, if a suitable receiver can't be identified, the stabilisation methodology below would apply and be completed in consultation with the NSW EPA.

The stabilisation methodology below can apply to gross tar contamination, or significantly elevated hydrocarbons impacted soils.

12.4.1 Suggested Methodology

- Collect bulk soil samples contaminated with coal tar / or high concentrations of hydrocarbons;
- Air-dry and homogenise;
- Laboratory analysis (total concentrations) of PAHs and TRH/TPH;
- Laboratory analysis (leachate concentrations) of PAHs and TRH. The leachate tests shall include:
  - Toxicity Characteristic Leaching Procedure (TCLP);
  - Australian Standard Leaching Procedure (ASLP); and
  - Multiple Extraction Procedure (MEP).
- Assess multiple treatment rates using the following expected treatment rates (established in earlier works at Barangaroo) as a midpoint:
  - 5% RemBind-FO and/or other stabilising agents;
  - 10% Portland Cement including alternative percentages;
  - Other additives that may increase chemical stabilisation of contaminants;
  - Analysis of treated samples for PAH and TPH (in TCLP, ASLP and MEP) and unconfined compressive strength (UCS); and
  - Report results in comparison to the NSW EPA Waste Classification Guidelines 2014.

It was noted in previous studies that bulk coal tar required physical stabilisation with the addition of 40-50% fly ash to achieve the UCS.

13. VALIDATION SAMPLING, ANALYSIS AND QUALITY PLAN

The objective of this VSAQP is to describe the sampling, analytical and quality programs to be undertaken during validation sampling works of soil during and following basement excavation. This VSAQP applies to all bulk excavated material, basement floors and walls, impacted 'hotspots' and imported materials to the EWDA-02 footprint.

13.1 Data Quality Objectives

In determining the type, quantity and quality of data needed to support decisions relating to the remediation of the site, the seven-step Data Quality Objective (DQO) approach has been undertaken in accordance with NSW *EPA Contaminated Land Management – Guidelines for the NSW Site Auditor Scheme (3nd Edition), 2017* (NSW EPA, 2017) and the *Schedule B2 – Site Characterisation* of the NEPM, 2013. The DQO's are presented in detail in the following sections.

13.1.1 Step 1: State the Problem

The site and the wider Central Barangaroo is to the north of the former gas works operations that have resulted in significant contamination of regions of the Barangaroo precinct. The site has also been reclaimed over 60 years

ago with material of unknown origin. The fill thickness extends to depths greater than 16.0 mbgl in deeper areas of the proposed excavation.

The site is proposed for redevelopment for eventual mixed residential (with basement carpark) and commercial (retail) land use.

Historical (2007) and recent (2022) investigations conducted on the site have identified generally a low level of contamination exists in the fill materials, with the typical contaminants of concern including TPH, PAHs, heavy metals and asbestos. However, localised areas of heavy contamination (TPH, PAHs and heavy metals), including free tar, have been identified in the southern portion of the site.

While the majority of these heavy impacts will be removed as a result of the bulk excavation, the worst of the impacts are known to exist along the proposed southern perimeter retention wall and are likely to remain on the immediate exterior of the wall once installed. The risk the contaminated soil and groundwater may pose to eventual human receptors inside the wall by either vapour inhalation or direct contact with groundwater seeps through the wall is unknown.

13.1.2 Step 2 Identify the Decisions

The decisions to be made based on the results of the validation program are as follows:

- Have the remediation works been undertaken in accordance with this RWP?
- Has the methodology proposed achieved the objectives outlined within this RWP?
- Does the HHRA suggest a low human health and environmental risk following construction of the wall?
- Can it be verified the wall and slab structures been built according to design?
- Are the finished wall and slab structures 'as-builts' commensurate with the HHRA model assumptions?
- Is there a requirement for a Long-term Environmental Management Plan?

13.1.3 Step 3 Identify Inputs to the Decisions

The inputs required to make the above decisions are as follows:

- Soil and groundwater data from historical (2007) and recent investigations (EDP, 2023);
- Site specific risk assessment for soil and groundwater (HHRA);
- Reconciled Waste Tracking Register for all waste disposal, material import, intra-site movement and water discharge;
- Water discharge monitoring;
- CQC and ITP documentation; and
- Finished as-built drawings

13.1.4 Step 4 Define the Boundaries

The boundaries of the remediation works have been identified as follows:

- Spatial boundaries – This remediation work is limited to the in-situ materials proposed for removal during the basement construction, piling and bulk excavation or earthwork activities associated with EWDA-02 **Appendix A**. The vertical extent is limited to the maximum bulk excavation depth of -12.7 reduced level (RL) plus the depth of proposed piles beneath the slab, including groundwater;
- Temporal boundaries – the temporal boundary is limited to the data collected during the soil and groundwater investigation works undertaken between July and November 2022 by EDP, supported by the historical data available from 2007; and

13.1.5 Step 5 Develop a Decision Rule

The decision rules for the remediation works are as follows:

1. If remediation works cannot be successfully conducted within the methodologies (Options 3 and 4) presented in this RWP, an alternate remedial option or revision to the current strategy may be undertaken; and
2. If sampling or inspection of imported materials fails the SAC or other regulatory requirements, materials will be rejected. If material is received on site without supporting compliance certificates or reports, the material will be rejected.
3. If water treatment shows repeated and consecutive (two) failures of the discharge criteria, discharges will stop until the treatment is demonstrated to be comply again. This is rule doesn't supersede any other specific discharge permit conditions.
4. If the HHRA indicates there is an ongoing risk to human health or the environment based on historical and current soil and groundwater investigation data, further design considerations regarding the basement construction will be required to ensure the eventual suitability of the site for the proposed mixed commercial and residential use. Depending on the outcome of the design updates (if required) a LTEMP may also be required.
5. If the construction quality control (CQC) or inspection test protocols (ITPs) show the perimeter retention wall or hydrostatic slab have been constructed with defects, not as per the HHRA assumptions, or not as per the design the following should be undertaken to ensure the eventual suitability of the site for the proposed mixed commercial and residential use:
    a. Update of the HHRA to accommodate the impact of the defect or variance to the design
    b. Design additional controls for the basement construction to mitigate defects or variances to the design and update the HHRA.

13.1.6 Step 6 Specify Limits on Decision Errors

The acceptable limits on decision errors to be applied in the remediation and characterisation works and the manner of addressing possible decision errors have been developed based on the Data Quality Indicators (DQIs) of precision, accuracy, representativeness, comparability and completeness.

The potential for significant decision errors are to be minimised by:

- Completing a robust Quality Assurance/Quality Control (QA/QC) assessment of the validation data and application of the probability that 95% of data will satisfy the DQIs, therefore a limit on the decision error will be 5% that a conclusive statement may be incorrect. A 95% confidence in data driven conclusions applies to:
    - Historical and current investigation data
    - Imported material sampling
    - HHRA conclusions
    - ASS verifications
    - Water discharge
    - Disposal volume variances between estimated and actual volumes (tonnages)
- All CQC and ITP documentation required for the perimeter retention wall and hydrostatic slab construction have 'passed' with structural engineer sign off and all documentation and inspections have been undertaken in accordance with the inspection hold points and timeframes per applicable Australian Standards

13.1.7 Step 7 Optimise the Design

The remediation plan is designed to ensure that the site can be made suitable for the proposed mixed commercial and residential use and that the remedial objectives have been undertaken successfully by implementing:

- Clear requirements on the grid georeferencing and grid cell nomenclatures, to control the excavation tracking of in-situ classified materials for intra-site movements and during off-site disposal
- Additional sampling and testing requirements where classifications are 'undefined' or for ASS neutralisation.

- Verification checks through document reviews, material inspections and supporting analysis (if required) on imported materials
- Establishment of the CQC and ITP requirements to ensure the structural elements of the remediation have been installed to recognised quality standards and in accordance with the HHRA assumptions.

13.2 Validation Sampling and Analysis Plan

The sampling frequencies and analytical plan is summarised in the following subsections.

13.2.1 Materials for Offsite Disposal

For materials excavated from the site which have an undefined waste classification per EDP, 2023, these will require appropriate classification in accordance with the NSW EPA Waste Classification Guidelines 2014. The excavated material is to be stockpiled onsite to allow sampling, analysis and subsequent classification by a qualified Environmental Consultant. Following the stockpile inspections, if there is evidence to suggest the material is inconsistent with any in-situ classification, further assessment of the material is required to confirm or otherwise reclassify the material.

Sampling frequencies for waste classification are to be as per the NSW EPA Sampling Design Part 1 – Application guidelines (NSW EPA, 2022).

Sampling frequencies for ASS verification sampling post lime treatment are per the ASSMP in **Appendix B.**

Should tar impacted material be encountered, this will require classification and management prior to disposal as discussed in **Sections 12.2.1 and 12.4**.

13.2.2 Validation of Quarried Materials for Importation

No specific validation analysis is required for quarried products. However, as explained in **Section 11**, visual inspection of the imported material at delivery to ensure compliance with associated certificates / report and completion of a waste tracking register;

13.2.3 Validation of VENM or ENM Imported Materials

The validation of imported materials is required to confirm that the materials meet the definition of VENM or ENM, and that they are suitable for the site, in consideration of the future and ongoing land use. This validation must include:

- Assessment of the materials origin. Materials to be used for landscape media should ideally be sourced from a known and reliable source.
- Imported material must be certified as VENM or ENM and must be supported by the appropriate certification documents as well as the results from laboratory analysis conducted on the material. Where considered necessary by the Environmental Consultant, the source is to be inspected to confirm the integrity and reliability of the certification prior to importation.
- Imported materials must be assessed (inclusive of documentation review and sampling) on a 'per source' basis.
- Sample collection and validation of imported materials must be undertaken by a reputable Environmental Consultant prior to the importing of these materials at the site.
- For VENM Classifications – the VENM report must have minimum of three samples per source site with a defensible rationale on the sampling analysis suite and frequency. The analysis must including at a minimum (and appropriate to source site) heavy metals, TRH, BTEX, PAH, OCP, PCBs and asbestos (0.1 g/kg), The report must demonstrate compliance with the definition of VENM under POEO Act.
- For ENM Classifications – the ENM report must satisfy the analysis and sampling requirement of the *NSW EPA Resource Recovery Order, Excavated Natural Materials Order, 2014* with discussion and explanation demonstrating compliance with the ENM Order;

- An inspection and documentation of each load imported to the site for consistency with source site is required; and
- Incorporation of the imported material verification and any additional confirmatory results into the SRVR.

13.2.4 *Validation of non - VENM / ENM Imported Materials*

In the event that materials do not meet the definition of VENM or ENM that require importation onto site (e.g., recovered aggregate), approval and assessment must be undertaken of such materials due to the increased risk of asbestos and other contaminants not required to be tested under the relevant EPA Orders. The required assessment must be satisfactory in confirming site suitability to ensure materials meet the adopted SAC.

The assessment must be designed on a case-by-case basis, based on the nature and potential risk posed by the materials. Commercial aggregate suppliers produce a variety of product types typically distinguished by the aggregate mix or sizing, these products are created at the commercial facility which receives raw aggregate materials from a multitude of source sites, which are then blended and crushed. Moreover, a commercial aggregate supplier may have multiple production/batch facilities across a city area which they distribute products from. This complexity makes it near impossible to validate 'the source' site. In this instance, the validation process for aggregates will be on a 'per supplier' basis. Provided the supplier issues a statement of compliance for all their products, and it can be demonstrated through sampling on a representative selection of the products that the material is compliant with SAC, products provided by that supplier are considered validated. Periodical testing at the following frequencies (whichever the sooner) must be conducted to ensure quality is maintained:

- 3 x samples once per month on a selected product imported.
- 3 x samples per 250 m^3 of import
- All analysis must test, at a minimum, for TRH, BTEX, heavy metals, PAHs and asbestos as asbestos fines (AF) and fibrous asbestos (FA) and compared to applicable concentrations provided in the snip of Table 5.8 from JBS, 2013, as shown in **Section 11.9.2.**

13.2.5 *Groundwater and Dewatering*

No groundwater remediation or ongoing monitoring is proposed under this RWP. As the remedial method involved removal and disposal of fill material within the boundary of the site, there is not anticipated to be any residual contamination within the site which would present an ongoing health or environmental risk.

On pumped groundwater through a dewatering process will be sampled. The sampling will occur post treatment at frequencies nominated in the CEMP documentation and discharge permits which outline the quality standards and allowable flows at prescribed discharge points.

13.2.6 *Stockpiled Soils*

Where samples are obtained from stockpiles, they will be collected from at least 0.3 m beneath the surface of the stockpile. No composite samples are proposed. The hand tools, if used, will be thoroughly decontaminated using a solution of a phosphate-free detergent and deionised water between each sampling location. During the collection of soil samples, features such as material uniformity, seepage, discolouration, staining, foreign materials, presence/absence of visible asbestos-containing materials, odours and other indications of contamination will be noted on the field documentation.

Collected soil samples will be immediately transferred to laboratory-supplied glass jars and sealed using Teflon-lined screw caps and filled so that there is minimum headspace. Sample labels will record job number; sample identification number; sampler's initials; and date and time of sampling. Sample containers will be transferred to a chilled ice box for sample preservation prior to and during transport to the testing laboratory. A COC form will be completed and forwarded with the samples to the testing laboratory.

13.3 Perimeter Retention Wall and Hydrostatic Slab CQCP, CQC and ITP

Prior to commencement of construction works, 'for-construction' drawings are to be reviewed by a certified structural engineer to verify the construction design meets or exceeds the HHRA input assumptions.

Adequate supervision and monitoring of the construction of the perimeter retention walls and hydrostatic slab design elements are required to ensure compliance and document that these elements are constructed in accordance with appropriate specifications. A combination of 'as built' drawings verified by a structural engineer are required to be produced to demonstrate the final finished structures. To support the as-built drawings, a construction quality control plan (CQCP) must be prepared by a structural engineer to establish the quality and inspection framework and requirements for all structural / construction elements. The CQCP will also outline what specific construction quality control (CQC) and inspection test protocol (ITP) documentation must be provided to demonstrate the quality of the construction method and inspections to ensure no material defects have/could occur.

The as-built drawings with supporting CQCs and ITPS must be incorporated into the final validation report.

13.4 Quality Assurance and Quality Control Plan

The field and laboratory quality assurance and quality control plan to be adopted for the remediation works has been designed to achieve pre-determined DQIs that will demonstrate the precision, accuracy, representativeness, completeness and comparability of the data set and that the data set is of acceptable quality to meet the objectives of the works.

The specific quality assurance and quality control plan for the field and laboratory components of the investigation have been developed based on NSW EPA, 2017 and NSW EPA, 2020, and are detailed below.

13.4.1 Field QA/QC

The field quality assurance procedures to be adopted and the field quality control samples to be collected during the remediation works and the corresponding acceptable control limits are presented in the table below.

Table 11 – Field QA/QC

Data Type	Comments and Acceptable Control Limits
Field Personnel	Use appropriately trained field personnel employing procedures listed in this RWP.
Field Data Collection	All data collection to be undertaken in accordance with this RWP. Site conditions and sample locations properly described. Information to be recorded in field notes. Field notes are appropriately completed and included in the report on the works.
Sample Handling (storage and transport)	Soil and water samples will be collected into the appropriately preserved sample containers supplied by the analytical laboratory and each sample will be characterised by a unique number. The sample containers will be stored on ice in a chilled, insulated container until received by the analysing laboratory. Sample numbers, dates, preservation and analytical requirements will be recorded on Chain-of-Custody (COC) documentation, which will also be delivered to the analytical laboratory. All samples are required to be documented as received by the laboratory chilled and intact.
Calibration of Field Equipment	PID will be calibrated using iso-butylene gas (100 ppm) at the start of each day of sampling and at a number of times during each day. A record of the calibrations undertaken will be kept and included in the report. Water quality meters will be calibrated prior to each monitoring event. A record of the calibrations undertaken will be kept and included in the report.
Field Intra/Inter-Laboratory Duplicates	Intra and inter-laboratory duplicates will be collected and analysed at a rate of 1 in every 10 primary samples. Duplicate samples will be labelled so as to conceal their relationship to the primary sample from the laboratory. It is expected that RPD's would be less than 30%, and if not, liaison with the laboratory will be undertaken and samples will be reanalysed, if required.

Data Type	Comments and Acceptable Control Limits
Rinsate Blanks	Rinsate blank samples (from an item of sampling equipment) will be collected and analysed at a rate of one per piece of re-useable equipment per day of sampling. Concentrations of analytes to be less than LORs.
Trip Blanks	Laboratory prepared trip blanks will be utilised during the sampling program (soil and groundwater). Trip blanks will be laboratory prepared where possible and filled with deionised water prior to sampling and remain in the sample storage container (esky) until the samples are removed by the receiving laboratory. Concentrations of analytes to be less than LORs.
Trip Spikes	Laboratory prepared trip spikes will be utilised during the sampling program (soil and groundwater). Trip spikes will be laboratory prepared prior to sampling events and remain in the sample storage container (esky) until the samples are removed by the receiving laboratory. Concentrations of analytes to be within 70-130% of the expected range.

13.4.2 Laboratory QA/QC

The laboratory quality assurance procedures to be adopted and the internal laboratory quality control samples to be analysed and the corresponding acceptable control limits are presented in the table below.

Table 12 – Laboratory QA/QC

Data Type	Comments and Acceptable Control Limits
Sample Analysis	All sample analyses to be conducted using NATA certified laboratories which will implement a quality control plan in accordance with NEPM 2013.
Holding Times	Maximum acceptable sample holding times: • Volatile organic analysis: Soil: 14 days; Water (and rinsate samples): 14 days; • Inorganic analysis: Soil: 3 months; Water (and rinsate samples): 3 months • Dioxins: Water:1 year; Soil: 1 year • Cyanide: Soil: 14 days; Water: 14 days • Ammonia: Water: 28 days
Laboratory Detection Limits	All laboratory LORs to be less than the SAC.
Laboratory Blanks	Laboratory blanks to be analysed at a rate of 1 in 20, with a minimum of one analysed per batch. Concentration of analytes to be less than the laboratory detection limits.
Laboratory Duplicates	Laboratory duplicates to be analysed at a rate of 1 in 20, with a minimum of one analysed per batch. RPDs to be less than 30%.
Laboratory Control Samples (LCS)	LCSs to be analysed at a rate of 1 in 20, with a minimum of one analysed per analytical batch. Control limits: Control limits: 70 to 130 % Acceptable Recovery and if not, liaison with the laboratory will be undertaken and samples will be reanalysed, if required.
Matrix Spikes	Matrix spikes and matrix spike duplicates prepared by dividing a field sample into two aliquots, then spiking each with identical concentrations of the analytes at a rate of 1 in 20. Matrix spike control limits: 70–130 % Acceptable recovery and if not, liaison with the laboratory will be undertaken and samples will be reanalysed, if required. Matrix spike duplicates: RPDs <30% and if not, liaison with the laboratory will be undertaken and samples will be reanalysed, if required.

13.4.3 Data Quality Indicators

Acceptance limits on field and laboratory data collected for the remediation and validation works have been established above. A summary of the data quality indicators (DQIs) and the corresponding measures to be applied for the investigation are presented in the table below.

Table 13 – Summary of DQIs

DQI	Field	Laboratory	Acceptability Limits
Precision	Sampling methodologies appropriate and complied with. Collection of intra/inter-laboratory duplicate and inter-laboratory duplicate samples	Analysis of: • Field intra/inter-laboratory duplicate samples (1 in 10 samples) • Laboratory duplicate samples	RPD of <30% (raised for results close to LOR)
Accuracy	Sampling methodologies appropriate and complied with. Collection of rinsate blanks	Analysis of: • Rinsate blanks (1/day/equipment) • Method blanks • Matrix spikes • Matrix spike duplicates • Laboratory control samples • Laboratory prepared spikes • Reagent blanks • Reference materials	• <LORs • <LORs • 70 to 130% • RPD of <30% • 70 to 130% • 70 to 130% • <LORs • Varies
Representativeness	Appropriate media sampled according to SAQP All media identified in SAQP sampled.	All samples analysed according to RWP.	All samples analysed according to RWP.
Comparability	Same sampling methodologies used on each day of sampling Experienced sampler Climatic conditions Same types of samples collected	Same analytical methods used (including clean-up) Sample laboratory detection limits (justify/quantify if different) Same laboratories (NATA accredited) Same units	As per NEPM 2013 < nominated criteria
Completeness	All critical locations and media sampled All samples collected Sampling methodologies appropriate and complied with Experienced sampler Documentation correct	All critical samples analysed and all analytes analysed according to VSAQP Appropriate methods Appropriate laboratory detection limits Sample documentation complete Sample holding times complied with	As per NEPM 2013 As per NEPM 2013

In the event that a DQI is not met by laboratory analyses, the field observations relating to the nature of the samples will be reviewed and if no obvious source for the non-conformance is identified, such as an error in sampling, preservation of sample/s or heterogeneity of sample/s, liaison with the laboratories will be undertaken in an effort to identify the issue that has given rise to the non-conformance and additional analyses will be undertaken on the original sample/s, on duplicate samples or on other samples, if required.

If no explanation for the non-conformance is identified, the concentrations for the affected samples will be marked as estimates.

14. ENVIRONMENTAL WORK HEALTH AND SAFETY

A site-specific Environmental WHS (EWHS) Plan must be prepared by the Remediation Contractor prior to the commencement of remediation works and reviewed/approved by the Remediation Consultant. The information contained in this section was prepared in the JBS RAP and shall be incorporated into the WHS Plan. The site-specific CEMP should also include detailed environmental controls required based on the proposed methodology to be implemented by the Remediation Contractor. The environmental controls listed in the CEMP should include the requirements listed in the development application for the site.

The EWHS Plan shall contain procedures and requirements that are to be implemented as a minimum during the works, in addition to the RWCP. The objectives of the WHS Plan are to:

- Apply standard procedures that minimises risks resulting from the works;
- Ensure all employees are provided with appropriate training, equipment and support to consistently perform their duties in a safe manner; and
- Have procedures to protect other site workers and the general public. These objectives will be achieved by:
  - Assignment of responsibilities;
  - An evaluation of hazards;
  - Establishment of personal protection standards, mandatory safety practices and procedures;
  - Monitoring of potential hazards and implementation of corrective measures; and
  - Provision for contingencies that may arise while operations are being conducted at the site.

In addition to the normal construction-related matters, the WHS Plan shall address the following site-specific hazards associated with the works relating to the management of contaminated soil and groundwater:

- Under/aboveground services, specifically former gasworks infrastructure (if any);
- Use of plant and machinery within confined spaces (i.e. excavations);
- Contact with contaminated soil (incl. dust), groundwater and vapours, including requirements for specific Personal Protective Equipment (PPE);
- Handling of potentially asbestos containing materials;
- Operation of water treatment plant; and
- Heat/Cold stress.

The Plan must detail the PPE and decontamination requirements to be followed to control the risks posed by potential exposure to chemical contaminants at the site, including consideration of the asbestos management plan (AMP) controls.

15. REPORTING

15.1 Validation Report

At the completion of the works detailed within this RWP, the results of the works will be presented in a site remediation and validation report (SRVR) that will be prepared in general accordance with the NSW EPA Consultants Reporting on Contaminated Land guidelines (EPA 2020) and with other relevant guidelines endorsed by NSW EPA and must be of sufficient reliability to allow the Site Auditor to compete the Site Audit Statement.

Interim validation reports may be prepared for the site and later combined in an overall site Validation Report. The program for validation reports will be developed in consultation with the Auditor.

The validation report shall include:

- Details of the remediation works conducted;
- Information demonstrating that the objectives of the RWP had been achieved, in particular that the results and assessment of the data against both the pre-defined data quality objectives and the remediation criteria;

- Any variations to the strategy undertaken during the implementation of the remedial works;
- Details on volumes of materials removed;
- A photographic record of the works;
- Details on waste classification, tracking and off-site disposal;
- Results of environmental monitoring undertaken during the course of the remedial works;
- Details of any environmental incidents occurring during the course of the remedial works and the actions undertaken in response to these incidents;
- Verification of regulatory compliance;
- Detail of imported materials;
- Documentation of visual inspections;
- Details on the reinstatement works undertaken;
- Validation of compliance with CEMP;
- Results of groundwater monitoring;
- Recommendations regarding the need for a LTEMP;
- Comment on the site's compliance with the RAP/SAR and the RAP objectives;
- Reporting on waste management; and
- Recommendations on the requirements for future groundwater monitoring, or additional soil validation sampling.

15.2 Materials Tracking and Compliance

Routine reports are required to monitor the progress of remediation and compliance with the MCMS. An audit of the MCMS and waste tracking register will be required early in the project works and on a month-by-month basis, to ensure all required information is being recorded appropriately and adequate records retained. The materials tracking and compliance reports will include:

- Summary of remediation works performed in the reporting period;
- Quantity and classification of materials disposed offsite;
- Quantity and quality of materials imported to the site;
- Reporting of the above in compliance of the MCMS;
- Description of non-conformances and corrective action; and
- Provision of waste tracking records and forms.

15.3 Summary of Hold Points

The **Table 14** below summarises the hold points required throughout the remediation works.

Table 14 – Summary of Remediation Hold Points

No #	Section	Description	Responsible
1	11.2	Application of georeferenced grid	Aqualand & Remediation Consultant
2	11.3	Labelling and tracking of Stockpiles	Remediation Consultant
3	11.4	Verification of stockpile treatment for disposal	Remediation Consultant
4	11.5	Verification prior to allowing importation of material	Remediation Consultant
5	11.7	Establishment of a waste tracking register	Remediation Consultant

16. CONCLUSION

Based on the low-risk conclusion derived for the site in the HHRA, it is considered that the site would be pose a low and acceptable risk for residential and commercial (retail) users, following proposed remedial works undertaken as detailed in this RWP.

Based on the low-risk conclusion derived for the site in the HHRA and providing the successful impletion of this RWP and corresponding validation, it is envisaged that a long term environmental management plan will not be required.

17. REFERENCES

CRC Care 2013, Petroleum Hydrocarbon Vapour Intrusion Assessment: Australian Guidance, CRC Care Technical report no. 23, CRC for Contamination Assessment and Remediation of the Environment, Adelaide Australia.

Driscoll, T. 2013, The Use of Asbestos-Contaminated Soils on Barangaroo.

NEPC 2013, National Environment Protection (Assessment of Site Contamination) Measure 1999 (amended in April 2013), National Environmental Protection Committee, Canberra.

NSW EPA 2014a, Protection of the Environment Operations (Waste) Regulation 2014, New South Wales Environmental Protection Authority.

NSW EPA 2014b, Waste Classification Guidelines Part 1: Classifying Waste, and Addendum to Part 1: classifying waste (2016), New South Wales Environmental Protection Authority.

NSW EPA 2014c, Waste Classification Guidelines Part 2: Immobilising waste, New South Wales Environmental Protection Authority.

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NSW EPA 2014e, The Excavated Natural Materials Exemption, New South Wales Environmental Protection Authority.

NSW EPA 2014ef, The Excavated Natural Materials Order, New South Wales Environmental Protection Authority.

NSW EPA 2017, Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (3rd Edition)

NSW EPA 2020, Consultants Reporting on Contaminated Land.

NSW EPA 2022, Contaminated Sites: Sampling Design Part 1 – Application.

VIC EPA 2009, Industrial Waste Resource Guidelines, Soil Sampling publication IWRG702.

Statement of limitations

This document has been prepared in response to specific instructions from the client to whom the report has been addressed. The work has been undertaken with the usual care and thoroughness of the consulting profession. The work is based on generally accepted standards, practices of the time the work was undertaken. No other warranty, expressed or implied, is made as to the professional advice included in this report.

The report has been prepared for the use by the client and the use of this report by other parties may lead to misinterpretation of the issues contained in this report. To avoid misuse of this report, EDP advise that the report should only be relied upon by the client and those parties expressly referred to in the introduction of the report. The report should not be separated or reproduced in part and EDP should be retained to assist other professionals who may be affected by the issues addressed in this report to ensure the report is not misused in any way.

EDP is not a professional quantity surveyor (QS) organisation. Any areas, volumes, tonnages or any other quantities noted in this report are indicative estimates only. The services of a professional QS organisation should be engaged if quantities are to be relied upon.

Sampling Risks

EDP acknowledges that any scientifically designed sampling program cannot guarantee all subsurface contamination will be detected. Sampling programs are designed based on known or suspected site conditions and the extent and nature of the sampling and analytical programs will be designed to achieve a level of confidence in the detection of known or suspected subsurface contamination. The sampling and analytical programs adopted will be those that maximises the probability of identifying contaminants. The client must therefore accept a level of risk associated with the possible failure to detect certain subsurface contamination where the sampling and analytical program misses such contamination. EDP will detail the nature and extent of the sampling and analytical program used in the investigation in the investigation report provided.

Environmental site assessments identify actual subsurface conditions only at those points where samples are taken and when they are taken. Soil contamination can be expected to be non-homogeneous across the stratified soils where present on site, and the concentrations of contaminants may vary significantly within areas where contamination has occurred. In addition, the migration of contaminants through groundwater and soils may follow preferential pathways, such as areas of higher permeability, which may not be intersected by sampling events. Subsurface conditions including contaminant concentrations can also change over time. For this reason, the results should be regarded as representative only.

The client recognises that sampling of subsurface conditions may result in some cross contamination. All care will be taken and the industry standards used to minimise the risk of such cross contamination occurring, however, the client recognises this risk and waives any claims against EDP and agrees to defend, indemnify and hold EDP harmless from any claims or liability for injury or loss which may arise as a result of alleged cross contamination caused by sampling.

Reliance on Information Provided by Others

EDP notes that where information has been provided by other parties in order for the works to be undertaken, EDP cannot guarantee the accuracy or completeness of this information the client therefore waives any claim against the company and agrees to indemnify EDP for any loss, claim or liability arising from inaccuracies or omissions in information provided to EDP by third parties. No indications were found during our investigations that information contained in this report, as provided to EDP, is false.

Recommendations for Further Study

The industry recognised methods used in undertaking the works may dictate a staged approach to specific investigations. The findings therefore of this report may represent preliminary findings in accordance with these industry recognised methodologies. In accordance with these methodologies, recommendations contained in this report may include a need for further investigation or analytical analysis. The decision to accept these recommendations and incur additional costs in doing so will be at the sole discretion of the client and EDP recognises that that the client will consider their specific needs and the business risks involved. EDP does not accept any liability for losses incurred as a result of the client not accepting the recommendations made within this report.

Appendix A: Figures

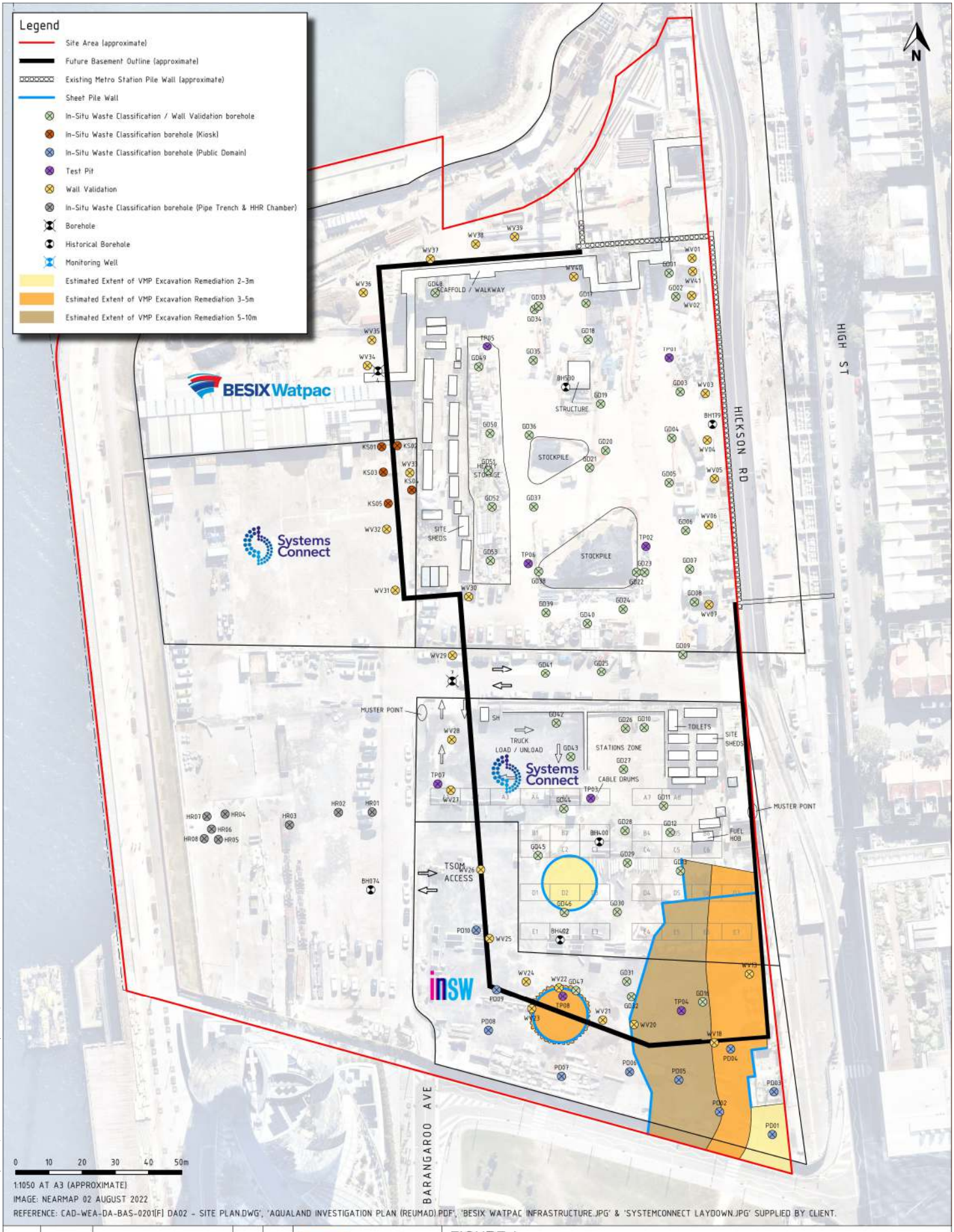

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IMAGE: NEARMAP 02 AUGUST 2022
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VER	DATE	AMENDMENTS	DRW	CKD
V1	22/12/2022	initial draft	LDW	

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COMMERCIAL IN CONFIDENCE

FIGURE 1
SITE LAYOUT, INVESTIGATION AND LENDLEASE REMEDIATION

Project Ref:	S-04478.AQL.ASSMP_EWDA-02		
Project:	Aqualand Barangaroo		
Location:	Central Barangaroo, Hickson Road, Barangaroo NSW		
Client:	Aqualand Projects Pty Ltd		
Easting: 333637	Northing: 6251819	Datum mAHD; UTM MGA2020 56H	PRINT: A3 (L)

CENTRAL BARANGAROO WASTE CLASSIFICATION DEC 2022 V1.vwx | Thursday, 22 December 2022 5:18:48 PM | drawn by laurie white at www.reumad.com.au

Appendix B: Proposed Basement Design

SJB Architects

We would like to Acknowledge the Traditional Custodians of the land on which we live and practice. We pay our respects to elders past, present and emerging, whose knowledge has cared for, and will continue to care for Country. We acknowledge that sovereignty was never ceded.

Central Barangaroo

Hickson Road, Barangaroo NSW

Country: Gadigal Country

SJB Architects
Level 2, 490 Crown Street
Surry Hills NSW
2010 Australia
T 61 2 9380 9911
www.sjb.com.au

Project Number: **6759**
Date: **25.04.25**
Client: **Aqualand**

FOR APPROVAL

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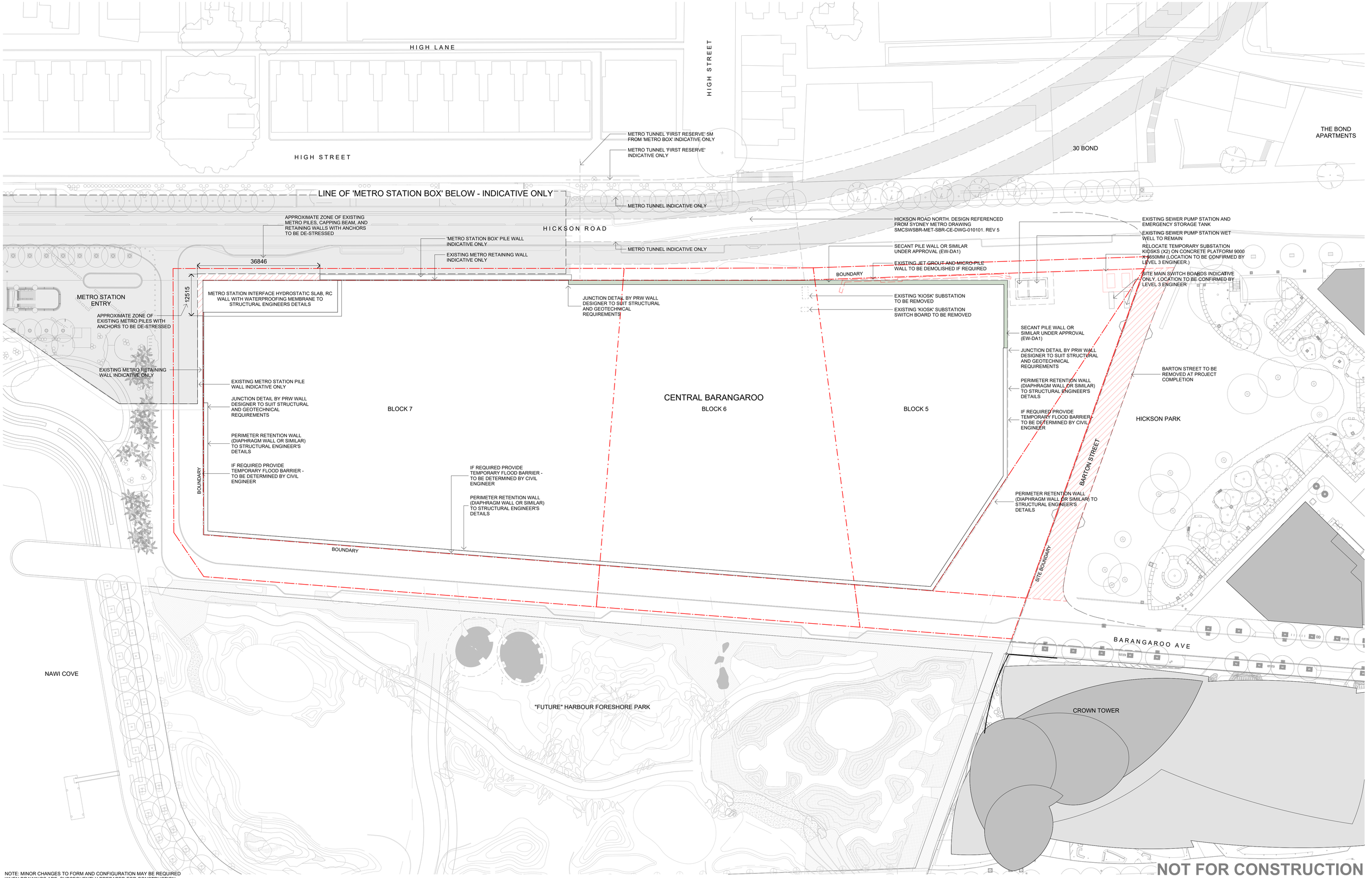
DA-00-2251	HYDROSTATIC SLAB AND PRW WP DETAILS - 1	3
DA-00-2252	HYDROSTATIC SLAB AND PRW WP DETAILS - 2	4

NOT FOR CONSTRUCTION



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Nominated Architects: Adam Haddow-7188 | John Pradel-7004

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1	31.01.24	DRAFT ISSUE	TM	JT
2	09.02.24	2ND DRAFT - UPDATED FOLLOWING AQUALAND REVIEW	JR	JT
3	21.02.24	DRAFT - BASEMENT AREA INCREASED AS INSTRUCTED	JR	JT
4	01.03.24	EWDA-2 DRAFT ISSUE	JR	JT
5	14.03.24	FOR INFORMATION	JR	JT
6	20.03.24	FOR INFORMATION	JR	JT
7	03.04.24	EWDA-2 - FOR APPROVAL	JR	JT
8	25.04.25	EWDA-2 - Updated to incorporate revised Metro Interface	JR	JT

Client

AQUALAND

Project

Central Barangaroo
Hickson Road, Barangaroo NSW

Country: Gadigal Country

Drawing Name

EARLY WORKS SITE PLAN

Date	Scale	Sheet Size
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TM	JT	6759
Drawing No.		Revision
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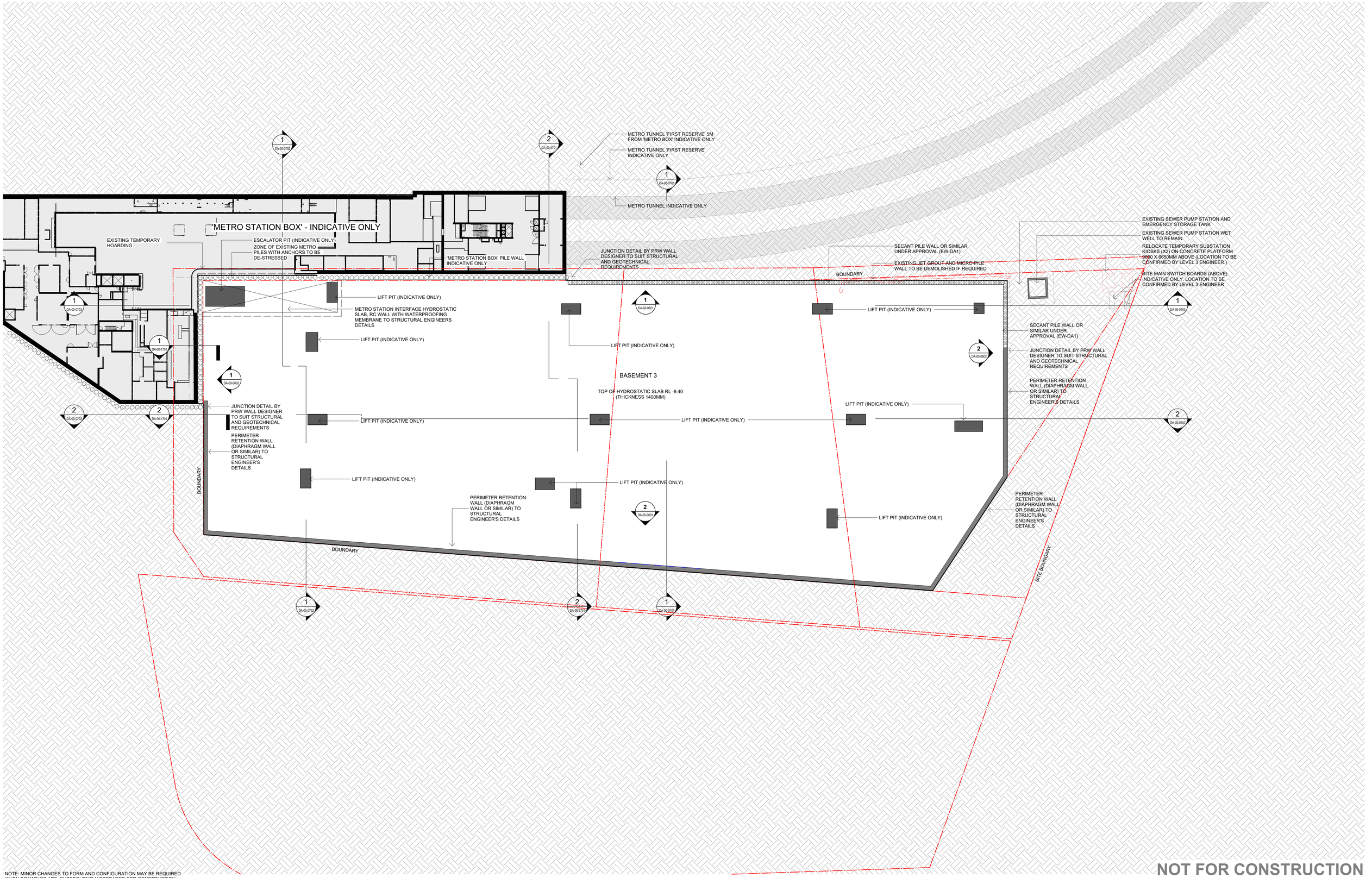

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Nominated Architects: Adam Haddow-7188 | John Pradel-7004

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3	20.02.24	DRAFT - B3 CHANGED TO SSL-9.00 AS INSTRUCTED	JR	JT
4	21.02.24	DRAFT - BASEMENT AREA INCREASED AS INSTRUCTED	JR	JT
5	01.03.24	EWDA-2 DRAFT ISSUE	JR	JT
6	14.03.24	FOR INFORMATION	JR	JT
7	20.03.24	FOR INFORMATION	JR	JT
8	03.04.24	EWDA-2 - FOR APPROVAL	JR	JT
9	25.04.25	EWDA-2 - Updated to incorporate revised Metro Interface	JR	JT

Client

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Central Barangaroo
Hickson Road, Barangaroo NSW

Country: Gadigal Country

Drawing Name

FLOOR PLAN - B3 (HYDROSTATIC SLAB ONLY)

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TM	JT	6759
Drawing No.		Revision
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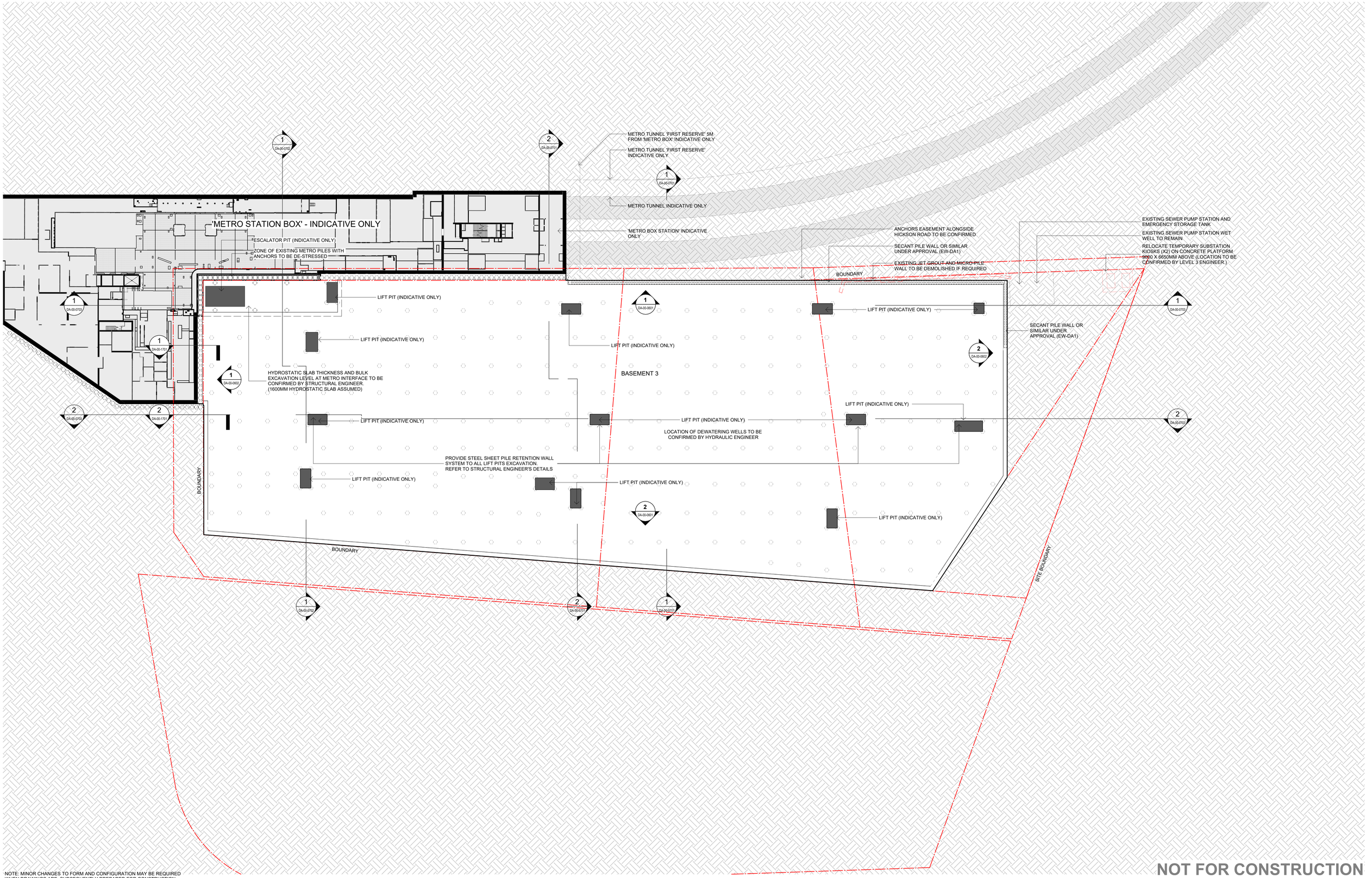

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Nominated Architects: Adam Haddow-7188 | John Pradel-7004

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3	14.03.24	FOR INFORMATION	JR	JT
4	18.03.24	FOR INFORMATION	JR	JT
5	20.03.24	FOR INFORMATION	JR	JT
6	03.04.24	EWDA-2 - FOR APPROVAL	JR	JT
7	25.04.25	EWDA-2 - Updated to incorporate revised Metro Interface	JR	JT

Client

AQUALAND

Project

Central Barangaroo
Hickson Road, Barangaroo NSW

Country: Gadigal Country

Drawing Name

BULK EXCAVATION PLAN

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Drawing No.		Revision
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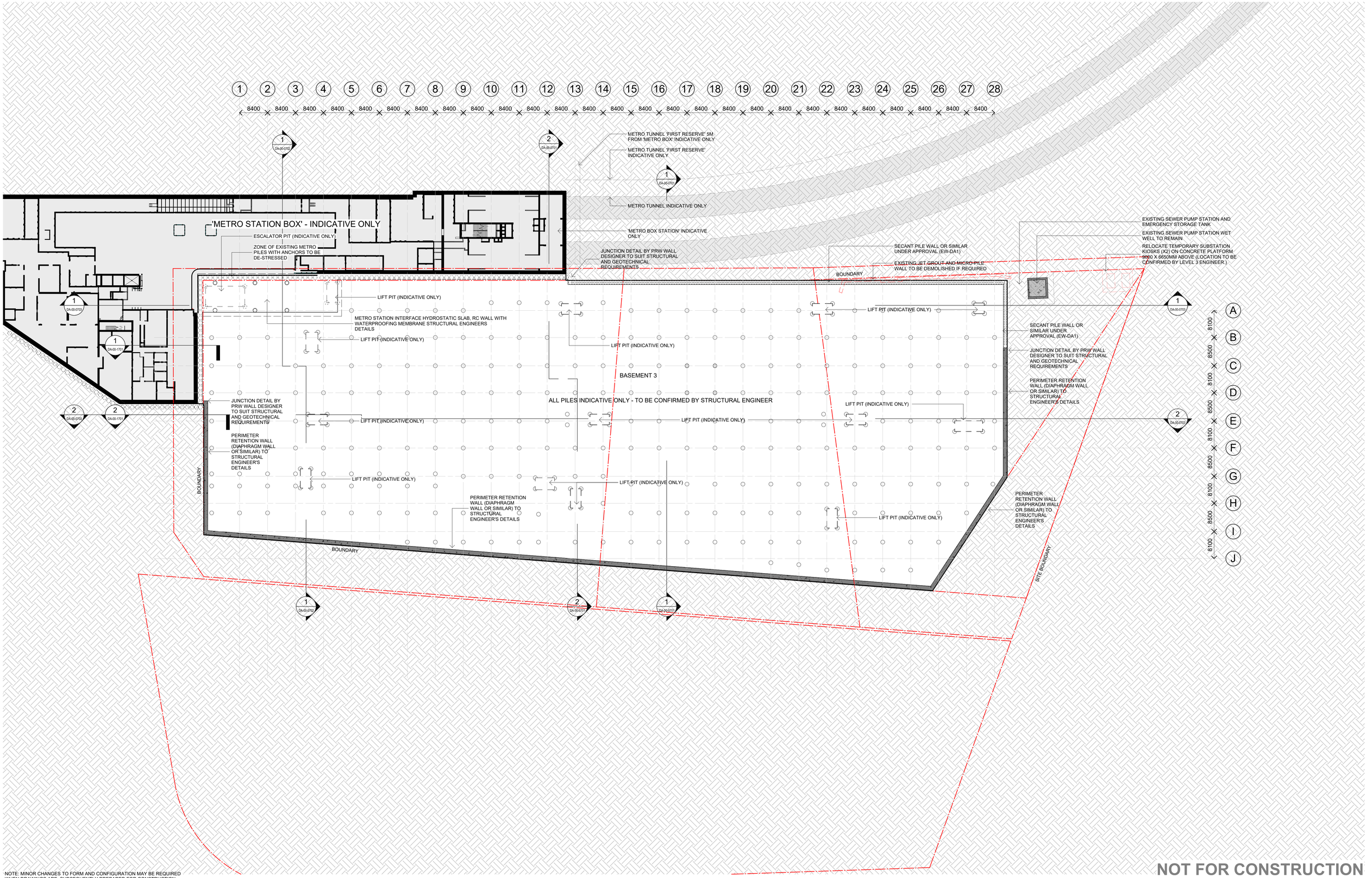

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NOT FOR CONSTRUCTION

FOR APPROVAL

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Nominated Architects: Adam Haddow-7188 | John Pradel-7004

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3	14.03.24	FOR INFORMATION	JR	JT
4	20.03.24	FOR INFORMATION	JR	JT
5	03.04.24	EWDA-2 - FOR APPROVAL	JR	JT
6	25.04.25	EWDA-2 - Updated to incorporate revised Metro Interface	JR	JT

Client

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Project

Central Barangaroo
Hickson Road, Barangaroo NSW

Country: Gadigal Country

Drawing Name

INDICATIVE PILING PLAN AND GRID SETOUT

Date	Scale	Sheet Size
25.04.25	1:500	@ A1
Drawn	Chk.	Job No.
TM	JT	6759
Drawing No.		Revision
DA-00-0501		/ 6

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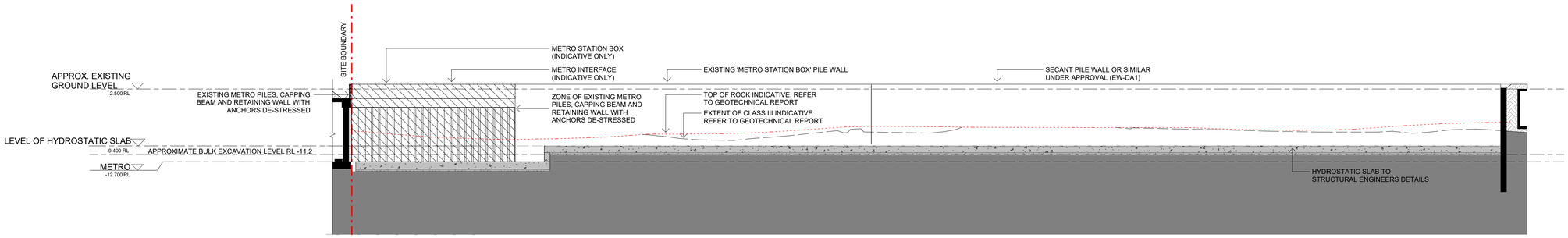
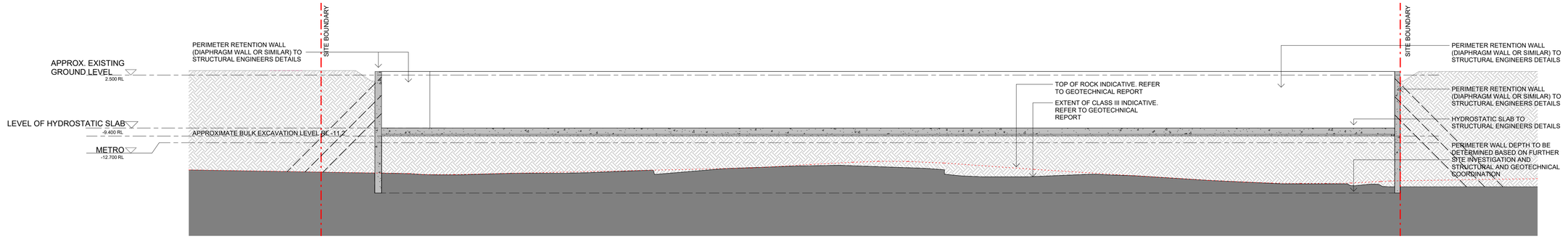


1 / - SHORING ELEVATION - EAST

SCALE 1 : 500



2 / - SHORING ELEVATION - WEST

SCALE 1 : 500

NOTE: MINOR CHANGES TO FORM AND CONFIGURATION MAY BE REQUIRED WHEN DRAWINGS ARE SUBSEQUENTLY PREPARED FOR CONSTRUCTION PURPOSES AFTER THE GRANT OF DEVELOPMENT CONSENT.

NOT FOR CONSTRUCTION

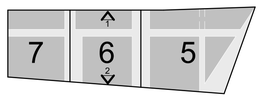
FOR APPROVAL

0 5 10 25m

1:500 @A1

Nominated Architects: Adam Haddow-7188 | John Pradel-7004

Rev	Date	Revision	By	Chk.
1	01.03.24	EWDA-2 DRAFT ISSUE	JR	JT
2	14.03.24	FOR INFORMATION	JR	JT
3	20.03.24	FOR INFORMATION	JR	JT
4	03.04.24	EWDA-2 - FOR APPROVAL	JR	JT
5	25.04.25	EWDA-2 - Updated to incorporate revised Metro Interface	JR	JT



Client

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Project

Central Barangaroo
Hickson Road, Barangaroo NSW

Country: Gadigal Country

Drawing Name

OVERALL BASEMENT ELEVATIONS SHEET 1

Date	Scale	Sheet Size
25.04.25	1:500	@ A1
Drawn	Chk.	Job No.
TM	JT	6759
Drawing No.		Revision
DA-00-0601		/ 5

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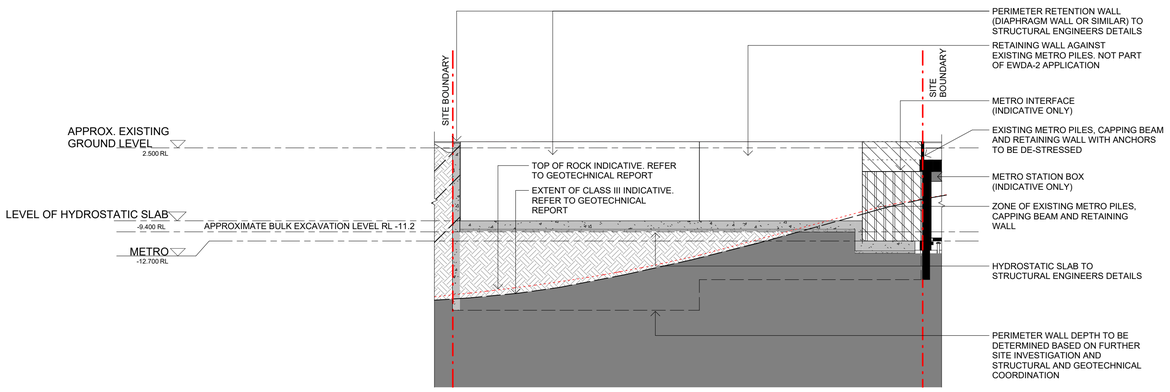
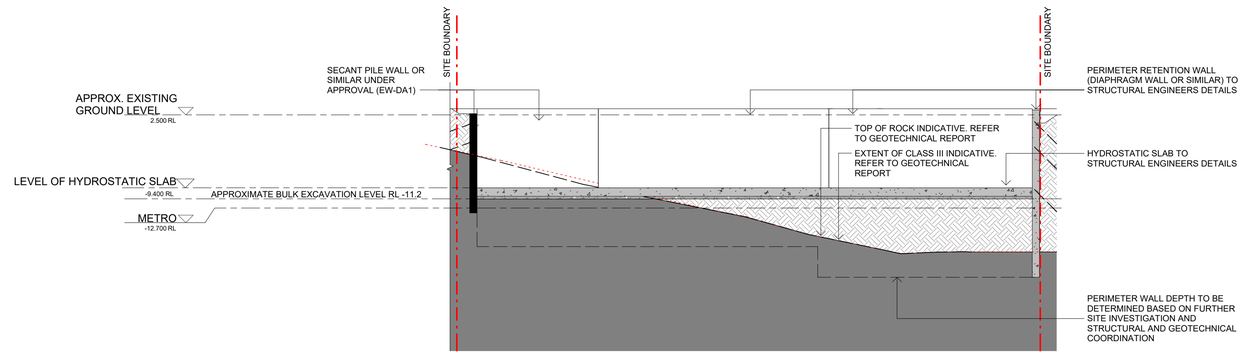


1 - SHORING ELEVATION - NORTH
SCALE 1 : 500



2 - SHORING ELEVATION - SOUTH
SCALE 1 : 500

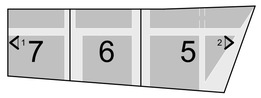
NOTE: MINOR CHANGES TO FORM AND CONFIGURATION MAY BE REQUIRED WHEN DRAWINGS ARE SUBSEQUENTLY PREPARED FOR CONSTRUCTION PURPOSES AFTER THE GRANT OF DEVELOPMENT CONSENT.

FOR APPROVAL

0 5 10 25m
1:500 @A1

Nominated Architects: Adam Haddow-7188 | John Pradel-7004

Rev	Date	Revision	By	Chk.
1	01.03.24	EWDA-2 DRAFT ISSUE	JR	JT
2	14.03.24	FOR INFORMATION	JR	JT
3	20.03.24	FOR INFORMATION	JR	JT
4	03.04.24	EWDA-2 - FOR APPROVAL	JR	JT
5	25.04.25	EWDA-2 - Updated to incorporate revised Metro Interface	JR	JT



Client
AQUALAND

Project
Central Barangaroo
Hickson Road, Barangaroo NSW

Country: Gadigal Country

Drawing Name
OVERALL BASEMENT ELEVATIONS SHEET 2

Drawing No.
DA-00-0602

Revision
/ 5

Date
25.04.25

Scale
1:500

Sheet Size
@ A1

Drawn
TM

Chk.
JT

Job No.
6759

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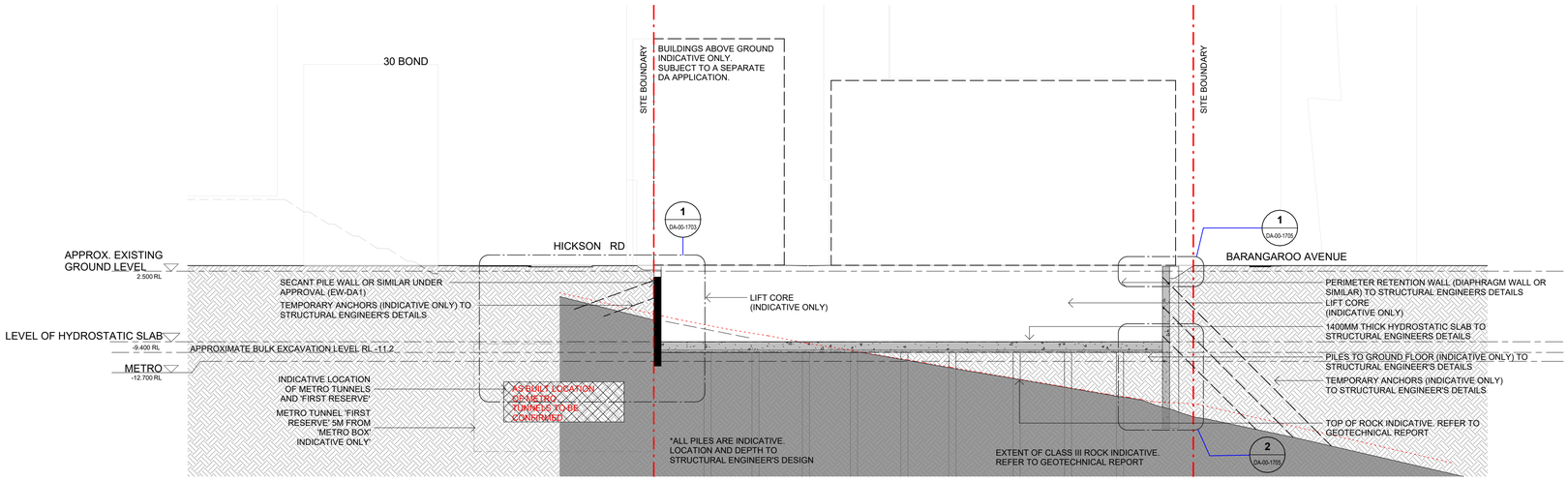
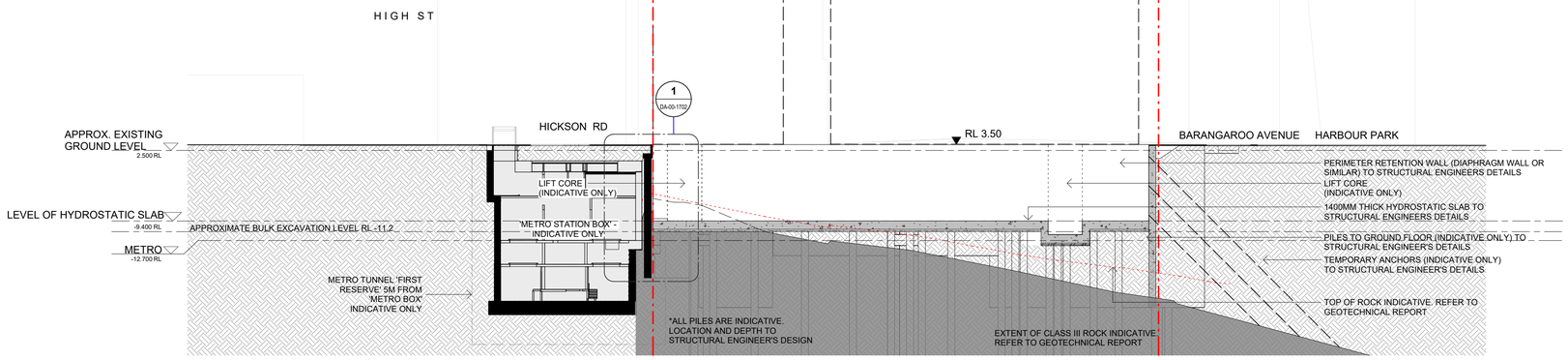


1 / - SITE SECTION B5

SCALE 1 : 500



2 / - SITE SECTION B6

SCALE 1 : 500

NOTE: MINOR CHANGES TO FORM AND CONFIGURATION MAY BE REQUIRED WHEN DRAWINGS ARE SUBSEQUENTLY PREPARED FOR CONSTRUCTION PURPOSES AFTER THE GRANT OF DEVELOPMENT CONSENT.

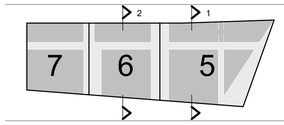
FOR APPROVAL

0 5 10 25m

1:500 @A1

Nominated Architects: Adam Haddow-7188 | John Pradel-7004

Rev	Date	Revision	By	Chk.
1	29.01.24	DRAFT ISSUE	TM	JT
2	09.02.24	2ND DRAFT - UPDATED FOLLOWING AQUALAND REVIEW	JR	JT
3	14.02.24	DRAFT ISSUE -TOP OF ROCK CLARIFIED	JR	JT
4	20.02.24	DRAFT - B3 CHANGED TO SSL-9.00 AS INSTRUCTED	JR	JT
5	21.02.24	DRAFT - BASEMENT AREA INCREASED AS INSTRUCTED	JR	JT
6	01.03.24	EWDA-2 DRAFT ISSUE	JR	JT
7	14.03.24	FOR INFORMATION	JR	JT
8	20.03.24	FOR INFORMATION	JR	JT
9	03.04.24	EWDA-2 - FOR APPROVAL	JR	JT
10	25.04.25	EWDA-2 - Updated to incorporate revised Metro Interface	JR	JT



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Project

Central Barangaroo
Hickson Road, Barangaroo NSW

Country: Gadigal Country

Drawing Name

OVERALL SECTIONS - EAST WEST - SHEET 1

NOT FOR CONSTRUCTION

Date	Scale	Sheet Size
25.04.25	1:500	@ A1
Drawn	Chk.	Job No.
TM	JT	6759
Drawing No.		Revision
DA-00-0701		/ 10

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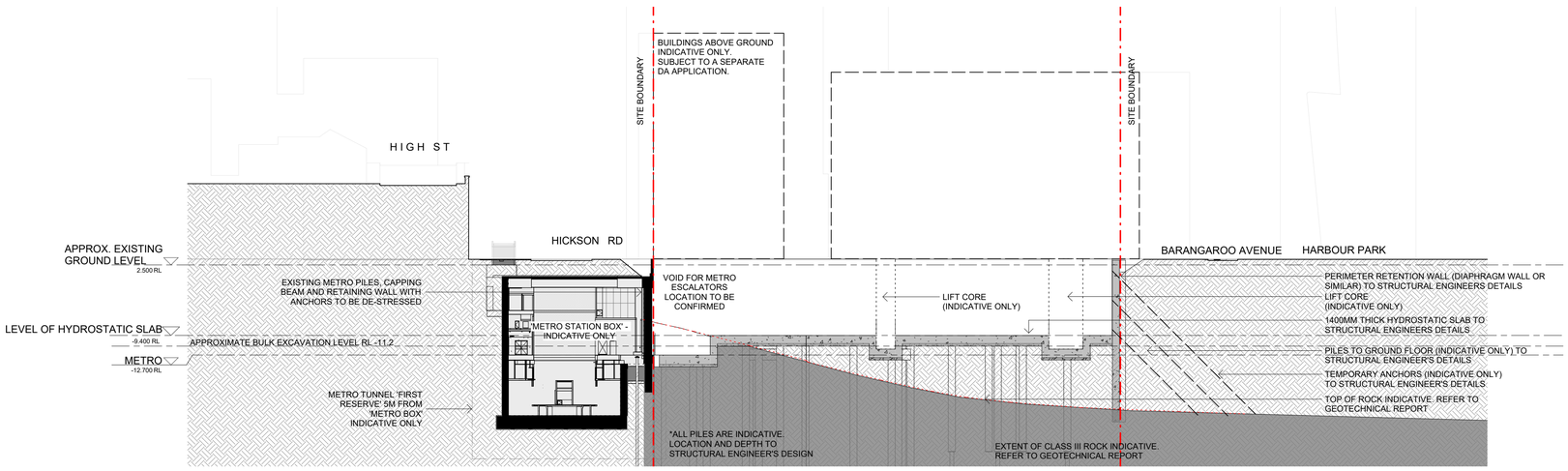


1 / - SITE SECTION B7
SCALE 1 : 500

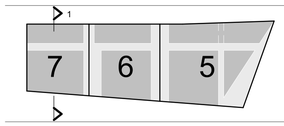
NOTE: MINOR CHANGES TO FORM AND CONFIGURATION MAY BE REQUIRED WHEN DRAWINGS ARE SUBSEQUENTLY PREPARED FOR CONSTRUCTION PURPOSES AFTER THE GRANT OF DEVELOPMENT CONSENT.

FOR APPROVAL

0 1 2 5m
1:100 @A1

Nominated Architects: Adam Haddow-7188 | John Pradel-7004

Rev	Date	Revision	By	Chk.
1	09.02.24	2ND DRAFT - UPDATED FOLLOWING AQUALAND REVIEW	JR	JT
2	14.02.24	DRAFT ISSUE -TOP OF ROCK CLARIFIED	JR	JT
3	20.02.24	DRAFT - B3 CHANGED TO SSL-9.00 AS INSTRUCTED	JR	JT
4	21.02.24	DRAFT - BASEMENT AREA INCREASED AS INSTRUCTED	JR	JT
5	01.03.24	EWDA-2 DRAFT ISSUE	JR	JT
6	14.03.24	FOR INFORMATION	JR	JT
7	20.03.24	FOR INFORMATION	JR	JT
8	03.04.24	EWDA-2 - FOR APPROVAL	JR	JT
9	25.04.25	EWDA-2 - Updated to incorporate revised Metro Interface	JR	JT



NOT FOR CONSTRUCTION

Client
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Project
Central Barangaroo
Hickson Road, Barangaroo NSW

Country: Gadigal Country

Drawing Name
OVERALL SECTIONS - EAST WEST - SHEET 2

Date	Scale	Sheet Size
25.04.25	1:100	@ A1
Drawn	Chk.	Job No.
JR	JT	6759
Drawing No.		Revision
DA-00-0702		/ 9

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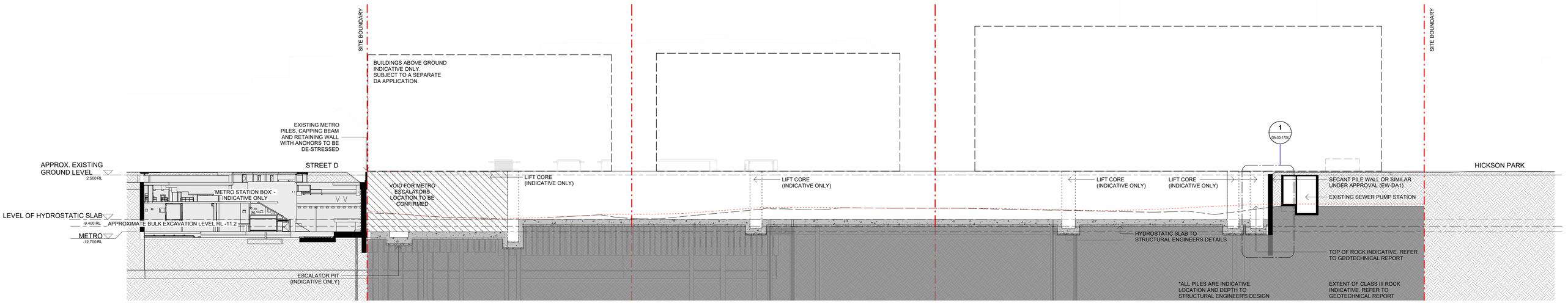
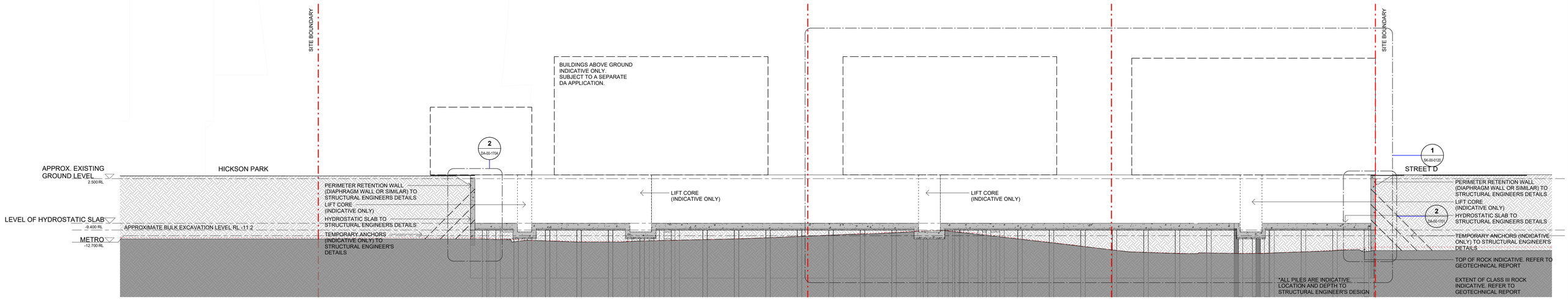


1 - SECTION NORTH SOUTH 1
SCALE 1 : 500



2 - SECTION NORTH SOUTH 2
SCALE 1 : 500

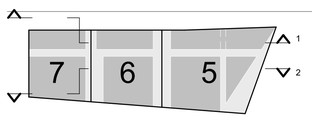
NOTE: MINOR CHANGES TO FORM AND CONFIGURATION MAY BE REQUIRED WHEN DRAWINGS ARE SUBSEQUENTLY PREPARED FOR CONSTRUCTION PURPOSES AFTER THE GRANT OF DEVELOPMENT CONSENT.

FOR APPROVAL

0 5 10 25m
1:500 @A1

Nominated Architects: Adam Haddow-7188 | John Pradel-7004

Rev	Date	Revision	By	Chk.
1	29.01.24	DRAFT ISSUE	TM	JT
2	09.02.24	2ND DRAFT - UPDATED FOLLOWING AQUALAND REVIEW	JR	JT
3	14.02.24	DRAFT ISSUE -TOP OF ROCK CLARIFIED	JR	JT
4	20.02.24	DRAFT - B3 CHANGED TO SSL-9.00 AS INSTRUCTED	JR	JT
5	21.02.24	DRAFT - BASEMENT AREA INCREASED AS INSTRUCTED	JR	JT
6	01.03.24	EWDA-2 DRAFT ISSUE	JR	JT
7	14.03.24	FOR INFORMATION	JR	JT
8	20.03.24	FOR INFORMATION	JR	JT
9	03.04.24	EWDA-2 - FOR APPROVAL	JR	JT
10	25.04.25	EWDA-2 - Updated to incorporate revised Metro Interface	JR	JT



Client
AQUALAND

Project
Central Barangaroo
Hickson Road, Barangaroo NSW

Country: Gadigal Country

Drawing Name
OVERALL SECTIONS - NORTH SOUTH

NOT FOR CONSTRUCTION

Date	Scale	Sheet Size
25.04.25	1:500	@ A1
Drawn	Chk.	Job No.
TM	JT	6759
Drawing No.		Revision
DA-00-0703		/ 10

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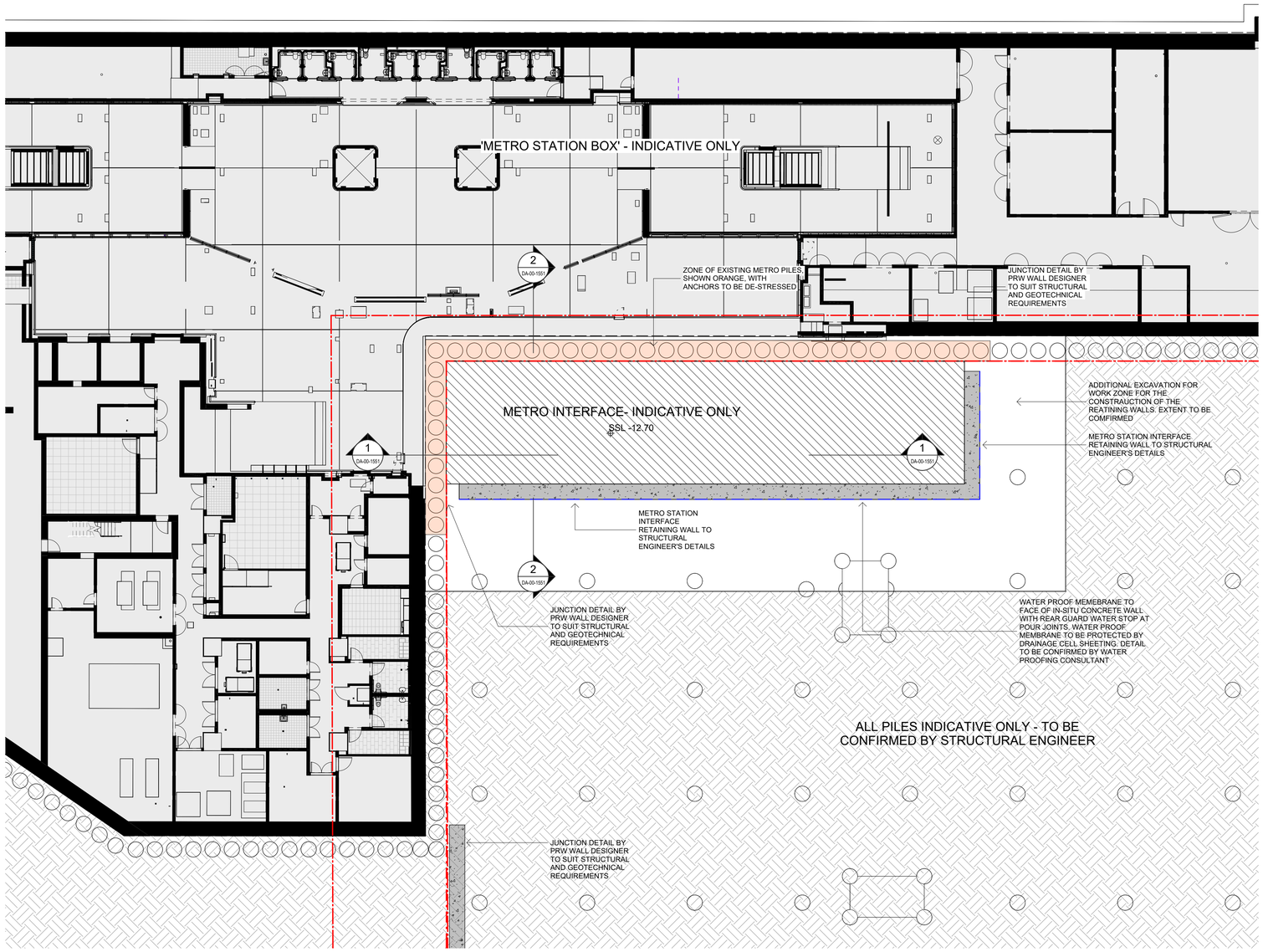

NOTE: MINOR CHANGES TO FORM AND CONFIGURATION MAY BE REQUIRED WHEN DRAWINGS ARE SUBSEQUENTLY PREPARED FOR CONSTRUCTION PURPOSES AFTER THE GRANT OF DEVELOPMENT CONSENT.

FOR APPROVAL

0 2 4 10m
1:200 @A1

Nominated Architects: Adam Haddow-7188 | John Pradel-7004

Rev	Date	Revision	By	Chk.
1	01.03.24	EWDA-2 DRAFT ISSUE	JR	JT
2	20.03.24	FOR INFORMATION	JR	JT
3	03.04.24	EWDA-2 - FOR APPROVAL	JR	JT
4	25.04.25	EWDA-2 - Updated to incorporate revised Metro Interface	JR	JT

Client

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Project

Central Barangaroo
Hickson Road, Barangaroo NSW

Country: Gadigal Country

Drawing Name

METRO INTERFACE PLAN

NOT FOR CONSTRUCTION

Date	Scale	Sheet Size
25.04.25	1:200	@ A1
Drawn	Chk.	Job No.
JR	JT	6759
Drawing No.		Revision
DA-00-1051		/ 4

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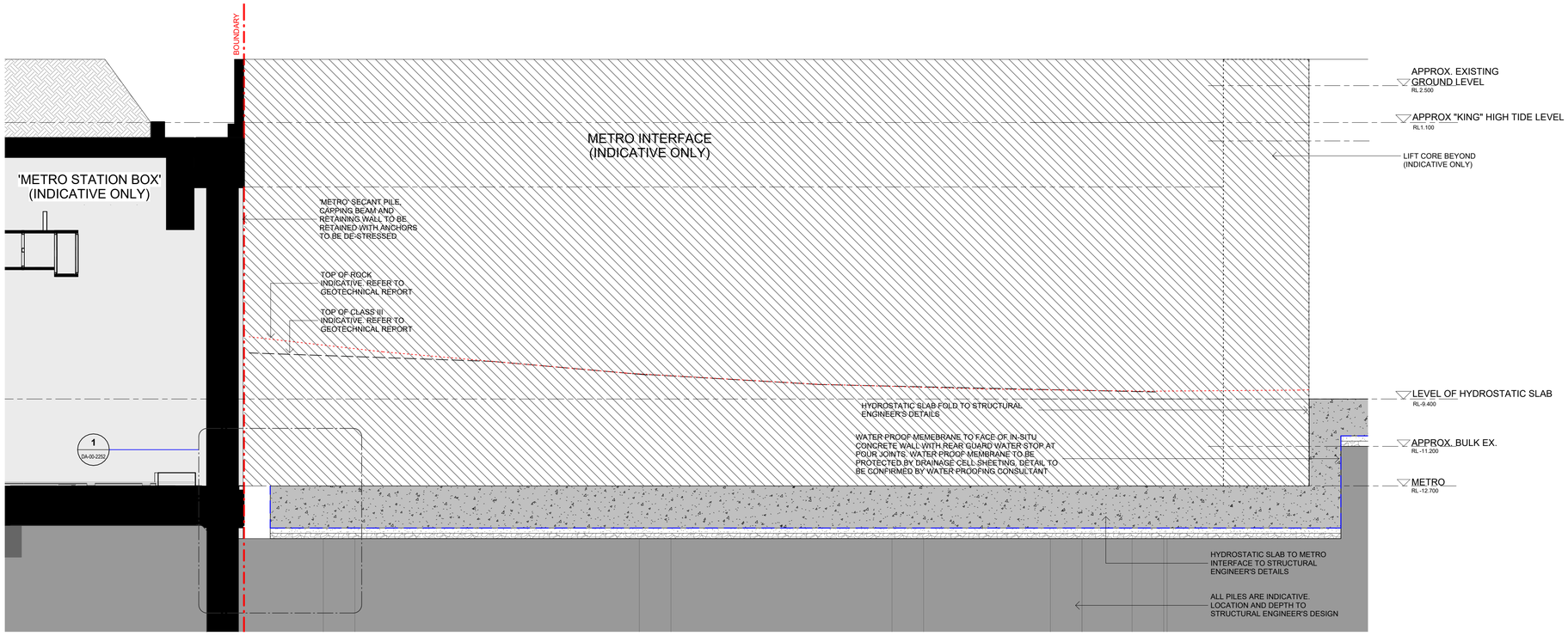
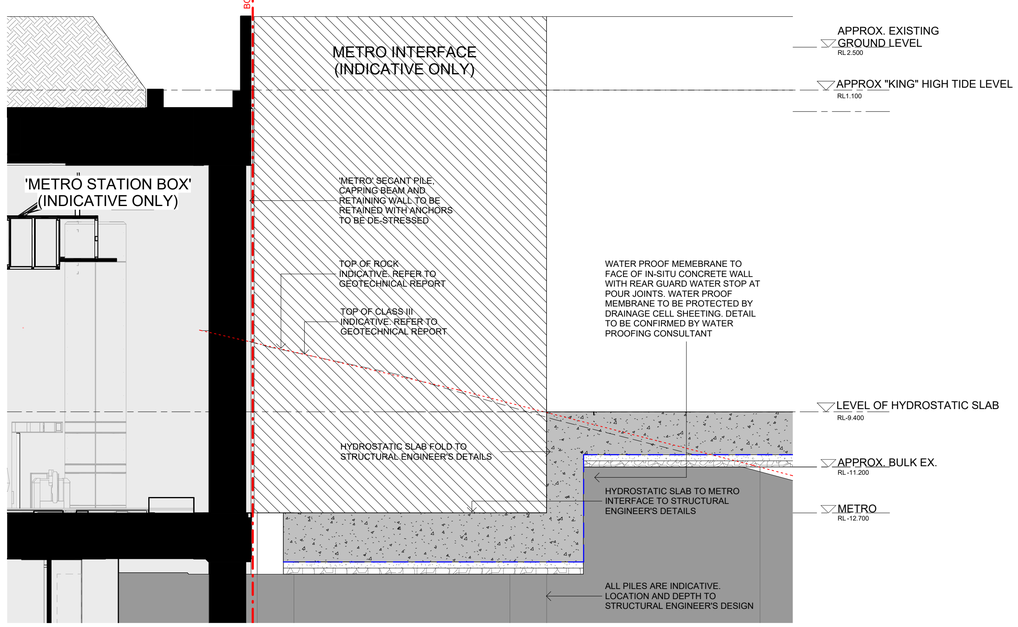


1 DA-00-1051 **METRO INTERFACE LONG SECTION**

1 : 100@A1



2 DA-00-1051 **METRO INTERFACE CROSS SECTION**

1 : 100@A1

NOTE: MINOR CHANGES TO FORM AND CONFIGURATION MAY BE REQUIRED WHEN DRAWINGS ARE SUBSEQUENTLY PREPARED FOR CONSTRUCTION PURPOSES AFTER THE GRANT OF DEVELOPMENT CONSENT.

FOR APPROVAL

0 1 2 5m

1:100 @A1

Nominated Architects: Adam Haddow-7188 | John Pradel-7004

Rev	Date	Revision	By	Chk.
1	01.03.24	EWDA-2 DRAFT ISSUE	JR	JT
2	20.03.24	FOR INFORMATION	JR	JT
3	03.04.24	EWDA-2 - FOR APPROVAL	JR	JT
4	25.04.25	EWDA-2 - Updated to incorporate revised Metro Interface	JR	JT

Client

AQUALAND

Project

Central Barangaroo
Hickson Road, Barangaroo NSW

Country: Gadigal Country

Drawing Name

METRO SECTIONS

NOT FOR CONSTRUCTION

Date	Scale	Sheet Size
25.04.25	1:100	@ A1
Drawn	Chk.	Job No.
JR	JT	6759
Drawing No.		Revision
DA-00-1551		/ 4

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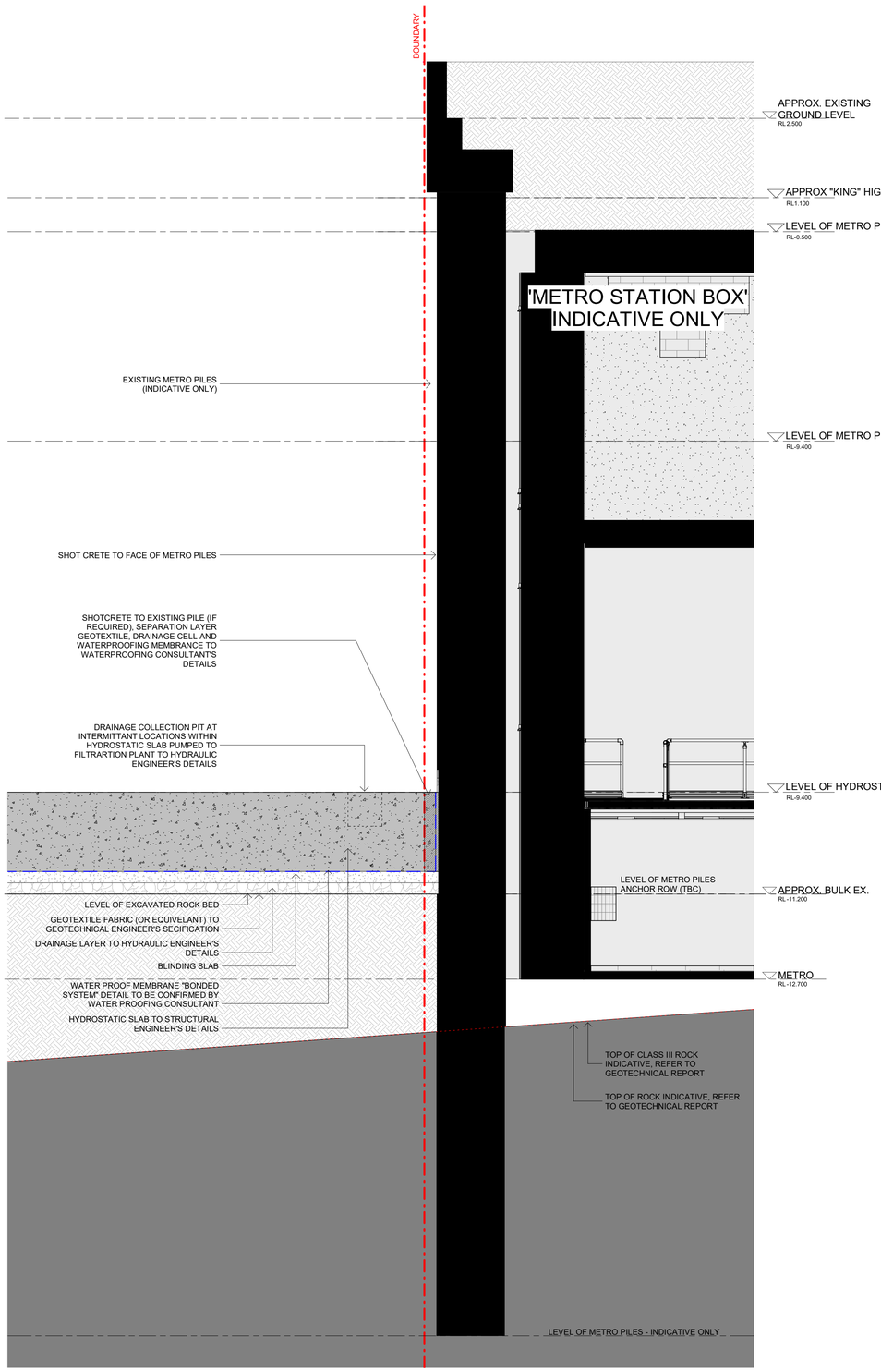
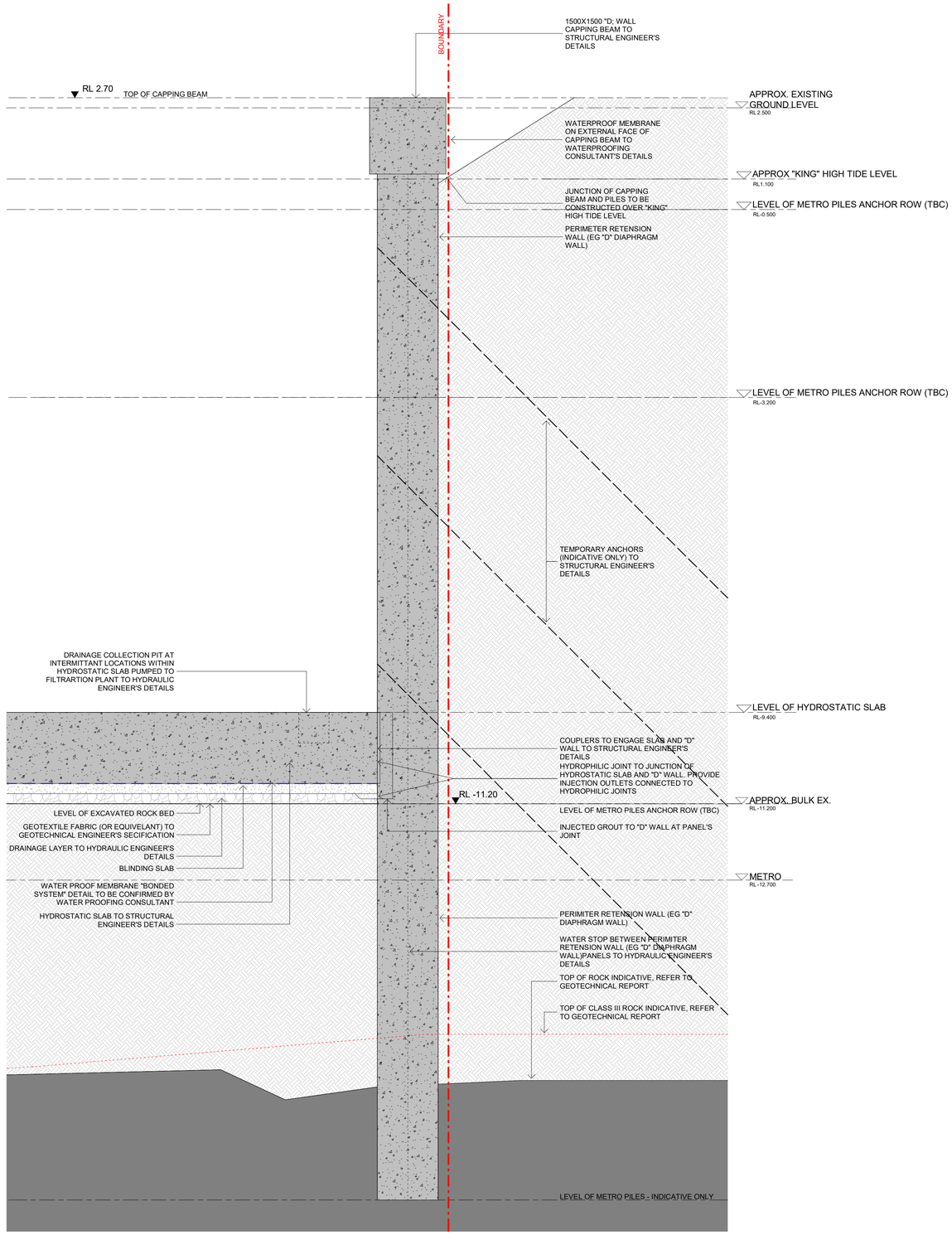


1 AR-00-0402 DETAIL - NORTHERN INSITU WALL

1 : 50@A1

NORTHERN BASEMENT WALL NEXT TO EXISTING METRO PILES



2 AR-00-0402 DETAIL - NORTHERN "D" WALL

1 : 50@A1

NORTHERN BASEMENT "D" WALL AT JUNCTION WITH EXISTING METRO PILES

NOTE: MINOR CHANGES TO FORM AND CONFIGURATION MAY BE REQUIRED WHEN DRAWINGS ARE SUBSEQUENTLY PREPARED FOR CONSTRUCTION PURPOSES AFTER THE GRANT OF DEVELOPMENT CONSENT.

NOT FOR CONSTRUCTION

FOR APPROVAL

0 500 1000 2500mm
1:50 @A1

Nominated Architects: Adam Haddow-7188 | John Pradel-7004

Rev	Date	Revision	By	Chk.
1	01.03.24	EWDA-2 DRAFT ISSUE	JR	JT
2	20.03.24	FOR INFORMATION	JR	JT
3	03.04.24	EWDA-2 - FOR APPROVAL	JR	JT

Client: AQUALAND

Project: Central Barangaroo
Hickson Road, Barangaroo NSW

Country: Gadigal Country

Drawing Name: DETAIL WALL SECTIONS - SHEET 1 (NORTH)

Date	Scale	Sheet Size
03.04.24	1:50	@ A1
Drawn	Chk.	Job No.
JR	JT	6759
Drawing No.		Revision
DA-00-1701		/ 3

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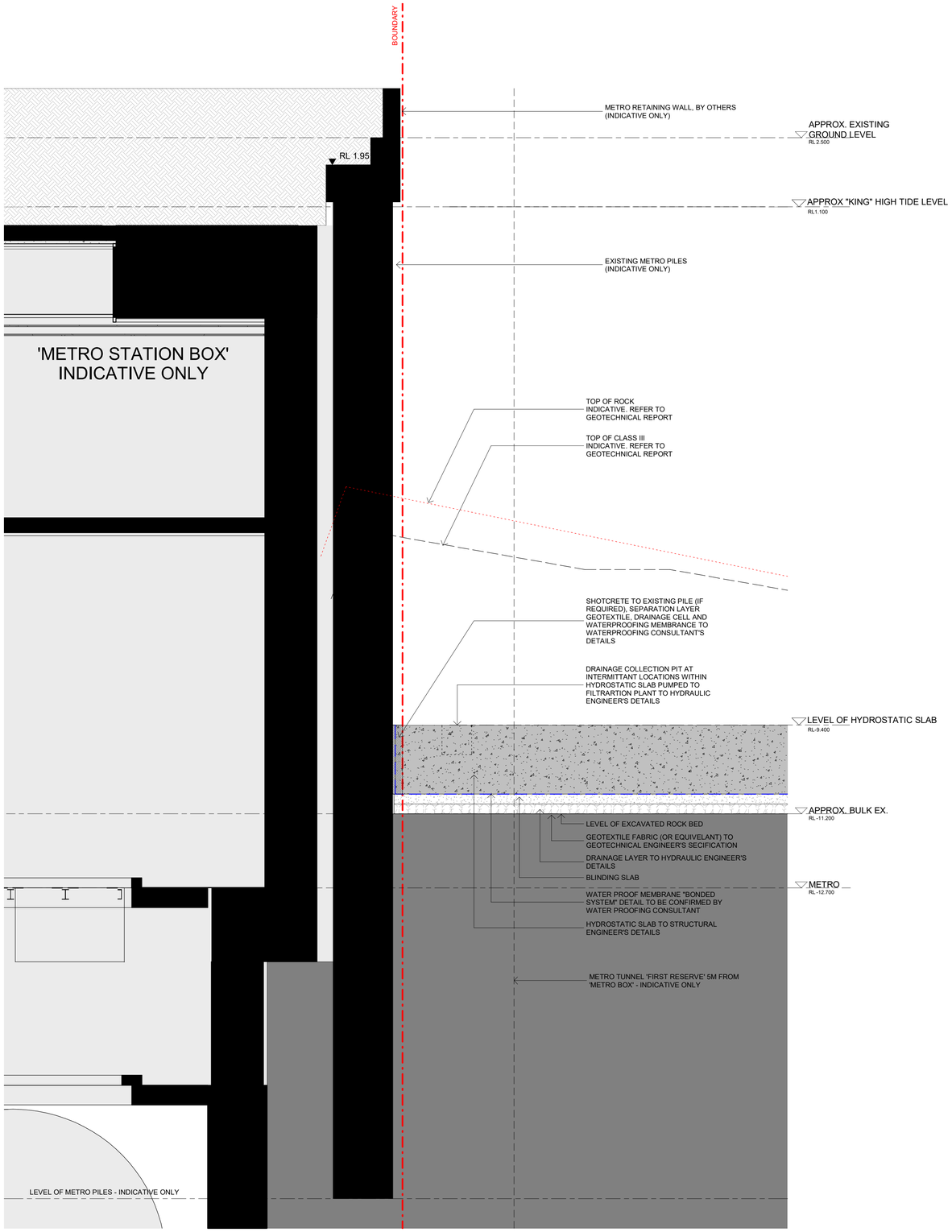

1
DA-00-0701

DETAIL 1 - EASTERN BOUNDARY TO METRO

1 : 50@A1

EASTERN BASEMENT WALL NEXT TO EXISTING METRO PILES

NOTE: MINOR CHANGES TO FORM AND CONFIGURATION MAY BE REQUIRED WHEN DRAWINGS ARE SUBSEQUENTLY PREPARED FOR CONSTRUCTION PURPOSES AFTER THE GRANT OF DEVELOPMENT CONSENT.

NOT FOR CONSTRUCTION

FOR APPROVAL

0 500 1000 2500mm
1:50 @A1

Nominated Architects: Adam Haddow-7188 | John Pradel-7004

Rev	Date	Revision	By	Chk.
1	01.03.24	EWDA-2 DRAFT ISSUE	JR	JT
2	08.03.24	DRAFT - UPDATE FOLLOWING CLIENT COMMENTS	JR	JT
3	20.03.24	FOR INFORMATION	JR	JT
4	03.04.24	EWDA-2 - FOR APPROVAL	JR	JT

Client: AQUALAND

Project: Central Barangaroo
Hickson Road, Barangaroo NSW

Country: Gadigal Country

Drawing Name: DETAIL WALL SECTIONS - SHEET 2 (EAST)

Date	Scale	Sheet Size
03.04.24	1:50	@ A1
Drawn	Chk.	Job No.
JR	JT	6759
Drawing No.		Revision
DA-00-1702		/ 4

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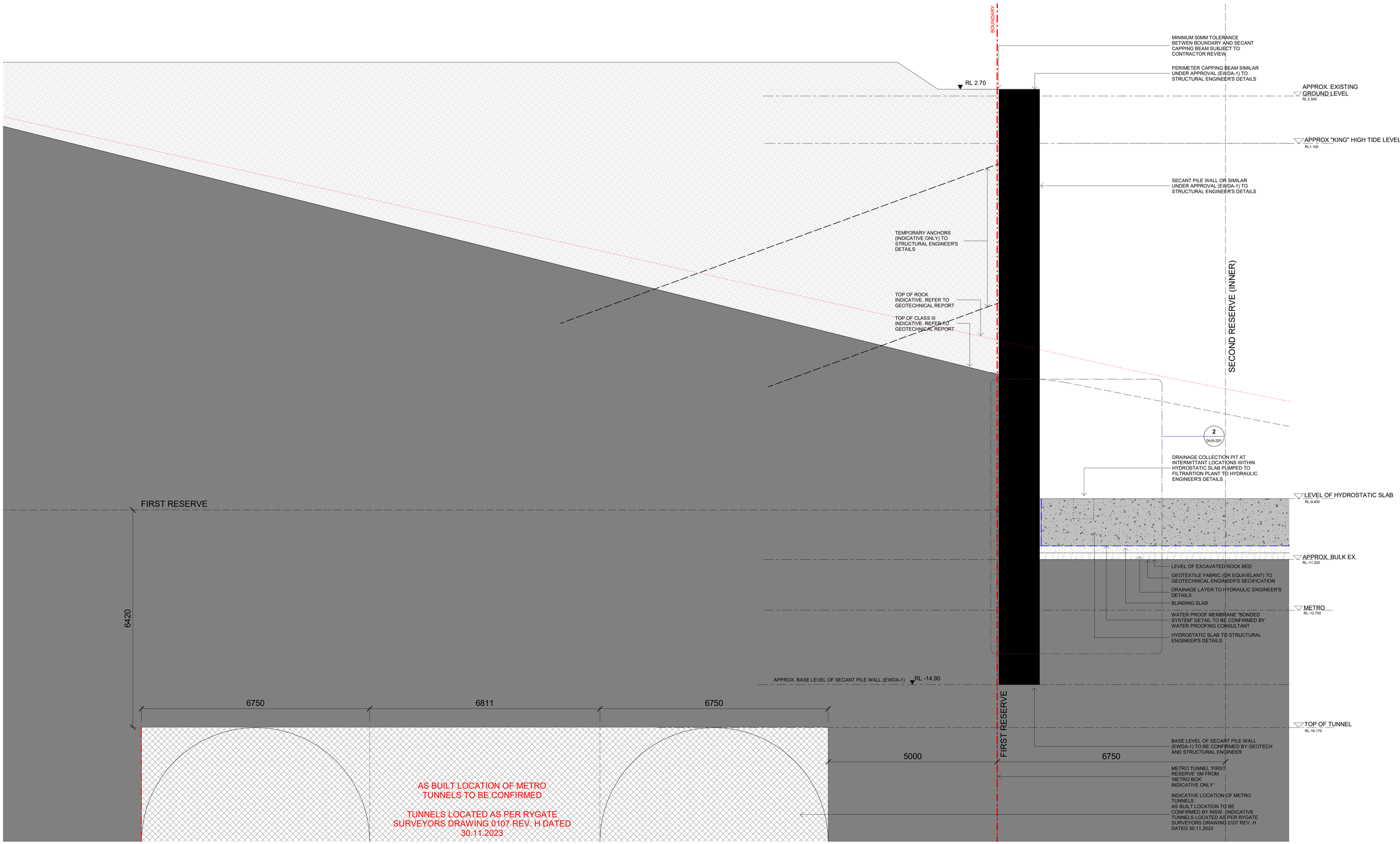

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DA-00-0701

DETAIL 2 - EASTERN BOUNDARY TO EWDA-1

1 : 50@A1

NOTE: MINOR CHANGES TO FORM AND CONFIGURATION MAY BE REQUIRED WHEN DRAWINGS ARE SUBSEQUENTLY PREPARED FOR CONSTRUCTION PURPOSES AFTER THE GRANT OF DEVELOPMENT CONSENT.

FOR APPROVAL

0 1 2 5m
1:100 @A1

Nominated Architects: Adam Haddow-7188 | John Pradel-7004

Rev	Date	Revision	By	Chk.
1	20.03.24	FOR INFORMATION	JR	JT
2	03.04.24	EWDA-2 - FOR APPROVAL	JR	JT

EASTERN BASEMENT WALL NEXT TO EWDA-1 PILES

Client

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Project
Central Barangaroo
Hickson Road, Barangaroo NSW

Country: Gadigal Country

Drawing Name
DETAIL WALL SECTIONS - SHEET 3 (EAST)

NOT FOR CONSTRUCTION

Date	Scale	Sheet Size
03.04.24	1:100	@ A1
Drawn	Chk.	Job No.
JR	JT	6759
Drawing No.		Revision
DA-00-1703		/ 2

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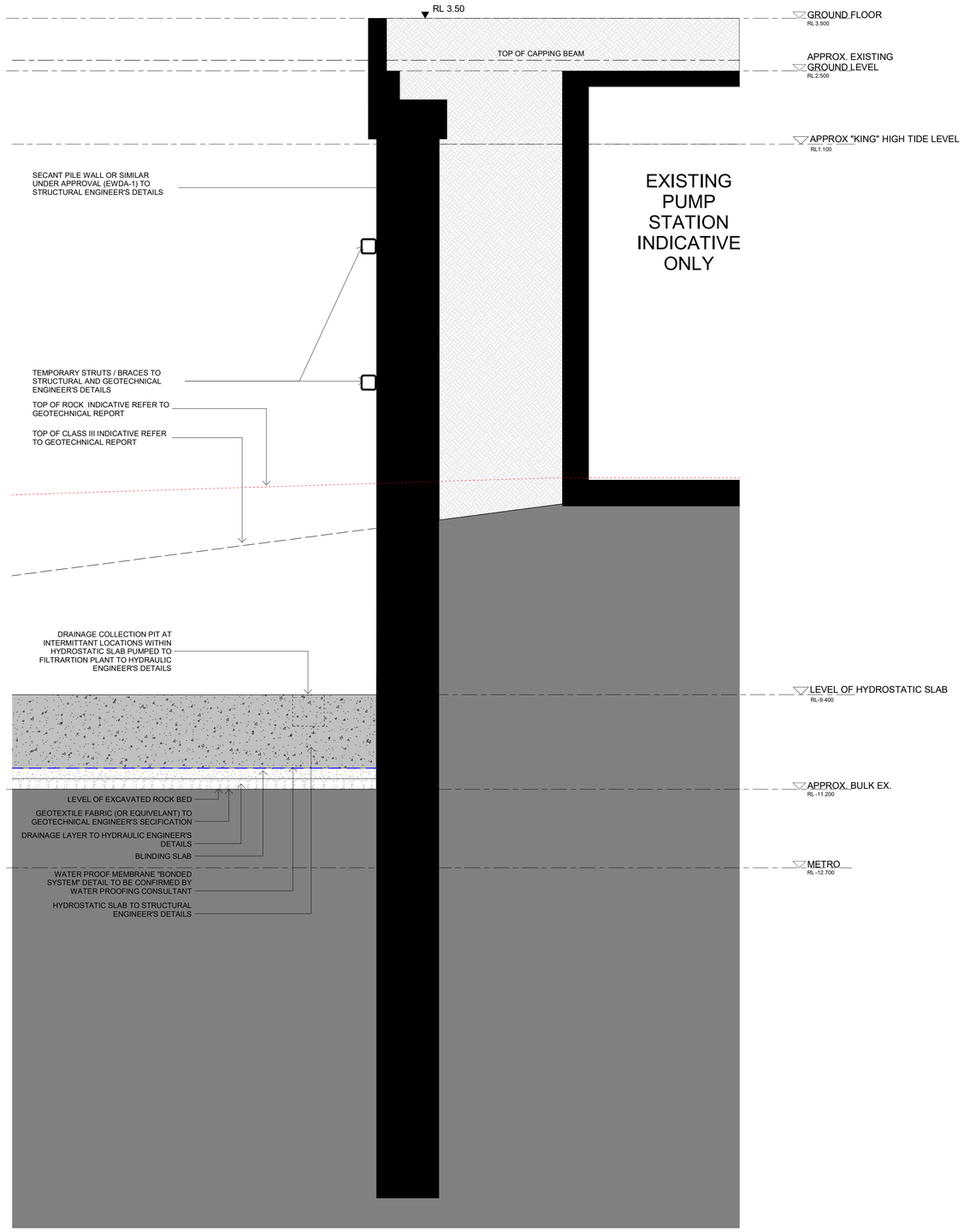
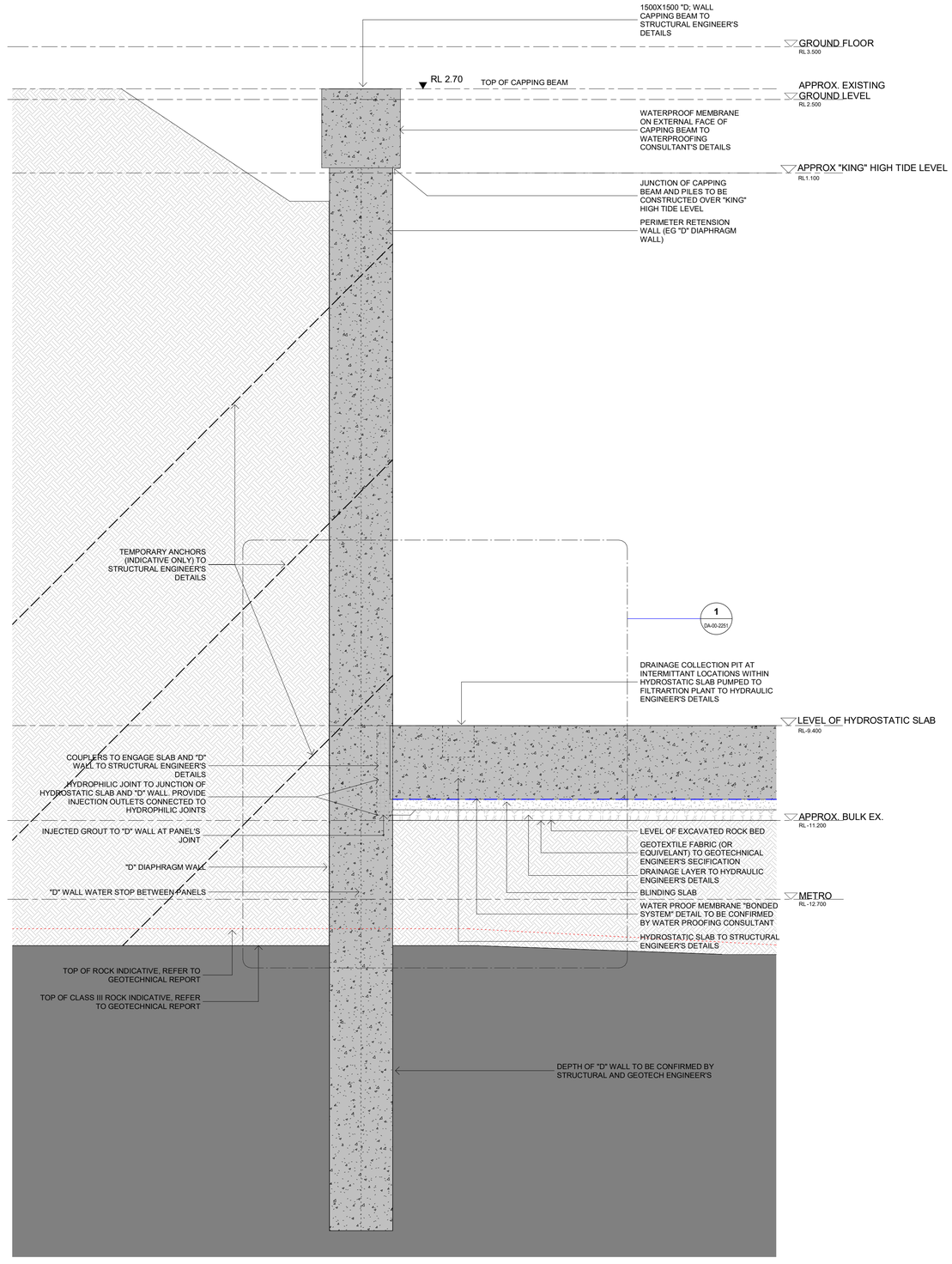


1 DA-00-0703 **DETAIL - SOUTHERN INSITU WALL**

1 : 50@A1



2 DA-00-0703 **DETAIL - SOUTHERN "D" WALL**

1 : 50@A1

NOTE: MINOR CHANGES TO FORM AND CONFIGURATION MAY BE REQUIRED WHEN DRAWINGS ARE SUBSEQUENTLY PREPARED FOR CONSTRUCTION PURPOSES AFTER THE GRANT OF DEVELOPMENT CONSENT.

FOR APPROVAL

0 500 1000 2500mm

1:50 @A1

Nominated Architects: Adam Haddow-7188 | John Pradel-7004

Rev	Date	Revision	By	Chk.
1	01.03.24	EWDA-2 DRAFT ISSUE	JR	JT
2	20.03.24	FOR INFORMATION	JR	JT
3	03.04.24	EWDA-2 - FOR APPROVAL	JR	JT

Client

AQUALAND

Project

Central Barangaroo
Hickson Road, Barangaroo NSW

Country: Gadigal Country

Drawing Name

DETAIL WALL SECTIONS - SHEET 4 (SOUTH)

Date	Scale	Sheet Size
03.04.24	1:50	@ A1
Drawn	Chk.	Job No.
JR	JT	6759
Drawing No.		Revision
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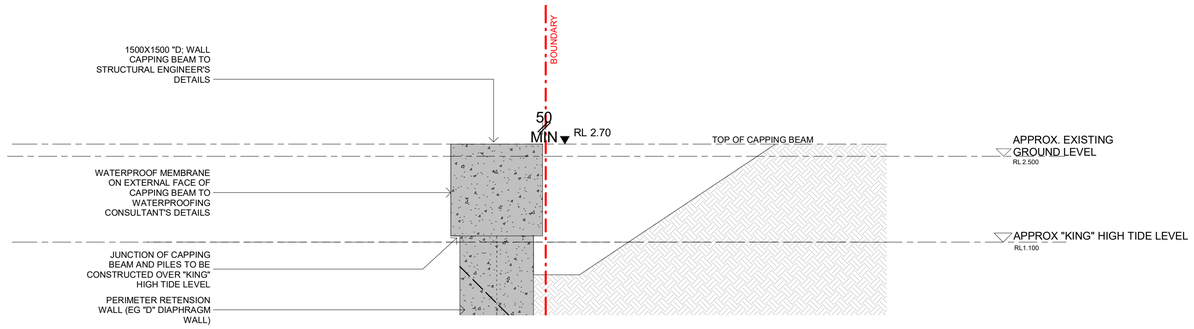

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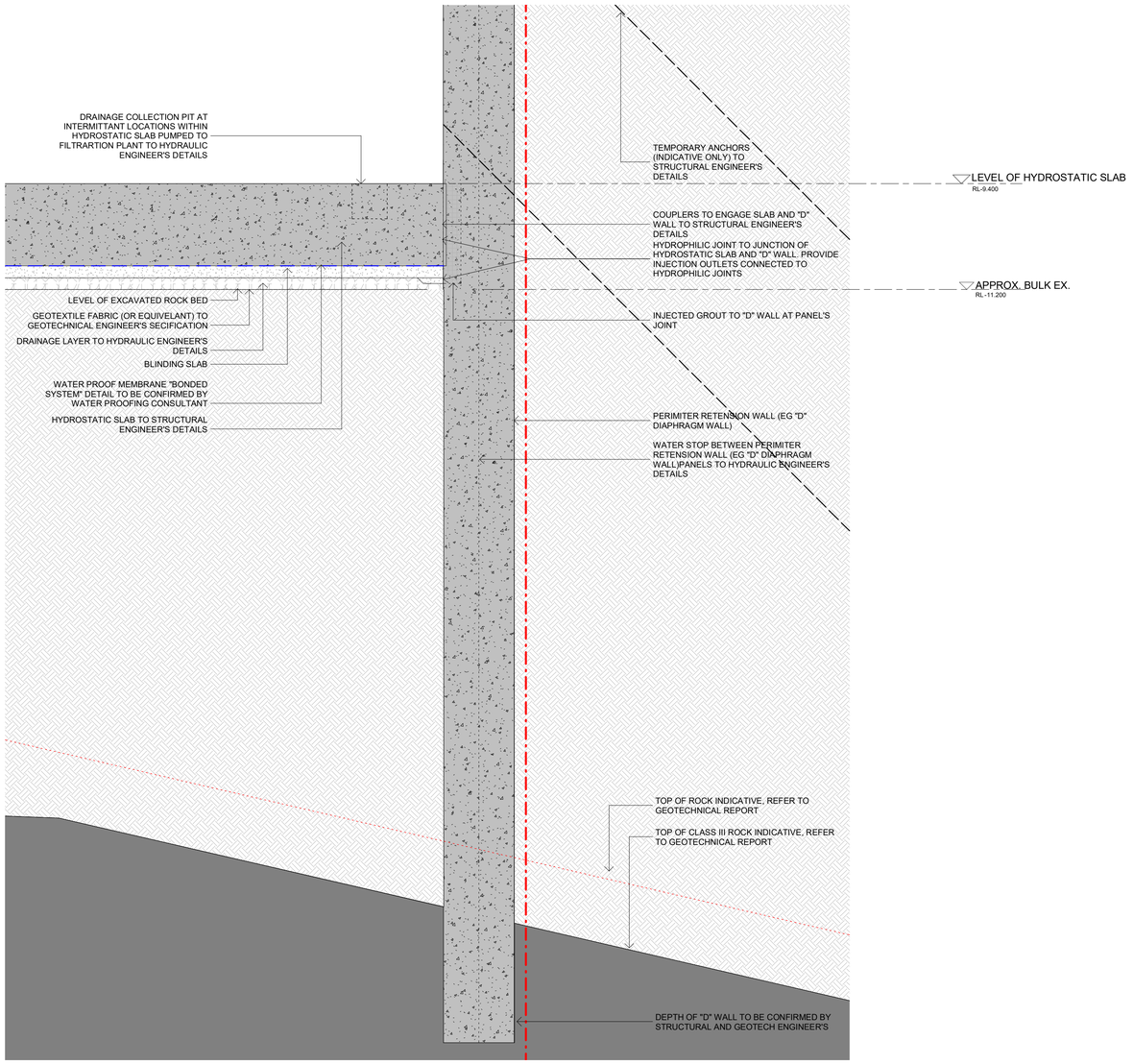

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Nominated Architects: Adam Haddow-7188 | John Pradel-7004

Rev	Date	Revision	By	Chk.
1	01.03.24	EWDA-2 DRAFT ISSUE	JR	JT
2	20.03.24	FOR INFORMATION	JR	JT

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Project

Central Barangaroo
Hickson Road, Barangaroo NSW

Country: Gadigal Country

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DETAIL WALL SECTIONS - SHEET 5 (WEST)

Date	Scale	Sheet Size
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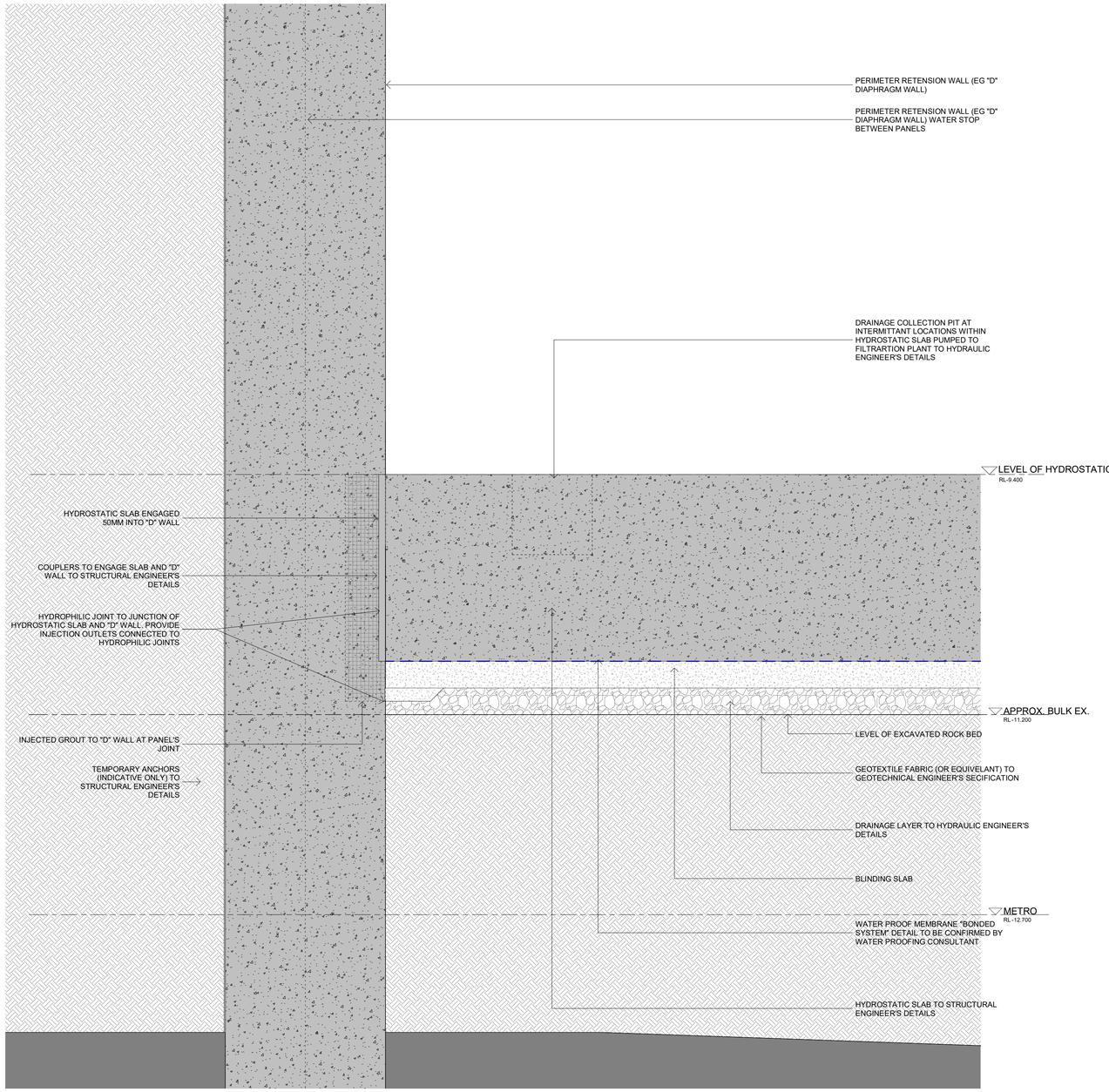

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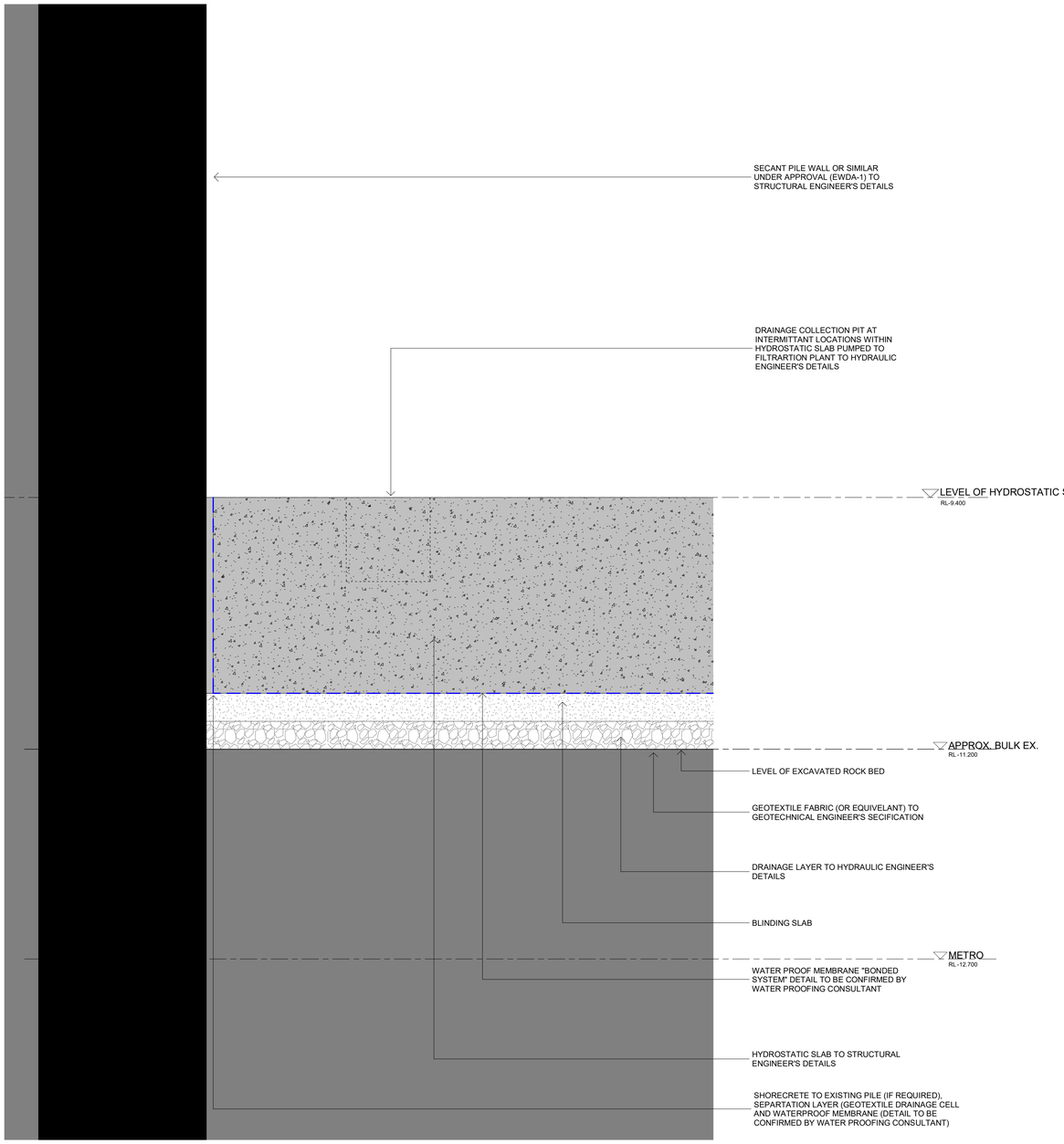

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NOTE: MINOR CHANGES TO FORM AND CONFIGURATION MAY BE REQUIRED WHEN DRAWINGS ARE SUBSEQUENTLY PREPARED FOR CONSTRUCTION PURPOSES AFTER THE GRANT OF DEVELOPMENT CONSENT.

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Nominated Architects: Adam Haddow-7188 | John Pradel-7004

Rev	Date	Revision	By	Chk.
1	01.03.24	EWDA-2 DRAFT ISSUE	JR	JT
2	20.03.24	FOR INFORMATION	JR	JT
3	03.04.24	EWDA-2 - FOR APPROVAL	JR	JT

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Central Barangaroo
Hickson Road, Barangaroo NSW

Country: Gadigal Country

Drawing Name
HYDROSTATIC SLAB AND PRW WP DETAILS - 1

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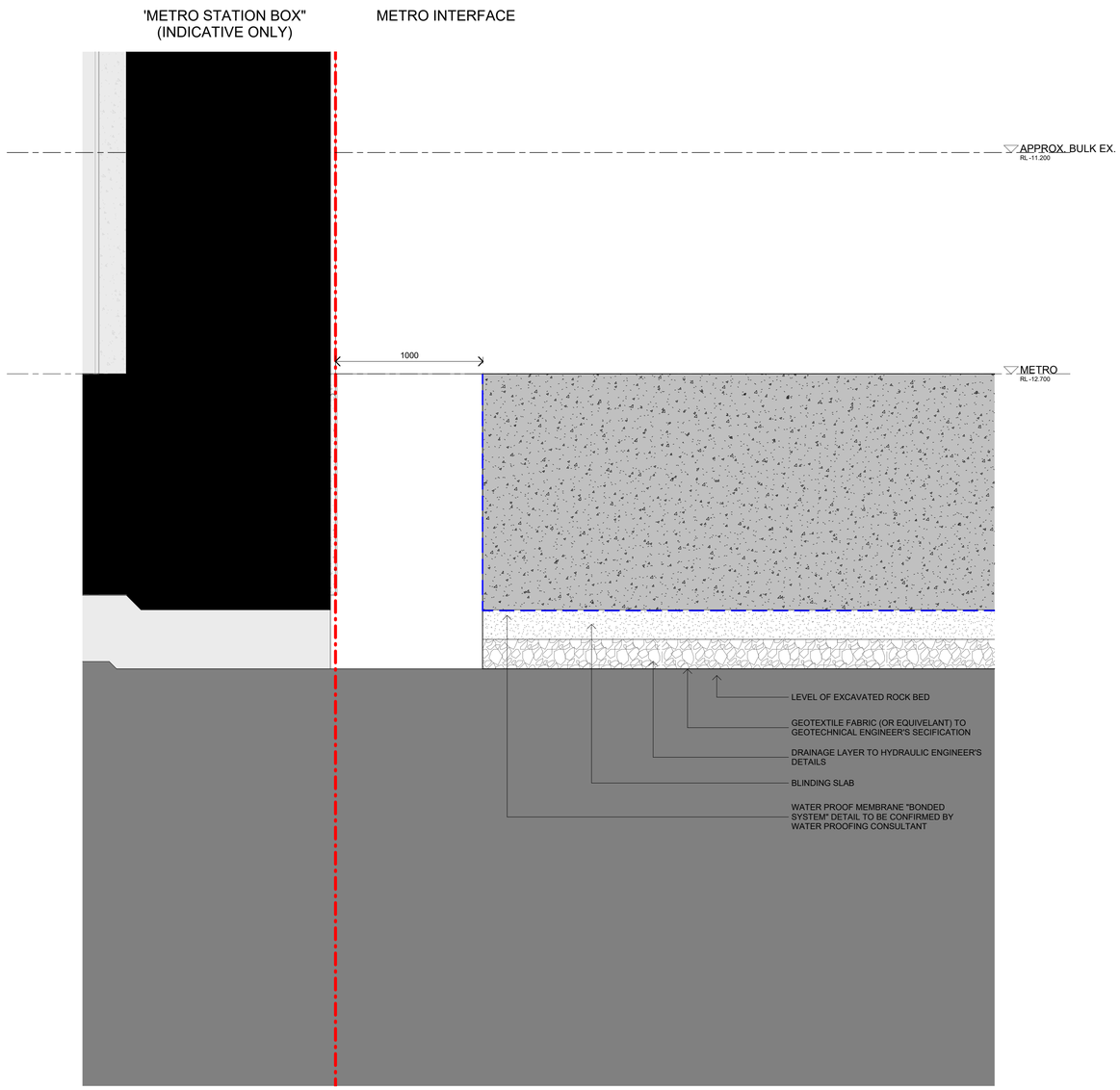

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METRO INTERFACE SLAB DETAIL

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FOR APPROVAL

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Nominated Architects: Adam Haddow-7188 | John Pradel-7004

Rev	Date	Revision	By	Chk.
1	01.03.24	EWDA-2 DRAFT ISSUE	JR	JT
2	20.03.24	FOR INFORMATION	JR	JT
3	03.04.24	EWDA-2 - FOR APPROVAL	JR	JT
4	25.04.25	EWDA-2 - Updated to incorporate revised Metro Interface	JR	JT

Client

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Central Barangaroo
Hickson Road, Barangaroo NSW

Country: Gadigal Country

Drawing Name

HYDROSTATIC SLAB AND PRW WP DETAILS - 2

Date	Scale	Sheet Size
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Appendix C: Asbestos Management Plan (EDP AMP, 2025)

Aqualand Projects Pty Ltd

Asbestos in Soil Management Plan

Central Barangaroo, Early Works DA-02

Prepared for:

Aqualand Projects Pty Ltd

Document Date:

06 March 2025

Reference:

S-04478.AQL.EWDA-02_AMP_V4

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DOCUMENT CONTROL

Project Details:	
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Client Name:	Aqualand Projects Pty Ltd
Reference:	S-04478.AQL.EWDA-02_AMP_V4
Prepared by:	Haneen Safadi
Reviewed by:	Hamish Donovan

Revision No.:	Revision Date:	Reason for Issue:	Authorised:	
			Name and Position:	Signature:
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V4	06/04/2025	Final	Hamish Donovan NSW Environment Manager	

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1. INTRODUCTION

EDP Consultants Pty Ltd (EDP) was engaged by Aqualand Projects Pty Ltd (Aqualand) to prepare an Asbestos Management Plan (AMP) to facilitate the Early Works Development Application 02 (EWDA-02) submission and works associated with EWDA-02. The site located at Hickson Road, Millers Point NSW (the site) as depicted in **Figure 1 - Appendix A.** The EWDA-02 is part of a larger Central Barangaroo area comprising part of Lot 52 of Deported Plan (DP) 1213772 (Central Barangaroo Site).

Asbestos contaminated soils will be disturbed / excavated as part of the EWDA-02 works which broadly involves the construction of perimeter diaphragm walls (including associated "tie-in" works to Metro Interface Wall and the secant pile wall proposed under EWDA-01), bulk excavation, dewatering, foundation piling, construction of a hydrostatic slab.

2. BACKGROUND

Asbestos contamination has been identified within soils at the site, historically imported as part of reclamation activities between the 1950s – 1970s. To support Aqualand's development plan, a detailed intrusive investigation was undertaken by EDP in 2023 across the site to characterise and waste classify in-situ soils. Refer to **Section 4** for summary of the *Waste Classification of In-Situ Material, Central Barangaroo, Hickson Road, Millers Point NSW* report (EDP, 2023).

The findings from EDP, 2023 confirmed the presence of asbestos throughout the majority of fill material which require management during excavation and soil disturbance works.

This AMP is a supporting document to the EDP Consultants, *EWDA-02 Remedial Works Plan, Central Barangaroo, 2024* report (herein referred to as RWP). The RWP was developed to provide additional remediation detail to the existing JBS Environmental Pty Ltd (JBS) Remediation Action Plan (RAP) (JBS 2013, herein referred to as the JBS RAP). The JBS RAP was subject to NSW EPA Site Auditor Review and considered appropriate to render the site suitable for the proposed use in the Site Audit Statement (SAS) (GN 439B-5) and Site Audit Report (herein referred as SAR) prepared by ENVIRON Australia Pty Ltd (AS121473, ENVIRON 2013), providing updated supporting documents (including this AMP) were prepared.

3. OBJECTIVE AND SCOPE

The objective of this AMP was to detail management strategies to mitigate risks posed by asbestos contaminated soils identified at the site which will be excavated for off-site disposal (or potential re-use) as part of the planned EWDA-02 works.

To achieve the above objective and to address legal obligations for managing asbestos in the workplace, EDP has prepared this AMP consistent with the requirements as outlined in the NSW *Work Health and Safety Regulation 2017* and Code of Practice: *How to Manage and Control Asbestos in the Workplace 2019*. The AMP specifies work practices and procedures to:

- Ensure the implementation of control strategies for the management of potential asbestos-impacted fill materials during the site works, with provision of safe work procedures and control measures;
- Identify asbestos-containing materials (ACM) at the site;
- Undertake emergency response for incidents relating to asbestos during the earthworks;
- Satisfy the expected Development Consent requirements for the site; and

4. PREVIOUS INVESTIGATIONS

4.1 EDP, 2023 In-Situ Waste Classification

Details of the *Waste Classification of In-Situ Material, Central Barangaroo, Hickson Road, Millers Point NSW* report (EDP, 2023) is summarised in the RWP. With regards to asbestos, the field sieving assessment undertaken in accordance with NEPM on test pits TP01 – TP08 did not identify ACM fragments within any of the 10 L samples. Only asbestos in TP03_2.4 (2.4 m depth) was observed in the AF/FA soil analysis.

Amosite, chrysotile and crocidolite asbestos was detected in 30 of the 1,232 presence/absence (AS4964-2004) soil samples collected using the sonic drilling rig. A total of 56 soil samples detected asbestos either above or below the laboratory detection limit of 0.1 g/kg. The detection of asbestos in soil was unable to be correlated with fibre cement fragments observed in fill across the site. Identified asbestos was found at depths from 1.0 m (GD18_1.0) to 15.0 m (WV24_15.0)

Laboratory comments on the nature of asbestos detected in the soil samples generally reported asbestos in the form of fibre bundles, fibrous mass, fibre cement sheets and bituminous materials.

Seven presumed ACM fragments were observed during the borehole advancement and were submitted for analysis as per AS4964-2004. Chrysotile and crocidolite asbestos were identified in six of the seven ACM fragments analysed from within the fill.

4.2 EDP, 2024 In-Situ VENM Assessment

Details of the *VENM Classification of In-Situ Material, Central Barangaroo, Hickson Road, Millers Point NSW* report (EDP, 2024) is summarised in the RWP. With regard to ASS, EDP, 2024 cross references the investigated material and draws correlations back to the original imported VENM during the Block 4 and Block 5 remediation. As VENM by nature must be free of sulfidic ores, no further ASS assessment of the imported material was undertaken as part of EDP, 2024 investigations.

5. SITE INFORMATION

5.1 Site Identification

Table 2 summarises the details of the work area associated with the requirements of this AMP. The site location and EWDA-02 Area is also illustrated in **Appendix A.**

Table 1: Site Details

Site Identification	
Site Address:	Hickson Road Millers Point NSW
Legal Identification:	Lot 52 in DP 1213772
Local Government Area:	City of Sydney
Site Description:	The site is located in Central Barangaroo, which forms part of the wider Barangaroo Precinct comprising a total area of 22ha. It is located in the north-western edge of Sydney CBD and falls within City of Sydney Local Government Area (LGA). Barangaroo Precinct interfaces with Hickson Road in the east, the foreshore in the west, Walsh Bay to the north and Darling Harbour in the south. ▪ **Barangaroo South (approx. 7.5ha)** – Located at the southernmost end of Barangaroo Precinct. Progressively built over the last six years and includes mixed-use neighbourhood comprising commercial office buildings, mixed use buildings, shops, cafes, hotel and community uses. ▪ **Central Barangaroo (approx. 5.2ha and area subject of SSDA)** – Located between Barangaroo South and Barangaroo Reserve. Currently vacant and

Site Identification	
	undergoing site preparation works to facilitate a mixed-use area with a focus on retail activation, residential and community uses. ▪ **Barangaroo Reserve (approve 6.1ha)** – Located in the northern end of the Precinct featuring Barangaroo Reserve. Featuring open space and lookout points to Sydney Harbour, Nawi Cove and Marrinawi Cove. Barangaroo Reserve features the Cutaway – a future arts and cultural entertainment space. The above results in a total area of 18.8ha. The residual 3.2ha is represented by the reshaping of the former industrial headland into Barangaroo Reserve and the creation of Nawi Cove as a substantial water body within the Barangaroo site, forming the original 22ha.
Site Area	5.2ha (approx.) of the 22ha Barangaroo Precinct
Current Zoning:	B4 Mixed Use and RE1 Public Recreation
Site Elevation:	Approximately 2 to 4 m Australian Height Datum (AHD)

5.2 Site Description and Surrounding Land Use

The area currently features a large concrete hardstand area/construction site that is occupied by temporary structures for site preparation works, machinery, materials and vehicle parking for site workers. Hoarding is currently erected around the Central Barangaroo site.

The site is also subject to current improvements such as remediation works, works to facilitate the Barangaroo Metro Station and a temporary road which runs off Hickson Road around the southern portion of the site. Tunnelling and excavation activities for the Barangaroo Metro Station have been completed.

5.3 Site History

Based on a review of the JBS RAP, the wider Barangaroo precinct was occupied by shipping and related merchants during the 1900s. Between 1840 and 1921, a gasworks operated by Australian Gas Light Company (AGL) was located within the southern end of site and extended east to what is currently Hickson Road. During this time, the original shoreline was altered to enable the construction of wharves which commenced from the mid-1920s. Over the past 20 years, the wider Barangaroo precinct was used primarily for stevedoring purposes until the majority of buildings were demolished and the land was prepared for redevelopment in the five years prior to the JBS RAP.

Priority was set to understand the conditions associated with the former gasworks area, referred to as the "Declaration Area" located within the southern end of the site. The gasworks were decommissioned between 1922 and 1925 and included the demolition of the surface of the gas holders, purifiers and other facilities and backfilling of holding tanks. No evidence was provided to suggest that operational gasworks waste or rubble generated during decommissioning were placed within the boundaries of the Barangaroo Central Site. Investigations within the Barangaroo Central site did not identify gasworks structures of waste materials.

Based on the timing of the gasworks decommissioning (between 1922 and 1925) and the commencement of site filling (between 1951 and 1972), JBS considered it highly unlikely that locally sourced gasworks waste or demolition material was used as fill during the reclamation works at Barangaroo Central.

6. TECHNICAL FRAMEWORK

The following legislation and Codes of Practice have been utilised (but not limited to) in preparation of this AMP:

- NSW *Work Health and Safety Act 2011*;
- NSW *Work Health and Safety Regulation 2017;*
- *Protection of the Environment Operations Act, 1997;*
- *Protection of the Environment Operations (Waste) Regulation 2014;*
- Code of Practice: *How to Manage and Control Asbestos in the Workplace 2019*;
- Code of Practice: *How to Safely Remove Asbestos 2019*;

- *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Edition* [NOHSC:3003(2005)];
- Australian Standard (AS) 4964-2004 *Method for the qualitative identification of asbestos in bulk samples* (AS4964-2004);
- *NSW EPA Waste Classification Guidelines: Part 1 – Classifying Waste 2014;*
- AS 2985-2009 Workplace atmospheres – *Method for sampling and gravimetric determination of respirable dust*;
- AS 3640-2009 Workplace atmospheres – *Method for sampling and gravimetric determination of inhalable dust*;
- AS 1319-1994 *Safety signs for the Occupational Environment*;
- AS/NZS 1716 2012 *Respiratory Protective Devices*; and
- AS/NZS 1715 2009 *Selection, use and maintenance of respiratory equipment*.

7. ASBESTOS CHARACTERISATION

EDP conducted a review of the data, photographs and field logging sheets around GD18_1.0 to determine if any characteristic differences between this location and other surrounding locations could explain the occurrence of asbestos at 1.0 m. Borehole data reviewed included GD03, GD17, GD19, GD34 and GD35, and the review could not conclude on distinguishing characteristics of GD18_1.0. Fill materials in shallower soils and are generally comprised an in-tact concrete blinding slab (surface), engineered fills, bitumen and aggregate, crushed concrete or sandstone. A summary of the borehole data review is included in **Appendix F** of this report.

Given the general material composition in soils shallower than 1.0 m, and that no other data from the boreholes or test pits (which involved NEPM %w/w sieving) presented evidence of asbestos contamination up to 1.0 mbgl, the asbestos at GD18_1.0 may be considered isolated to this location. With exception of the hardstand concrete slab which is ~0.3 m thick at GD18, all underlying soils at GD18 to the extent of the next clean sample (laterally) are considered asbestos impacted.

Across the site, there is some uncertainty around the nature of the fill materials at depths of approximately 1.0 m and deeper given the variability in the soil type, and other indication of contamination such as building and demolition wastes and hydrocarbon odours. Although not part of the basement excavation, asbestos was also identified in KS04_1.0 located immediately west with a similar soil profile. Other instances of asbestos are identified at 2.0 m and 3.0 m in soils with similar profiles to those at and immediately below 1.0 m. Based on this, soils across the site deeper than 1.0 mbgl are considered asbestos impacted with exception of former Block 4 and 5 remediation zones within the former ribbon wall as explained below and descripted in **Section 4.1**.

Soils to be excavated soils within the former remediation area (ribbon zone only) of Block 4 and Block 5 to the approximate surveyed depth of remediation are not considered asbestos impacted, on the provision that supervision by an environmental consultant will be undertaken where excavation within the ribbon zone is:

- within 2 m of the surveyed remediation depth; and
- within 3 m of the surveyed remediation boundary (ribbon wall).

As there may be some ambiguity of precise former ribbon wall location and exact depth of remediation (which was variable), supervision is required to minimise risks of inadvertently excavating original reclamation fill materials (deemed as asbestos contaminated) with the formerly imported VENM.

Based on the data and findings from EDP, 2023, the nature of asbestos contamination is considered to be non-friable.

8. ROLES AND RESPONSIBILITIES

Table 3 outlines the roles and responsibilities required as part of this AMP.

Table 3: Roles and Responsibilities

Role	Description of Responsibilities:
Asbestos Management Plan	The AMPC is to be a representative of or nominated by Aqualand. Duties of the AMPC include:

Role	Description of Responsibilities:
Controller (AMPC)	• Informing employees, contractors and subcontractors of the location of ACM at the site through the implementation of awareness training, as part of the induction process, etc.; • Providing or delegating supervision as required to ensure that the procedures documented in this AMP are implemented; • Ensuring asbestos related health and safety procedures, including permits to work are completed and safe work method statements (SWMS) are developed and updated on a regular basis; • Establishing a platform for consultation for all relevant site personnel to ensure responsibilities are understood and feedback can be provided; • Notifying workers or occupants of air monitoring results during asbestos remedial works; and • Ensure asbestos related records are maintained with this AMP. Documentation must be archived for an indefinite period and be accessible to any NSW Regulator if requested.
Person Conducting a Business or Undertaking (PCBU)	The PCBU is Aqualand organisation conducting business and undertaking works within Central Barangaroo. A general duty is imposed on any PCBU at a workplace to eliminate, as far as is reasonably practicable, a person's exposure to airborne asbestos, or if not reasonably practicable, to minimise so far as is reasonably practicable. A PCBU must ensure that the exposure standard for asbestos is not exceeded at the workplace. A PCBU has a responsibility in relation to asbestos to: • Provide and maintain, so far as practicable, safe and healthy work environments and practices generally, and have written policies on the control of asbestos; • Ensure, so far as is reasonably practicable, that all asbestos or ACM at the workplace is identified by a competent person; • Comply with legislative provisions; and • Liaise where appropriate on a continuous basis so that the existence and condition of asbestos in the working environment is known.
Principal Contractor	The Principal Contractor is to be appointed by Aqualand Projects Pty Ltd. Without negating the PCBU duties, the Principal Contractor assumes management or control of the site for the duration of the project. The Principal Contractor must: • Ensure, so far as is reasonably practicable, that all asbestos or ACM at the workplace is identified by a competent person; • Arrange for sampling, analysis and verification; • Engage a Class-A and Class-B licensed asbestos removal contractor (LARC),dependant on type of material being removed, for asbestos remedial works; • Engage suitably qualified and experienced hygienists to conduct asbestos hygiene services including air monitoring and clearances (as required); • Provide adequate instruction and training for employees and supervision of health and safety measures; • Consult with employees, their representatives and organisations and the NSW Regulator on the control of exposure to airborne asbestos; • Anticipate the need for the control of asbestos risks to be initiated in any particular case; • Provide appropriate protective clothing and equipment, hygiene procedures and personal decontamination facilities; • Prepare, complete, and submit documents for obtaining necessary approvals; and • Ensure a copy of the AMP is made readily accessible for all relevant personnel.
Principal Contractor Hygienist	The Principal Contractor Hygienist will be engaged by Aqualand and will be required to undertake a number of high level hygienist tasks on behalf of Aqualand, including: • Development, review and update of this AMP; • Providing advice on all matters related to occupational hygiene across all work packages and delivery stages; • Liaising directly with Aqualand, but also a number of stakeholders (for example, Project Management team, Sub-Contractor Hygienist, Site Safety Committee, INSW, SafeWork NSW);

Role	Description of Responsibilities:
	• Review and provide feedback on health and hygiene matters proposed by the Sub-Contractor Hygienist; and • Undertake regular due diligence reviews to ensure that the works are being undertaken in accordance with the relevant plans, procedures and legislation.
Sub-Contractor Hygienist	Each sub-contractor undertaking works at the site will be required to supply their own Sub-Contractor Hygienist. The Sub-Contractor Hygienist will be responsible for: • Undertaking air monitoring during excavation works; • Providing on-site visual inspection, identification of asbestos impacted material and validation sampling of non-asbestos impacted materials; and • Supervising works to ensure compliance with this AMP and NSW regulatory requirements for asbestos management and disposal.
All Hygienists	Hygienists referred to in this AMP should hold an asbestos assessor's licence to provide asbestos hygiene services for the works, including air monitoring clearance inspections. Additionally, all hygienists must be suitably qualified and experienced Competent Person with knowledge and experience in conducting asbestos in soil risk assessments, including sampling and validation.
Licensed Asbestos Removal Contractors	The licensed asbestos removal contractor (LARC) will be engaged to conduct asbestos remedial works (as required). The LARC must perform all works in accordance with licensing requirements and standard industry practice for asbestos removal. The LARC must: • Hold either a Class A (friable) or Class B (non-friable) Asbestos Removal Licence (as required). • Develop a SWMS for the removal work. • Develop an Asbestos Removal Control Plan (ARCP). • Submit an Asbestos Permit to Work Permit (APW) issued and approved by the AMPC. • Submit a 5-day asbestos removal notification to Safe Work NSW prior to remediation works. • Ensure all workers have been inducted into the site. • Ensure the appropriate licences and training/competencies of the workers undertaking the removal works are up to date. • Ensure asbestos work area is established. • Set up decontamination area. • Decontaminate machinery and equipment as required.
Sub-contractors	Aqualand will engage other sub-contractors during the works, including (but not limited to) plant and machinery operators and waste haulage contractors. These contractors must ensure their responsibilities are met in accordance with this AMP, including: • Completion of induction and training requirements in accordance with this AMP, including asbestos awareness training program for those entering the asbestos work area. • Working under supervision of LARC (as required). • Ensuring plant and machinery entering asbestos work areas have cabins with closed loop air conditioning system fitted with HEPA filter. • Ensuring minimum asbestos PPE is available and worn when entering and exiting asbestos work area.
Employers	Employers have a responsibility, in relation to asbestos for: • Ensure staff have attended an asbestos awareness training program. • Consulting on health and safety matters generally and on measures that may need to be taken on asbestos in occupied areas, on machinery and equipment. • Keeping themselves informed of advice given by competent persons in relation to inspections and meeting health and safety commitments. • Co-operating on any reasonable request for the variation to work hours and hours of work. • Advising members of their obligations and responsibilities under occupational health legislation.

Role	Description of Responsibilities:
Workers	Any person entering or conducting work at the site, including workers involved in off-site processes such at transportation, haulage and materials delivery have a responsibility in relation to asbestos that includes: • Taking reasonable care for his or her own health and safety. • Taking reasonable care that his or her acts or omissions do not adversely affect the health and safety of other persons. • Complying with instructions given for their own safety and health and that of others generally. • Complying with all work procedures and instructions related to asbestos. • Co-operating with supervisors and managers in their fulfilment of legislative obligations. • Reporting immediately to their supervisor any perceived safety or health risk. • Wearing and maintain in good order all protective clothing and apparatus provided by the manager or supervisor for personal protection and maintain same in good order. • Ensuring all equipment is in good working order.
Visitors	Visitors have a responsibility in relation to asbestos that includes: • Entering the site under the permission and escort of the Principal Contractor and PCBU. • Taking reasonable care for his or her own health and safety. • Taking reasonable care that his or her acts or omissions do not adversely affect the health and safety of other persons. • Complying with instructions given for their own safety and health and that of others generally; • Complying with all work procedures and instructions related to asbestos. • Co-operating with site staff in their fulfilment of legislative obligations. • Complying, so far as the person is reasonably able, with any reasonable instruction that is given by the person conducting the business or undertaking to allow the person conducting the business or undertaking to comply with all legislative requirements and this AMP. • Reporting immediately (as applicable) to Aqualand, any perceived safety or health risk.
SafeWork NSW / Regulator	NSW Work Health and Safety Regulator. Focuses on harm prevention and improving the safety culture in NSW workplaces. They provide the following: • Offers advice on improving work health and safety. • Provide licenses and registrations for potentially dangerous work. • Investigate workplace incidents. • Enforce WHS laws in NSW.

9. INDUCTIONS, TRAINING & HEALTH MONITORING

All workers who may impact on potential asbestos in soil while working at the site should be made aware of the presence of asbestos through inductions to this AMP, toolbox talks and awareness training package.

9.1 Toolbox Talks

While conducting any works at the site with the potential for soil disturbance, all relevant site personnel should undertake a toolbox talk session to ensure that employees and contractors are adequately trained to recognise environmental and work, health and safety issues on a regular basis. The toolbox talk should incorporate details and instructions on how to manage asbestos-impacted soils that may be encountered whilst undertaking works at the site, in accordance with this AMP.

9.2 Inductions

The AMPC will provide (or delegate) an induction into this AMP for new employees and contractors whose involvement has the potential for asbestos to be encountered at the site. As part of the induction, the AMPC (or delegate) must examine the works to be performed, determine whether the works will impact on asbestos-impacted soils and advise what can and cannot be done. The induction should include information such as (but not limited to):

- The known asbestos-impacted areas;
- Type of asbestos that may be/have been encountered within the soil;
- The necessary permits to be completed (i.e. permit to work/SWMS), with the control measures to be adopted and appropriate personal/respiratory protective equipment (PPE/RPE) and decontamination procedures to be conducted; and
- Unexpected finds and expected finds protocol, including reporting ACM finds to the AMPC (or delegate) as soon as possible so that the appropriate corrective action can be initiated.

This AMP must be made available onsite to all contractors for reference, particularly for the direction on how to manage asbestos-impacted soils during earthworks or if encountered at the site, refer to **Section 12**.

Record of contractors or other personnel who have attended the induction must be maintained in **Appendix B** of this AMP.

9.3 Asbestos Awareness Training

As per the Code of Practice: *How to Manage and Control Asbestos in the Workplace 2019,* the training program should include the following topics:

- Health risks of asbestos;
- Types, uses and likely presence of asbestos at the site;
- Roles and responsibilities of the AMPC and workers under the AMP;
- Where to find the AMP and how to understand the information contained;
- Safe work procedures to be followed with examples to prevent exposure;
- The correct use of PPE/RPE;
- How to implement of control measures and safe work procedures;
- When a Class-A or Class-B LARC are required for asbestos remedial works; and
- Air monitoring requirements and exposure standard for airborne asbestos.

The objective of the training is to create changes in behaviour and asbestos management through improved awareness of workers at the site. The purpose of the training is also to provide understanding to workers of the health implications with of exposure to asbestos, the appropriate control measures and their responsibilities legislative obligations.

It should be considered that all workers at the site undergo an asbestos awareness training session to advise of the presence of potential asbestos in soil whilst conducting works associated with the site.

9.4 Health Monitoring

As per Clause 435 of the *WHS Regulation 2017*, the PCBU has a duty to provide health monitoring to a worker carrying out ongoing asbestos-related work and is at risk of exposure to asbestos when carrying out the work.

Based on the available information relating to asbestos contamination reported within the other stages of the project, the risk of exposure to asbestos during the earthworks is considered to be low based on the asbestos contamination considered to be non-friable in nature with limited ability to become airborne.

It is understood that the results of the air monitoring conducted during the previous stages of the project were all less than the reporting limit of <0.01 fibres/ml, indicating a low risk of exposure during soil disturbance. As such, health monitoring is not deemed to be a mandatory requirement for workers conducting general earthworks at the site. Confirmation of potential asbestos exposure levels will be monitored throughout the works with background and exposure asbestos-fibre air monitoring conducted for the duration of the works. Airborne asbestos-fibre concentrations must be maintained less than 0.01 fibres/ml, otherwise health monitoring requirements will be triggered.

As per legislative requirements, health monitoring is still required for personnel routinely engaged in asbestos removal and asbestos associated works outside this particular project. This is expected to include the asbestos supervisor and hygienists as a minimum.

9.5 Respirator Fit Testing

Any respirators used during works undertaken at the site must be face fitted to the individual with evidence of the quantitative face fit provided with the contractor's safety documentation. All operatives required to wear respirators must be cleanly shaven to ensure a suitable seal.

9.6 Permit to Work

For any asbestos remedial work, an asbestos permit to work (APW) will need to be issued to, and signed by, the LARC. The APW may only be issued by the AMPC. Before being issued with an APW, the LARC are required to read and understand the AMP.

The APW should detail the nature of the work to be performed and document the removalist/contractor agreement to:

- Abide with the requirements for working with ACM as detailed in the NSW Codes of Practice;
- Isolate/restrict access to the work area;
- Provide and erect appropriate warning signs;
- The use of safe work procedures;
- Appropriate use of PPE/RPE;
- Appropriate decontamination and clearance inspections of the work area; and
- Remove and dispose of any ACM (including PPE/RPE) in accordance with WHS legislation.

The APW formally transfers the responsibility for compliance with this AMP and the NSW *Work Health and Safety Regulation 2017* to the signatories.

An example APW is provided in **Appendix C.**

10. COMMUNICATION AND CONSULTATION

Consultation through an agreed and documented mechanism where workers consult on a regular basis to express their views on health and safety matters at the site should be established.

The procedure should provide a framework for:

- Workers to communicate health and safety matters associated with asbestos at the site;
- Resolving workplace health and safety risks;
- Ensuring management personnel are aware of hazards and health and safety issues experienced by employees, contractors and visitors to site;
- Decision-making about health and safety by gathering a wider source of health and safety ideas and knowledge;
- Supporting commitment to health and safety;
- Reducing the number and severity of health and safety risks and hazards; and
- Strengthening the health and safety culture at the site.

11. RECORD KEEPING

The AMP is to be a dynamic document that is revised where necessary to reflect any changes to the site that may result in a change to asbestos exposure risk factors and associated asbestos controls. As soon as reasonably practicable, after such a change is identified, the AMP shall be revised by the Principal Contractor's Hygienist. Whenever the AMP is amended, all site personnel including sub-contractors shall be inducted to the revisions of the AMP and any associated revisions relating to their responsibilities. Documentation of the changes / updates to the AMP and communication of the changes must be recorded within this AMP.

The AMP shall be maintained by the AMPC and PCBU with input from other stakeholders.

Relevant documentation regarding the implementation of this AMP should be maintained by the AMPC and PCBU. The documentation may include (but not be limited to):

- Site plans, identifying the location of asbestos-impacted soil at the site;
- Revisions of the AMP for the site;
- Asbestos related incident reports;
- Employee and contractor inductions and training records;
- Health monitoring records or statement of subcontractors regarding compliance with health monitoring requirements; and
- Relevant environmental reports.

It will be the responsibility of AMPC and PCBU to review and update the records as required and to implement corrective actions where necessary.

Relevant records should be maintained with this AMP. And example of an AMP review and change register is included in **Appendix E**.

12. ASBESTOS REMEDIATION SPECIFICATION

Remedial works procedures and sequencing which this AMP relates are described in the RWP. Details of the specific controls and mitigations to manage asbestos are detailed in the following sections.

12.1 General Requirements

Any works proposed to disturb the soils at the site will require management in accordance with this AMP. If earthworks are to be completed in an area of confirmed asbestos contamination the works must be supervised by a contactor holding a Class A (friable) or Class B (non-friable) asbestos removal licence issued by SafeWork NSW under all applicable controls and procedures in accordance with this AMP. In addition, air monitoring and clearance inspections are required for all earthworks by a nominated hygienist/LAA, independent from the LARC.

12.2 Safe Work Method Statement

Responsible Party: Aqualand, Licensed Asbestos Removal Contractor, Hygienist and Sub-Contractors

Prior to the commencement of earthworks at the site, all employees or nominated sub-contractors are required to have completed a detailed SWMS for the works. The SWMS should include task-specific health and safety protocols for the works, including the management of asbestos contamination.

12.3 Regulator Notification

Responsible Party: Licensed Asbestos Removal Contractor

The appointed LARC must submit a five-day notification and Asbestos Removal Control Plan prior to the commencement of asbestos in soil removal works to SafeWork NSW.

12.4 Neighbour Notification

Responsible Party: Aqualand and Licensed Asbestos Removal Contractor

The LARC will draft the required notification for adjacent properties and will submit this to PCBU for review and approval. The LARC is to notify neighbouring properties of the removal of asbestos. This will be undertaken at least two weeks in advance of the works to ensure adjacent properties are aware of the upcoming works.

12.5 Control Measures for Asbestos Remedial Works

Responsible Party: Aqualand, Licensed Asbestos Removal Contractor, Hygienists and Sub-Contractors

The following procedure must be followed during the asbestos remedial works, which are deemed to include the excavation, stockpiling, transport and disposal of confirmed asbestos-impacted soil at the site.

- Prior to the commencement of the works, all relevant site personnel must be appropriately trained and inducted into the requirements of this AMP and undertake a toolbox talk as detailed in **Section 9.1** to ensure that workers are adequately trained to recognise environmental and health-related issues associated with potential asbestos in soil contamination at the site.
- LARC to delineate the asbestos work area(s). The asbestos work area(s) is where the asbestos-impacted soils will be excavated and stockpiled and will also include vehicle transit routes and decontamination area(s).
- The asbestos work area must be established by the LARC with suitable exclusion zones with signs and barricades to clearly delineate and isolate the area. Signs must be placed in positions that clearly indicate the location of the asbestos work area(s). The work area(s) must remain in place until the works are completed within an area, with all air monitoring results satisfactory and clearance certificate issued by hygienist.
- LARC must set-up dry decontamination area at the entrance/exit to the asbestos work area(s), as detailed in **Section 12.8.1.**
- LARC to establish a suitable stockpiling area within the asbestos work area. The stockpile footprint is to be lined with high-density polyethylene (HDPE) sheeting and should be located away from drainage lines and waterways.
- The hygienist shall undertake control asbestos fibre air monitoring for the duration of the earthworks in accordance with the NOHSC *Membrane Filter Method for Estimating Airborne Asbestos Fibres, 2nd Edition 2005* [NOHSC:3003(2005)]. Monitoring must be NATA accredited, including sampling and analytical methods, as detailed in **Section 12.10.2.**
- Minimum PPE must be worn at all times by workers within the asbestos work area including P2 half face respirator, Type 5/6 coveralls, disposable booties and gloves. Further details on PPE requirements are provided in **Section 12.7.**
- Truck drivers and plant/machinery operators will operate and be supervised in the asbestos work area by the LARC. Operators may be exempt from some asbestos PPE requirements if it can be shown that their cab can be sealed during works and closed loop air conditioning can be engaged with HEPA filter attached. As a minimum a P2 half face respirator must be worn when entering the asbestos work area and traveling to and from the excavator cab.
- Transport routes must be planned prior to commencing transport across the site to minimise driving over fill materials with minimal obstacles.
- All drains that may be affected by the asbestos remedial works (including contaminated water from decontamination area(s) should be capable of capturing particles down to 5µm to prevent asbestos residue entering the drainage system. Filter material shall be inspected and replaced regularly. Soiled filter media is to be disposed offsite as Special Waste (asbestos waste).
- Care should be taken to ensure dust generation is kept to a minimum, with dust suppression techniques to be employed throughout each stage of works. Dust suppression should be in the form of a fine mist water spray. This can be achieved with a mains-supplied hose fitted with a pistol grip or water cart. Excessive use of water causing pooling and run-off should be avoided, further dust suppression techniques are provided in **Section 12.6.3**.
- During the excavation process, all earthworks must be undertaken systematically with observations of all soil being extracted, stored, moved, and disposed offsite recorded.
- Surface concrete should be carefully separated from soil and visually inspected and cleared by hygienist prior to offsite disposal.
- Stockpiles generated during the works must be carefully placed within the stockpiling area and covered and secured with weighted HDPE sheeting or geofabric as detailed in **Section 12.6.4.**
- Hygienist must conduct soil sampling of stockpiles for waste classification purposes to facilitate offsite disposal of the material to a licensed landfill facility in accordance with *the NSW EPA Waste Classification Guidelines: Part 1 – Classifying Waste, 2014.*

- All plant and machinery must be decontaminated and visually cleared by hygienist prior to leaving the site, as per **Section 12.8.3.**
- Decontamination of all workers, PPE and tools used during the asbestos earthworks is required when exiting the asbestos work area. All waste generated during the works must be disposed offsite as Special Waste (asbestos). Further details of decontamination and waste procedures in outlined in **Section 12.8.**
- The hygienist must provide clearance inspections at various stages of the earthworks as detailed in **Section 12.10.3.**

12.6 Site Set-Up

12.6.1 Fencing and Signage

Responsible Party: Principal Contractor and Licensed Asbestos Removal Contractor

The asbestos work area shall be established for the duration of the earthworks and must be made secure and signed appropriately (e.g. 'Authorised Persons Only' or 'Specialised Work Zone'). The asbestos work area shall include the establishment of a physical barrier and an exclusion zone surrounding the site.

For the purposes of this AMP the asbestos work area should be designated as the zone where soil disturbance is being undertaken, including the decontamination area. The asbestos work area should be established prior to earthworks commencing. This boundary shall be maintained throughout the duration of the works.

12.6.2 Erosion and Sediment Control

Responsible Party: Principal Contractor and Licensed Asbestos Removal Contractor

Erosion and sediment controls must be in place prior to commencement of work, especially in areas of highly erodible soil. Suitable containment and (where applicable) filtration is to be used at the asbestos work area boundaries to prevent run-off to adjoining property or to the adjacent water body particularly at vehicle wash points.

12.6.3 Dust Suppression

Responsible Party: Principal Contractor and Licensed Asbestos Removal Contractor

Dust suppression techniques must be adopted to minimise the generation and dispersal of dusts during excavation works. Note that care must be taken to prevent and control water run-off.

These techniques may include:

- Fine water spraying;
- Use of gravel or fabric barriers to the surface of trafficked areas;
- Minimising the degree of traffic;
- Covering stockpiles with HDPE sheeting or geofabric at the conclusion of each shift; and
- Ceasing works if environmental conditions result in visible dust being generated from the site.

12.6.4 Stockpile Management

Responsible Party: Licensed Asbestos Removal Contractor

The following is required for stockpiles generated during the works:

- Stockpiles shall be established on HDPE sheeting or geofabric on the ground surface;
- Dust suppression shall be in place as discussed above;
- Stockpiles shall not exceed 2 m in height and shall be of the lowest height practicable;
- Stockpiles shall have asbestos signage displayed where present;
- Stockpiles are to be wetted down with water;
- Stockpiles to be stored for more than one day, or where adverse weather conditions are expected (e.g. high winds) shall be covered with weighted HDPE or geofabric; and

- Stockpiles shall be suitably barricaded or otherwise fenced off to prevent access.

12.7 Personal and Respiratory Protective Equipment

Responsible Party: All Workers Entering and Exiting the Asbestos Work Area

All contractors undertaking asbestos remedial work at the site shall be responsible for providing their workers with appropriate PPE/RPE to minimise the risk of exposure to asbestos. The level of PPE/RPE required for asbestos remedial work detailed in this AMP has been based on the asbestos contamination previously identified within Stage 1A (non-friable ACM). Minimum asbestos PPE should include the following:

- Half face respirator with P2 particulate filter;
- Disposable nitrile or latex gloves;
- Type 5/6 disposable coveralls; and
- Disposable boot covers or footwear that can be easily decontaminated (i.e. gumboots).

Plant and machinery operators may be exempt from asbestos PPE requirements if it can be shown that the cab can be sealed during works and closed loop air conditioning can be engaged with HEPA filter attached. As a minimum a half face respirator with P2 particulate filter must be worn when entering the asbestos work area and traveling to and from the excavator cab.

See the below sections and **Appendix D** for further information/specifications on asbestos PPE.

12.7.1 Respirators

The selection of suitable RPE depends on the nature of the asbestos work, the probable maximum concentrations of asbestos fibres encountered and any personal characteristics of the wearer that may affect the facial fit of the respirator (facial hair and glasses etc.). Workers must be clean shaven to maintain a sufficient seal and respirators must be fit-tested for the individual on annual basis. If the wearer cannot be clean shaven, a powered air purifying respirator (PAPR) with hood may be worn.

Based on the non-friable asbestos contamination previously identified at the site a half face P2 respirator is deemed to provide suitable protection for the asbestos remedial works. If friable ACM is uncovered during the works, a risk assessment must be conducted by the hygienist to determine the most appropriate form of RPE to be worn, alternatively a P3 full face respirator must be worn.

12.7.2 Coveralls and Boot Covers

Disposable coveralls should be utilised to minimise the risk of asbestos fibres contaminating clothing or under garments during asbestos remedial works. Coveralls rated Type 5/6 or Category 3 (EN ISO 13982–1) are of a suitable standard and should be fitted with elastic hoods, cuffs and anklets to reduce the risk of penetration of asbestos fibres.

If laced boots with eyelets are worn by workers, it is advisable that protective boot covers are worn in tandem with coveralls. Boot covers help ensure asbestos fibres do not contaminate footwear which cannot be easily decontaminated.

Coveralls and boot covers should be used for single use only. Once coveralls and boot covers have been used, they should be treated as asbestos contaminated waste.

12.7.3 Gloves

Disposable latex or nitrile gloves should be worn when handling asbestos or working around asbestos. Gloves should be single use only and disposed of as asbestos waste one used.

12.8 Decontamination

Decontamination of the work area, workers, PPE/RPE and tools used in asbestos remedial work is an important requirement in the process of minimising exposure to airborne asbestos fibres. Decontamination not only reduces

the exposure risk to workers exiting an asbestos work area but also to persons outside the asbestos removal work area.

To determine the appropriate decontamination procedure, the risks of the remedial works should be assessed. Either wet decontamination, dry decontamination methods (or a combination of both) should be utilised each time persons or equipment enter/exit an asbestos work area and at the completion of the asbestos work.

The selection of decontamination methods and procedures including how to set up an effective decontamination area/s is outlined in the *Code of Practice: How to Safely Remove Asbestos 2019*. The following decontamination procedure has been developed as part of this AMP which is based on the nature of potential asbestos contamination at the site (non-friable ACM).

12.8.1 Decontamination Area Set-Up

Responsible Party: Licensed Asbestos Removal Contractor

The LARC must provide a dry decontamination area(s) set up at the entrance/exit to the asbestos work area for site workers to personally decontaminate when entering and exiting the asbestos work area.

This decontamination area shall include:

- A dirty decontamination area that includes:
  - Equipment for hosing down (by use of a fine mist) contaminated clothing and footwear;
  - Storage for contaminated clothing and footwear;
  - Asbestos waste bags and duct tape; and
  - Geofabric lining to capture water.
- A clean decontamination area that includes:
  - Storage for individual RPE in containers.
  - Spray bottle of water or wet wipes; and
  - Asbestos waste bags and duct tape.
- A clean change area that includes:
  - Storage for clean clothing and PPE.

12.8.2 Decontamination of Personnel and Hand Tools

Responsible Party: All Workers Entering and Exiting the Asbestos Work Area

The procedure for entry to the asbestos work area for all workers is to be as follows:

- Enter via the clean changing area, where personnel will change into the required PPE. Any clothes removed here shall be stored.
- Move to the clean decontamination area and put on respirators. Check for good fit and seal before progressing.
- Proceed to asbestos work area.

The procedure for leaving the asbestos work area for all workers is to be as follows:

- Proceed into the dirty decontamination area. Decontaminate all tools and equipment used during the works using wet wipes and/or fresh water before they are removed from the asbestos work area.
- Spray down PPE and RPE using fine mist water spray. Do not remove respirators at this stage. Booties, coveralls and gloves can be removed and placed in labelled asbestos waste bags.
- Proceed to clean decontamination area: Wash hands, fingernails, face, head and respirator using wet wipes or spray bottle of water. Respirator can be removed at this point. Store respirator in a suitable container within the clean decontamination area.
- Move to the clean change area and change into clean clothing.

Disposable PPE and all waste generated during decontamination procedure must be placed in double asbestos waste bags, tied in a goose-neck position with duct tape and disposed offsite as Special Waste (asbestos). Note that asbestos waste bags must be filled to 50% capacity only.

12.8.3 Decontamination of Plant and Equipment

Responsible Party: Licensed Asbestos Removal Contractor

A plant decontamination area must be designated and maintained at the site during asbestos remedial works which is to remain until completion of the works. Additional decontamination procedures include:

- Placing geofabric on the surface of the designated plant and equipment wash bay prior to commencing decontamination.
- Installing silt fencing or bunding if necessary, to prevent water and/or contaminated soil from leaving the site.
- Using a water truck or hose pipe, and hand tools for the purpose of decontaminating plant such as excavators, paying particular attention to the excavator track and bucket.
- Installing wheel wash bay at the exit of the asbestos work area for all plant and machinery to exit through.

12.9 Exempt Tools and Equipment

Tools and equipment that generate dust must not be used on asbestos impacted soils during the project. These include:

- High-speed abrasive power and pneumatic tools, for example angle grinders, sanders, saws and highspeed drills.
- Brooms and brushes.
- High-pressure water spray, jets, power or similar tools and instruments.
- Compressed air.

12.10 Asbestos Hygiene

12.10.1 Visual Inspection of Site-Set-Up

Responsible Party: Hygienist

A visual inspection will be undertaken by the hygienist / LAA to assess the completion of the establishment of the asbestos work area and decontamination facilities prior to commencement of the asbestos remedial works. Access to the asbestos work area will only be permitted following satisfactory completion of the visual inspection.

12.10.2 Asbestos-Fibre Air Monitoring

Responsible Party: Hygienist

NATA accredited asbestos fibre air monitoring must be undertaken during the asbestos removal works by a the hygienist / LAA. Air monitoring must be undertaken in accordance with NOHSC: 3003(2005) and ISO/IEC 17025 *General requirements for the competence of testing and calibration laboratories 2017*.

Air monitoring results must be daily. Works shall cease if the air monitoring results are found to be above the reporting limit of 0.01 fibres per millilitre of air (f/ml). Emergency procedures shall be followed when air monitoring control levels are exceeded as outlined in **Section 15.2.**

12.10.3 Visual Clearances Inspections and Certificates

Responsible Party: Hygienist

Following the completion of daily works, a site walkover must be undertaken by the nominated hygienist to confirm that no visible asbestos materials are present outside the asbestos work area(s). Clearance certificates should be

provided and issued for the site following clearance inspections and at appropriate milestones throughout the removal works, including:

- Following concrete removal to facilitate offsite disposal as construction and demolition waste. This is also a hold point to verify exposed soils (except around GH18) are clear of asbestos.
- Once excavation has occurred to the required design depths and new concrete has been satisfactorily installed.
- Dismantling of stockpile staging areas or stockpile bays.
- Plant and machinery prior to exiting the asbestos work area.

Any stockpiles generated during excavation works shall be wetted down and covered with weighted HDPE sheeting or geofabric as detailed above.

At the conclusion of works in a specific area, the hygienist must also undertake a walkover of the area to confirm that visible asbestos materials in the area have been sufficiently removed and the area has been sufficiently stabilised.

As air monitoring certificates are issued for the site, an accompanying daily update summarising the asbestos-related activities undertaken at the site should be provided to Aqualand.

12.11 Transport and Waste Disposal

Responsible Party: Licensed Asbestos Removal Contractor and Waste Haulage Contractors

For the offsite disposal of asbestos-impacts soils generated at the site, the material will be pre-classified as Special Waste (asbestos waste) with soil chemical characterisation required in accordance with the *NSW EPA Waste Classification Guidelines: Part 1 – Classifying Waste 2014* prior to disposal offsite to an appropriately licensed landfill facility. Hygienists or environmental consultants must conduct soil chemical characterisation for waste classification to facilitate appropriate offsite disposal to a NSW landfill facility.

Asbestos materials need to be double bagged in asbestos waste bags and tied in a goose-neck position prior to disposal. Soils should be directly placed into awaiting trucks lined and covered with tarpaulin. Asbestos waste must be tracked for quantities greater than 10 m^2 or volumes greater than 100 kg using NSW EPA's Waste Locate https://wastelocate.epa.nsw.gov.au/.

13. SAMPLE COLLECTION OF SUSPECTED ASBESTOS

If suspected ACM requires identification during the works, the nominated hygienist shall sample the suspected material in accordance with AS4964-2004.

Sample/s collected must be delivered to and analysed by a NATA accredited laboratory for the presence of asbestos using polarised light microscopy and dispersion staining techniques. Once the NATA accredited laboratory report has been received, Aqualand is to engage the Principal Contractor Hygienist to conduct a risk assessment of the material if found to contain asbestos and determine whether the existing control measures are adequate or whether additional control measures need to be adopted.

If ACM is identified, details should be recorded and actioned within the ACM Find Checklist provided in **Appendix E.**

14. UNEXPECTED FINDS PROTOCOL

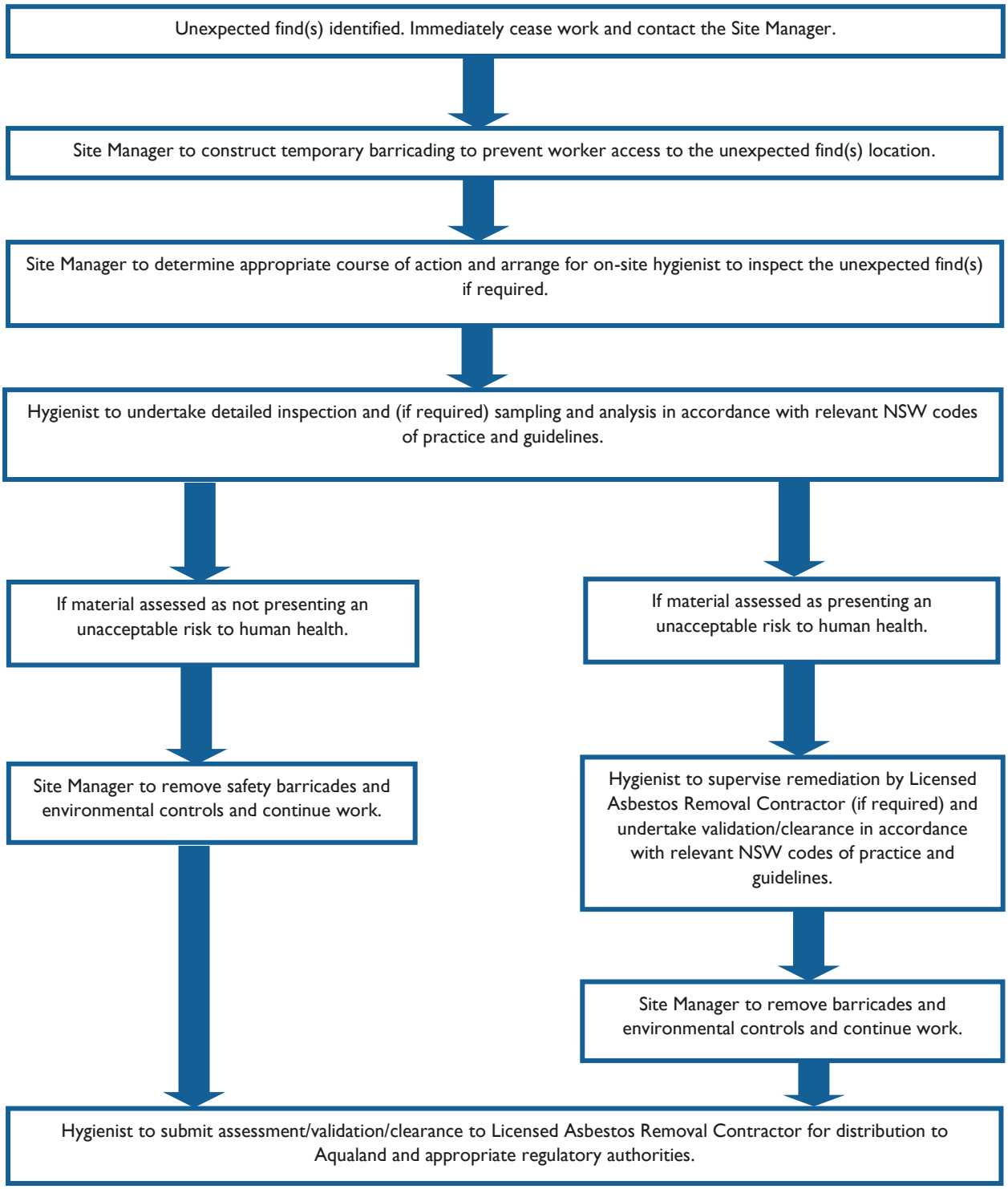
If one or more of the following situations is identified, the AMPC and PCBU must be notified, works shall cease within the area, the excavation covered with soil and the area made secure until such time as an assessment of the area can be undertaken by the hygienist and an appropriate course of action determined:

- Friable ACM is uncovered;
- Any form of asbestos within areas not considered to be asbestos contaminated per **Section 7**; and/or

- Other potential contaminants are identified including stained or malodourous soil in some instances. Refer to the Remedial Works Plan for the site for a greater detail on unexpected finds.

The flow-chart overleaf details the unexpected finds protocol to be adopted.

FLOW CHART – UNEXPECTED FINDS PROTOCOL



15. INCIDENTS AND EMERGENCY PROCEDURES

The following sections outline the emergency procedures to follow should there be an uncontrolled release of asbestos fibres at the site, or if air monitoring detects an exceedance of respirable airborne fibres above the action levels.

15.1 Asbestos Disturbance

In the event that an activity causes the accidental disturbance of ACM resulting in the potential uncontrolled release of airborne fibres, the following outlines the steps which should be followed.

Table 4: Emergency Response Procedure

Step:	Responsible Person:	Action:
1	Occupant / Worker / Contractor	• Stop work and immediately notify the AMPC.
2	AMPC	• Remove personnel from the area who are potentially at risk of exposure.
3	AMPC	• Restrict access to the area, dampen and contain. • Erect signage and barricades to restrict access to the area.
4	AMPC / Hygienist	• Contact hygienist to provide advice on additional controls.
5	AMPC	• If asbestos confirmed, hygienist to conduct air monitoring within the area. • All air monitoring results must be below the lowest reporting limit for the method of <0.01 fibres/ml. • Engage LARC (as required) to undertake asbestos remedial work.
6	LARC / Hygienist	• LARC (as required) to perform asbestos remedial works. • Hygienist to perform control asbestos air monitoring during removal works
7	Hygienist	• Hygienist to perform clearance asbestos air monitoring within removal works area (if required), to ensure the area is suitable for reoccupation. • Provide clearance certificate based on successful clearance inspection and/or clearance air monitoring. All air monitoring results must be below the lowest detectable limit for the method of <0.01 fibres/ml.

15.2 Elevated Asbestos Fibre Air Monitoring Results

If during asbestos remedial work, air monitoring results exceed the method reporting limit of 0.01 fibres/ml of air, the existing controls will need to be reviewed and improved before works may continue.

The following table provides the procedure to be followed depending on the air monitoring result.

Table 5: Emergency Response Procedure

Action Level	Responsible Person:	Control / Action:
>0.02 fibres/mL	Hygienist	• Notify LARC and AMPC of results as soon as practicable.
	LARC	• Stop work immediately. • Notify the regulator by phone or in writing with air monitoring result and that removal works have ceased.
	AMPC / LARC	• Erect signage and barricades around asbestos work area to restrict access.
	AMPC / Hygienist / LARC	• Conduct an investigation into the cause for the exceedance. This is to be performed by thorough visual inspection of the work area and equipment in consultation with workers. • Once suspected cause is identified existing controls to be reviewed and new and/or improved controls to be implemented.
	Occupational Hygienist	• Conduct additional air monitoring around the asbestos work area once new controls have been implemented. • Works must not recommence until air monitoring results are <0.01 fibres/ml.
≥0.01 fibres/mL BUT ≤0.02 fibres/mL	Hygienist	• Notify LARC and AMPC of results as soon as practicable.
	AMPC / Hygienist / LARC	• Investigate potential cause for the exceedance. • Existing controls to be reviewed and new and/or improved controls to be implemented where applicable.
<0.01 fibres/mL	LARC	• Continue with existing control measures.

16. PROJECT LIMITATIONS

This Asbestos Management Plan (AMP) has been prepared by EDP Consultants Pty Ltd (EDP) solely for the client listed in **Section 1 (Client)**. This report may only be used and relied upon by the Client and must not be copied to, used by, or relied upon by any person other than the Client or altered, amended or abbreviated, issued in part or issued incomplete without the prior written consent of EDP. This report relates only to the site as detailed within **Section 3** and as described in this report and must not be used in relation to any other work area or site.

EDP, its employees, agents and contractors expressly disclaim responsibility to any person other than the Client arising from or in connection with the report. Other than as stated in this report, to the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by EDP and the report are excluded.

The services undertaken by EDP in connection with preparing the report were limited to those expressly detailed in **Section 2**. The opinions, conclusions and any recommendations in the report are based on the conditions encountered, inspection findings and reviewed information and documentation only.

Please note that subsequent to the date of this report, works or site conditions may have resulted in changes to the status of any identified materials. All changes should be documented and provided to EDP as a supplement to this report.

The data and advice provided herein relate only to the project and structures described in the report. EDP accepts no responsibility for any other use of the data or advice.

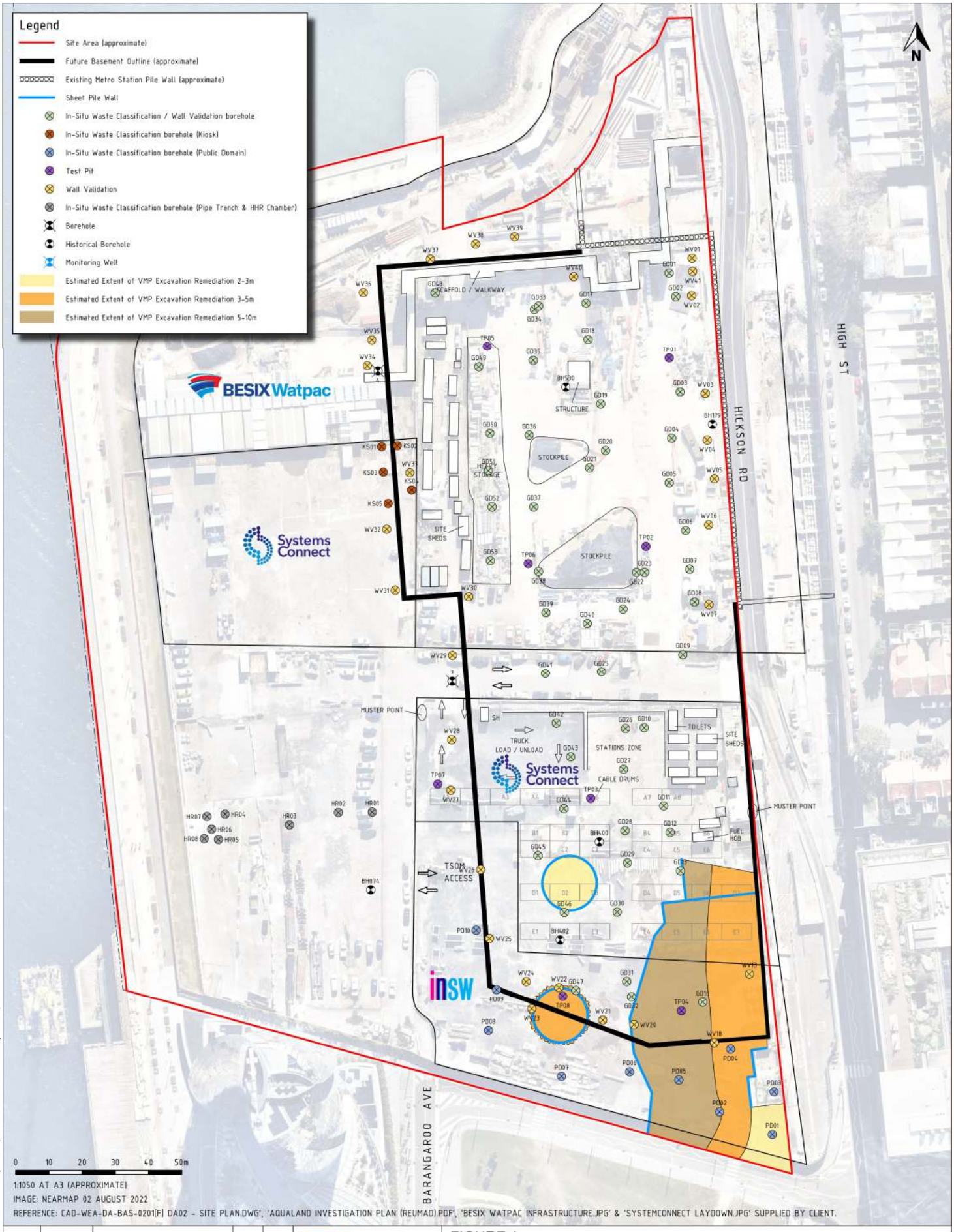
Where applicable, if a third party conducted survey work, reports (such as laboratory reports) or provided verbal information that has been relied upon by EDP the responsibility for the accuracy of such data remains with the original entity and not with EDP.

EDP expressly disclaims responsibility for any error in, or omission from, the report arising from or in connection with any of the assumptions above being incorrect.

This report must be read in conjunction with all of the attached appendices and should be kept in its entirety without separation of individual pages or sections. EDP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

EDP is not a professional quantity surveyor (QS) organisation. Any areas, volumes, tonnages or any other quantities noted in this report are estimates only. The services of a professional QS organisation should be engaged if quantities are to be relied upon.

Appendix A: Site Plan



1:1050 AT A3 (APPROXIMATE)
IMAGE: NEARMAP 02 AUGUST 2022
REFERENCE: CAD-WEA-DA-BAS-0201[F] DA02 - SITE PLAN.DWG', 'AQUALAND INVESTIGATION PLAN (REUMAD).PDF', 'BESIX WATPAC INFRASTRUCTURE.JPG' & 'SYSTEMCONNECT LAYDOWN.JPG' SUPPLIED BY CLIENT.

VER	DATE	AMENDMENTS	DRW	CKD
V1	22/12/2022	initial draft	LDW	

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COMMERCIAL IN CONFIDENCE

FIGURE 1
SITE LAYOUT, INVESTIGATION AND LENDLEASE REMEDIATION

Project Ref:	S-04478.AQL.ASSMP_EWDA-02		
Project:	Aqualand Barangaroo		
Location:	Central Barangaroo, Hickson Road, Barangaroo NSW		
Client:	Aqualand Projects Pty Ltd		
Easting: 333637	Northing: 6251819	Datum mAHD; UTM MGA2020 56H	PRINT: A3 (L)

CENTRAL BARANGAROO WASTE CLASSIFICATION DEC 2022 V1.vwx | Thursday, 22 December 2022 5:18:48 PM | drawn by laurie white at www.reumad.com.au

Appendix B: AMP Induction Record

AMP Induction Record

Name:	Company:	Signed:	Date:

Appendix C: Example Asbestos Permit to Work

ASBESTOS PERMIT TO WORK PERMIT (EXAMPLE)

WORK REQUEST FORM REFERENCE:	
VALID UNTIL (Insert Date)	
Description of asbestos materials:	
Will an asbestos consultant be required?	YES ❑ NO ❑
Will a licensed removal contractor be required?	YES ❑ NO ❑
Company Name:	
Supervisor:	
Contact Number:	
SPECIFIC PERMIT REQUIREMENTS (TICK AS REQUIRED):	
Scope of works/technical specification for ACM removal?	YES ❑ NO ❑
Contractor Safe Work Method Statement (SWMS) issued for review and approval prior to commencement of work?	YES ❑ NO ❑
Other Items (list details):	
CONTRACTOR ACCEPTANCE STATEMENT:	
I have read and understood the permit requirements and will undertake the work in accordance with all necessary procedures and specifications.	
Signed:	
Print Name and Position:	
Date:	

The contractor must retain a copy of the work permit and work request form on site for the duration of works.

WORK PERMIT COMPLETION

(To be completed by the Management Plan Controller & Contractor)

Date Work Completed:	
Clearance certificate & air monitoring results (if applicable) received (list reference numbers):	
I am satisfied that the works have been completed in accordance with the work permit and the area has been cleaned to the required standard. Inspections and air monitoring (if applicable) confirm that the area can be safely re-occupied.	
Management Plan Controller Signature:	
Date:	
Contractor Signature:	
Date:	

Original to be retained by the **Management Plan Controller.**

Copy to be retained by **instigator of the work request.**

Appendix D: Asbestos Personal Protective Equipment

ASBESTOS MATERIALS PERSONAL PROTECTIVE EQUIPMENT

During asbestos remedial works, PPE must be worn by the LARC, the hygienist and all other personnel that may have come into contact or handled the soils onsite or uncovered asbestos materials.

The following PPE should be used as required:

PPE	Picture
Half faced disposable P2 respirator may be used for non-friable asbestos remedial works. Respirators must comply with AS/NZS 1715-2009 Selection, use and maintenance of respiratory equipment.	
Half faced respirator with a P2 particulate filter cartridge to be used for non-friable (bonded) asbestos remedial works or entry into asbestos work area at the completion of the works. Respirators must comply with AS/NZS 1715-2009 Selection, use and maintenance of respiratory equipment.	
Full faced respirator with a P3 particulate filter cartridge to be used for friable asbestos remedial works within the asbestos work area during the remedial works. Respirators must comply with AS/NZS 1715-2009 Selection, use and maintenance of respiratory equipment.	
Disposable coveralls rated Type 5/6 or equivalent e.g. Tyvek To be used for intrusive works.	
Appropriate glasses or goggles. To be used for intrusive works.	
Appropriate gloves i.e. cut resistant gloves for working with soil and disposable nitrile gloves to be worn over the cut resistant gloves, where required. Occupational protective gloves shall comply with EN 420-1994(AS/NZS2161.2-1998) Occupational Protective Gloves, Part 2 General Requirements.	
Disposable booties or safety gum boots/non-laced safety boots. To be used for intrusive works.	

It is important to note that the disposable coveralls and gloves are single use only and must be disposed of as asbestos waste after each use. Non-disposable respirators must be decontaminated prior to leaving the asbestos work area. Cartridges must be inspected and replaced as required dependent upon the type and duration of usage. Good personal hygiene practices must be carried out following any contact with asbestos materials, with particular attention paid to washing hands, fingernails and head prior to removing respirator.

Appendix E: AMP Review and Change Register

AMP Review and Change Register					
Date	AMP Reviewer (Name/Position)	All AMP content / controls adequate?	Change/Update Require?	Section and Description of update	Sign off:

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St Leonards, NSW 2065, Australia

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Appendix D: Acid Sulfate Soil Management Plan (EDP ASSMP, 2025)

Aqualand Projects Pty Ltd

Acid Sulfate Soils Management Plan
Central Barangaroo, Early Works DA – 02

Prepared for:

Aqualand Projects Pty Ltd (Aqualand)

Document Date:

06 March 2025

Reference:

S-04478.AQL.EWDA-02-ASSMP.V4

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DOCUMENT CONTROL

Project Details:	
Report Name:	Acid Sulfate Soil Management Plan – EWDA-02 Central Barangaroo
Client Name:	Aqualand Projects Pty Ltd
Reference:	S-04478.AQL.EWDA-02-ASSMP.V4
Prepared by:	Haneen Safadi
Reviewed By:	Hamish Donovan

Revision No.:	Revision Date:	Reason for Issue:	Authorised:	
			Name and Position:	Signature:
V1 Draft	14/10/2022	First issue to client	Ryan Jacka Principal Consultant CEnvP #874	
V2	01/03/2024	Revised draft issue to client	Hamish Donovan NSW Environment Manager	
V2	09/04/2024	Final draft	Hamish Donovan NSW Environment Manager	
V4	06/03/2025	Final	Hamish Donovan NSW Environment Manager	

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GLOSSARY OF TERMS

Abbreviation:	Definition:
ASS	Acid Sulfate Soils (including Actual Acid Sulfate Soils and Potential Acid Sulfate Soils)
AASS	Actual Acid Sulfate Soil
ASSMAC	Acid Sulfate Soil Management Advisory Committee
ASSMP	Acid Sulfate Soil Management Plan
EPA	Environment Protection Authority
NATA	National Association of Testing Authorities
PASS	Potential Acid Sulfate Soils
pHf	Field pH with the addition of deionised water onsite
pHfox	Oxidised pH with the addition of peroxide onsite
SPOCAS	Suspension Peroxide Oxidation Combined Acidity and Sulfate

1. INTRODUCTION

EDP Consultants Pty Limited (EDP) was engaged by Aqualand Pty Ltd (Aqualand), to prepare an Acid Sulfate Soils Management Plan (ASSMP) for the Early Works Development Application 02 (EWDA-02) to facilitate Aqualand's Early Work Development Application submission. The site located at Hickson Road, Millers Point NSW (the site) as depicted in **Figure 1** - **Appendix A.** The EWDA-02 is part of a larger Central Barangaroo area comprising part of Lot 52 of Deported Plan (DP) 1213772 (Central Barangaroo Site).

The objective of this ASSMP was to detail management strategies to mitigate risks posed by the potential acid sulfate soils (PASS) identified at the site. PASS will be disturbed / excavated as part of the EWDA-02 works which broadly involves the construction of perimeter diaphragm walls (including associated "tie-in" works to Metro Interface Wall and the secant pile wall proposed under EWDA-01), bulk excavation, dewatering, foundation piling, construction of a hydrostatic slab.

2. BACKGROUND

Acid sulfate soil risk maps provided on in City of Sydney Council Local Environmental Planning (LEP) 2012, identified areas of the site with a Class 1 acid sulfate soil. Given this risk, and also further characterise soils from a waste classification perspective, a detailed intrusive investigation program was undertaken by EDP in 2023 across the site. Refer to **Section 4** for summary of the *Waste Classification of In-Situ Material, Central Barangaroo, Hickson Road, Millers Point NSW* report (EDP, 2023).

The findings from EDP, 2023 confirmed the presence of PASS throughout the majority of fill material which were confirmed to require treatment prior to disposal or re-use.

This ASSMP is a supporting document to the EDP Consultants, *EWDA-02 Remedial Works Plan, Central Barangaroo, 2024* report (herein referred to as RWP). The RWP was developed to provide additional remediation detail to the existing JBS Environmental Pty Ltd (JBS) Remediation Action Plan (RAP) (JBS 2013, herein referred to as the JBS RAP). The JBS RAP was subject to NSW EPA Site Auditor Review and considered appropriate to render the site suitable for the proposed use in the Site Audit Statement (SAS) (GN 439B-5) and Site Audit Report (herein referred as SAR) prepared by ENVIRON Australia Pty Ltd (AS121473, ENVIRON 2013), providing updated supporting documents (including this ASSMP) were prepared.

3. OBJECTIVES

This ASSMP was developed to assist in the effective management of the environmental and waste disposal risks associated with excavating ASS during the development works. The ASSMP was also developed in response to the Secretary's Environmental Assessment Requirements (SEARs) for the project. The objectives of the ASSMP are to:

- Ensure project personnel are aware of this plan and can identify instances of ASS from visual and olfactory observations;
- Ensure appropriate control measures are adopted to protect the environment;
- Provide a framework to manage and treat ASS soils to enable off-site disposal; and
- Contingency strategies.

4. PREVIOUS INVESTIGATIONS

4.1 EDP, 2023 In-Situ Waste Classification

Details of the *Waste Classification of In-Situ Material, Central Barangaroo, Hickson Road, Millers Point NSW* report (EDP, 2023) is summarised in the RWP. With regards to acid sulfate soils, 78 of the 115 samples in fill, and 23 of the 44 samples in the natural or alluvium material were above the trigger values for mol H^+/t (18 mol H^+/t)

or sulfur % (0.03 %S). Soils require treatment where they have failed the management criteria as presented in the Department of Agriculture and Water Resources *National Acid Sulfate Soils Guidance; National acid sulfate soils sampling and identification methods manual 2018* (DAWR, 2018).

The pH_{KCL} ranged between 4.9 and 10.6 with only one sample falling below the actual acidity indicator of 6.5. The sample collected at WV23_10.0 did not show exceedances of the sulphur of acid trail however reported the lowest pH_{KCL} value in the fill profile.

Liming rates (without ANC) ranged between <0.1 and 120 kg $CaCO^3$/t coming to an average rate of 19.14 $CaCO^3$/t for the full data set.

When interrogating the data and spread of samples, only a small selection of samples were collected across the shallower soil profiles as the nature of the fill had a greater presence of aggregates, crushed sandstone and concrete. These materials present a significantly lower risk of PASS/AASS with no notable organics. With exception of one sample, PD07_2.0 which is located outside the site area, there was no confirmed presence of ASS in the soil data or suspected based on visual observations to a depth of 3 m. However, the majority of samples at 4 m exceeded the screening criteria.

4.2 EDP, 2024 In-Situ VENM Assessment

Details of the *VENM Classification of In-Situ Material, Central Barangaroo, Hickson Road, Millers Point NSW* report (EDP, 2024) is summarised in the RWP. With regard to ASS, EDP, 2024 cross references the investigated material and draws correlations back to the original imported VENM during the Block 4 and Block 5 remediation. As VENM by nature must be free of sulfidic ores, no further ASS assessment of the imported material was undertaken as part of EDP, 2024 investigations.

5. SITE INFORMATION

5.1 Site Identification

Site identification details are summarised in **Table 1** and the location of the site is shown on **Figure 1** and site layout on **Figure 2**, provided in **Appendix A.**

Table 1: Site Identification

Site Identification	
Site Address:	Hickson Road Millers Point NSW
Legal Identification:	Lot 52 in DP 1213772
Local Government Area:	City of Sydney
Site Description:	The site is located in Central Barangaroo, which forms part of the wider Barangaroo Precinct comprising a total area of 22ha. It is located in the north-western edge of Sydney CBD and falls within City of Sydney Local Government Area (LGA). Barangaroo Precinct interfaces with Hickson Road in the east, the foreshore in the west, Walsh Bay to the north and Darling Harbour in the south. ▪ **Barangaroo South (approx. 7.5ha)** – Located at the southernmost end of Barangaroo Precinct. Progressively built over the last six years and includes mixed-use neighbourhood comprising commercial office buildings, mixed use buildings, shops, cafes, hotel and community uses. ▪ **Central Barangaroo (approx. 5.2ha and area subject of SSDA)** – Located between Barangaroo South and Barangaroo Reserve. Currently vacant and undergoing site preparation works to facilitate a mixed-use area with a focus on retail activation, residential and community uses. ▪ **Barangaroo Reserve (approve 6.1ha)** – Located in the northern end of the Precinct featuring Barangaroo Reserve. Featuring open space and lookout points to Sydney Harbour, Nawi Cove and Marrinawi Cove. Barangaroo Reserve features the Cutaway – a future arts and cultural entertainment space.

Site Identification	
	The above results in a total area of 18.8ha. The residual 3.2ha is represented by the reshaping of the former industrial headland into Barangaroo Reserve and the creation of Nawi Cove as a substantial water body within the Barangaroo site, forming the original 22ha.
Site Area	5.2ha (approx.) of the 22ha Barangaroo Precinct
Current Zoning:	B4 Mixed Use and RE1 Public Recreation
Site Elevation:	Approximately 2 to 4 m Australian Height Datum (AHD)

5.2 Site Description and Surrounding Land Use

The area currently features a large concrete hardstand area/construction site that is occupied by temporary structures for site preparation works, machinery, materials and vehicle parking for site workers. Hoarding is currently erected around the Central Barangaroo site.

The site is also subject to current improvements such as remediation works, works to facilitate the Barangaroo Metro Station and a temporary road which runs off Hickson Road around the southern portion of the site. Tunnelling and excavation activities for the Barangaroo Metro Station have been completed and construction work is currently continuing for the Barangaroo Metro Station and crossover cavern.

5.3 Site History

Based on a review of the JBS RAP, the wider Barangaroo precinct was occupied by shipping and related merchants during the 1900s. Between 1840 and 1921, a gasworks operated by Australian Gas Light Company (AGL) was located within the southern end of site and extended east to what is currently Hickson Road. During this time, the original shoreline was altered to enable the construction of wharves which commenced from the mid-1920s. Over the past 20 years, the wider Barangaroo precinct was used primarily for stevedoring purposes until the majority of buildings were demolished and the land was prepared for redevelopment in the five years prior to the JBS RAP.

Priority was set to understand the conditions associated with the former gasworks area, referred to as the "Declaration Area" located within the southern end of the site. The gasworks were decommissioned between 1922 and 1925 and included the demolition of the surface of the gas holders, purifiers and other facilities and backfilling of holding tanks. No evidence was provided to suggest that operational gasworks waste or rubble generated during decommissioning were placed within the boundaries of the Barangaroo Central Site. Investigations within the Barangaroo Central site did not identify gasworks structures of waste materials.

Based on the timing of the gasworks decommissioning (between 1922 and 1925) and the commencement of site filling (between 1951 and 1972), JBS considered it highly unlikely that locally sourced gasworks waste or demolition material was used as fill during the reclamation works at Barangaroo Central.

6. ENVIRONMENTAL SETTING

6.1 Topography

A review of the NSW Government National Map online database (http://www.nationalmap.gov.au/) accessed in August 2022, indicated that the site was generally flat and was located at an elevation of approximately 2 to 4 m AHD.

6.2 Geology and Soils

According to the 1:100 000 Geological Survey of NSW (Sydney) Sheet 9130 (Ed 1) 1983 and numerous site investigations, the Central Barangaroo Site is underlain by man-made fill materials that have been placed over marine sands underlain by Hawkesbury Sandstone. The stratigraphic summary provided in the SAR is presented

in **Table 2.** Refer the TetraTech Coffey *Central Barangaroo Staeg 2 Early Works – Geotechnical Impact Assessment Report, February 2024* (TetraTech, 2024) for detailed geotechnical profile of within the site.

Table 2: Summary of Stratigraphy of Central Barangaroo (Environ SAR 2013)

Thickness (m)	Material	Location	Description
0.5	Pavement	Over all of site	Hard surfacing, bituminous concrete except for 20 m concrete strip along the shoreline
			Gravel, occasionally concrete slab
6 – 18	Fill	Shallowest on eastern side near Hickson Road, increasing in thickness towards Darling Harbour	Variously described as sand or clay but mainly sandy, gravelly, silty or clayey in places. Possibly broken sandstone. Contains some brick, concrete, tile, but appears minor
0–2	Alluvial soil	Overlying bedrock or residual soil, absent in places on eastern side	Alluvial sediments consisting predominantly of dark silty clay
0 – 20	Residual soil	Overlying bedrock, absent in places on eastern side	Sandy clay residual, highly weathered rock
	Bedrock	Whole of site	Sandstone, some shale. Weathering and fracturing decreasing with depth

Based on information available in previous reports, the depth of fill and alluvial soil was determined based on the identified depth of bedrock. The rock contours follow a steep decline in a westerly direction, ranging from less than -4 mAHD in the eastern area to -23 mAHD in the western areas of the site.

The fill profile did not show any distinct and predictable layers but rather a widespread fill layer overlying alluvial or residual soils. Boreholes in close proximity to each other show significant differences in soil description, however show a similar pattern of deep fill material.

6.3 Hydrogeology

Groundwater across the site is shallow, generally reflective of sea level at a depth of approximately 2 metres below ground level (mbgl). Previous investigations and experience in the greater Barangaroo area show the groundwater to be tidally influenced. The SAR notes that tidal studies at the southern end of Barangaroo indicate a high degree of connectivity between groundwater and the adjoining waters of Darling Harbour, decreasing towards Hickson Road.

Due to the presence of fill materials, hydraulic conductivity is expected to vary locally, however is expected to be high due to the prevalence of sand in the field logs.

Due to the tidal influence, groundwater is expected to be saline. The overall groundwater flow direction is expected to be to the west towards Darling Harbour, however, will vary due to preferential flow pathways within the fill body and tidal influence interacting with inflow from the east.

6.4 Acid Sulfate Soils

A review of the 1:100 000 Geological Survey of NSW (Sydney) Sheet 9130 (Ed 1) 1983 shows the Barangaroo precinct to be defined as man-made fill and has is classified as disturbed terrain. This disturbed terrain may include filled / reclaimed areas of low-lying swamps for urban development. Other disturbed terrain includes areas which have been mined or dredged or have undergone heavy ground disturbance trough general urban development. Soil investigations are required to assess these areas for potential occurrence of acid sulfate.

Review of Sydney Local Environmental Plan 2012 Acid Sulfate Soils Risk Map – Sheet 014 indicated that the site is classified as Class 5 indicating that ASS are not expected to be encountered, however immediately north of the site is classified as Class 1 indicating that ASS are likely to be found.

Based on intrusive investigations conducted on similar materials, at similar depths in neighbouring portions of the site, PASS is very likely to exist within the fill and natural superficial deposits materials underlying the site.

7. TECHNICAL FRAMEWORK

This ASSMP has been developed in general accordance with the following documents:

- NSW *Work Health and Safety Act 2011*;
- NSW *Work Health and Safety Regulation 2017*;
- NSW EPA *Waste Classification Guidelines 2014: Part 1 – Classifying Waste; and Part 4 – Acid Sulfate Soils 2014* (NSW EPA 2014);
- NSW EPA *Protection of the Environment Operations (POEO) Act 1997*;
- NSW EPA *POEO (Waste) Regulation 2014*;
- ASSMAC *Acid Sulfate Soils Assessment Manual 1998* (ASSMAC Manual 1998);
- Department of Agriculture and Water Resources *National Strategy for the Management of Coastal Acid Sulfate Soils 2000*
- Department of Agriculture and Water Resources *National Acid Sulfate Soils Guidance; National acid sulfate soils sampling and identification methods manual 2018; and*
- Department of Agriculture and Water Resources *National Acid Sulfate Soils Guidance; National acid sulfate soils identification and laboratory methods manual 2018*

8. EWDA-02 PROJECT SUMMARY

The proposed SSDA will seek approval for early works associated with the future mixed-use development of Central Barangaroo (set out under MP06_0162). The proposal sees to undertake bulk excavation and site establishment works for the installation of the perimeter retention wall, and conduct remediation and archaeological investigations within the site.

These works will facilitate the provision of future basements, consistent with the parameters set out under the approved Concept Plan for Barangaroo under MP06_0162. The works subject of the SSDA include the following:

- Establish the site and installation of temporary plant and machinery, including dewatering and bentonite slurry plant and ancillary services,
- Construction of perimeter retention wall, including any required excavation, associated rock anchors and PRW capping beam construction,
- Associated remediation and Archaeological investigations in the area of excavation and works;
- Provision for future services,
- Associated "tie-in" works to Metro Interface Wall and the secant pile wall proposed by the applicant under SSD-39587022,
- De-stressing and removal of existing anchors supporting Sydney Metro pile wall,
- Bulk excavation for the provision of a future basement and associated rock anchors (including anchors to support the secant pile wall approved inSSD-39587022 ,
- Construction of foundation piling,
- Installation of waterproofing membrane,
- Construction of hydrostatic slab, and
- Structure and waterproofing for the Barangaroo Metro station southern entrance interface next to the existing Sydney Metro pile wall.

The proposal does not seek approval of any buildings, or the design, construct and use of the basement. These will be subject to future detailed SSDAs for Central Barangaroo, consistent with the outcomes of MP06_0162.

The proposed early works can be submitted under the current approved Concept Plan. The approved Concept Plan does not establish any express parameters on the extent of excavation or early works within the site. The application is capable of satisfying the requirement for consistency with the approved Concept Plan (s4.24(2) of the Environmental Planning and Assessment Act 1979 (EP&A Act 1979).

9. ASSESSMENT CRITERIA

Assessment of ASS conditions and the impacts of the proposed development were based on information provided in the Department of Agriculture and Water Resources *National Acid Sulfate Soils Guidance; National acid sulfate soils sampling and identification methods manual 2018* (DAWR, 2018a) and *National Acid Sulfate Soils Guidance; National acid sulfate soils identification and laboratory methods 2018* (DAWR, 2018b). The DAWR includes information on assessment of the likelihood that the site lies within an ASS area, the need for an ASS management plan, and the development of mitigation methods for the proposed development.

9.1 Management Plan Trigger Criteria

The guidelines provide action criteria which determine the need to prepare an ASSMP, based on the percentage of oxidizable sulfur or Total Potential Acidity (TPA), for broad categories of soil. The action criteria adopted for this ASSMP are provided in the **Table 3**.

Table 3: ASSMP Action Criteria

Type of Material		Action Criteria 1–1000 tonnes ASS disturbed		Action Criteria if more than 1000 tonnes disturbed	
Texture range. McDonald et al. (1990)	**Approx. clay content (%<0.02mm)**	**Sulfur trail** *% S oxidisable (oven-dry basis)* *e.g. S_{TOS} or S_{POS}*	**Acid trail** *mol H^+/T (oven-dry basis) e.g. TPA or TSA*	**Sulfur trail** % S oxidisable (oven-dry basis) e.g. STOS or SPOS	**Acid trail** *mol H+/T (oven-dry basis) e.g. TPA or TSA*
Coarse Texture	<5	0.03	18	0.03	18
Sands to loamy sands	5 – 40	0.06	36	**0.03**	**18**
Medium Texture	>40	0.1	62	0.03	18

The action criteria for coarse textured soils (sands to loamy sands) and more than 1000 tonnes disturbed should be adopted for future works.

9.2 ASS Treatment – Applicable Depths and Area

As outlined in Section 4.1, 78 of 115 samples collected for CRS analysis exceeded the management criteria in Section 9.1. Due to the heterogeneity of the fill and variability of the sulfur concentrations, there is little confidence in drawing a defensible correlation between areas of higher PASS vs areas of lower PASS for the purposes of treatment and lime dosing. Where a liming dose was provided in the laboratory data for all samples, the average across liming dose detects was 19.14 kg $CaCO^3$/t. The median dose was 11.00 kg $CaCO^3$/t.

In accounting for the lime dose average and median, mixing of 40 kg $CaCO^3$/t is considered an appropriate ratio when commencing excavation works. This ratio, approximately double the average lime dosing rate, will increase confidence in ensuring ASS is ameliorated after one round of treatment, while not overdosing or placing onerous dosing requirements.

This ratio is not fixed. It can be adapted anytime dependant on the verification outcome as explained in **Section 9.3**.

Expanding upon the findings from EDP, 2023 in **Section 4.1**, there is was an absence of ASS visual indicators in the top 3 m of soil which was also support by the data within the assessment boundary. In this regard, no treatment of excavated soils from current ground level to 3 m deep is required within the basement excavation area.

Revision of the ASS occurrences is permissible with further investigation and analysis to confirm otherwise.

Furthermore, no treatment of excavated soils within the former remediation area (ribbon zone only) of Block 4 and Block 5 to the approximate surveyed depth of remediation is required, on the provision that supervision by an environmental consultant will be undertaken where excavation within the ribbon zone is:

- within 2 m of the surveyed remediation depth; and
- within 3 m of the surveyed remediation boundary (ribbon wall).

As there may be some ambiguity of precise former ribbon wall location and exact depth of remediation (which was variable), supervision is required to minimise risks of inadvertently excavating original reclamation fill materials, or natural alluvium (which is ASS containing) with the formerly imported VENM.

9.3 Treatment Verification Criteria

DAWR, 2018b includes guidance to verify if sufficient neutralising material has been applied to soil to prevent any further acidification. In a properly ameliorated soil, the pH_{kcl} will usually be greater than 6.5 and the verification net acidity will be less than zero. In the determination of verification net acidity, the acid neutralising capacity (ANC) measured in the treated soils is subtracted from that initially measured in the untreated soil.

At the time of preparation of this ASSMP, investigations are currently underway to assess the ASS potential within the fill and natural materials at the site. This data should be used to determine individual, or average ANC for non-treated soils across the site. Indicative lime dosing rates will also be informed by the investigation data currently being collected.

The verification net acidity equation is provided in DAWR, 2018b and is as follows.

Equation 3.3 Verification Net Acidity.

$$\begin{aligned} &Verification\ Net\ Acidity \\ &\quad = Potential\ Sulfidic\ Acidity + Actual\ Acidity + Retained\ Acidity \\ &\quad - (post\ treatment\ Acid\ Neutralising\ Capacity \\ &\quad - initial\ Acid\ Neutralising\ Capacity) \end{aligned}$$

Figure 1 Verification Net Acidity Equation

In summary, the verification criteria for treated ASS is:

- Net acidity (using appropriate fineness factor) = Zero or negative *mol* H^+ / *t*
- pH_{kcl} = Greater than 6.5

10. ASS TREATMENT AND MANAGEMENT STRATEGY OVERVIEW

10.1 Management Strategy Overview

ASS management will be required to prevent adverse impacts occurring to the environment and infrastructure from ASS during the proposed excavation works at the site. The following subsections provide an overview of the responsibilities and sequence of management/treatment for ASS material. At a high level, the management and treatment process involves:

- Assessment of soils (confirming presence of ASS requiring treatment)
- Treatment area setup
- Treatment process
- Liming and dosing requirements and materials
- Verification testing
- Off-site disposal or reuse

At time of preparation of this ASSMP, it is understood that excavated soils will be disposed offsite. However, if there is opportunity for re-use, soils which have been demonstrated to be effectively treated for ASS and are chemically compliant with the acceptance criteria outlined in the Remedial Works Plan, can be considered for re-use.

10.2 Responsibilities

A copy of this ASSMP should be kept onsite at all times and anyone who will conduct work within the site or will be undertaking future works must be inducted into this ASSMP.

Table 4 provides a summary of responsibilities of interested parties onsite which relates to the project.

Table 4: Summary of Responsibilities

Position / Organisation	Report to	Summary of Responsibilities
Aqualand	Regulatory Authorities (as required)	▪ Engage Civil Contractor. ▪ Engage a suitably qualified environmental consultant (eg. EDP) ▪ Communicate requirements to all contractors. ▪ Review documentation provided by contractors. ▪ Review the ASSMP and any other reports developed by consultants. ▪ Ensure the ASSMP is implemented correctly. ▪ Ensure the ASSMP is available to anyone.
Civil Contractor	Aqualand	▪ Must have experience in managing, treating and disposing ASS. ▪ Complete SafeWork NSW permits and notification as required. ▪ Notify landfill for acceptance of the waste and adhere to landfill requirements. ▪ Undertake ASS treatment, soil and wastewater removal in accordance with their contract and ASSMP requirements for the site. ▪ Follow instructions by environmental consultant during the works. ▪ Regularly inspect and monitor all activities for adherence to appropriate environmental standards. ▪ Undertake works in a safe and environmentally responsible manner and in accordance with legislative requirements. ▪ Management of unexpected constraints and conditions that may arise during the works.
Environmental Consultant (e.g. EDP)	Aqualand	▪ Must be experienced in contamination assessments including the identification and management of ASS. ▪ Provide work, health and safety and environmental consultancy to Aqualand. ▪ Ensure works are undertaken in accordance with this ASSMP and current legislative requirements. ▪ Provide validation testing for ASS and waste classification assessments prior to off-site disposal as required. ▪ Track all materials moving on and off-site. ▪ Undertake surface water monitoring as required.

10.3 Assessment of Soils

Responsible Party: Civil Contractor and Environmental Consultant

EDP, 2024 has provided broad coverage of ASS assessment across the site. However, should further assessment of in-situ soils be required, they should be undertaken in accordance with DAWR, 2018 and EDP's *Sampling and Analysis Quality Plan – Central Barangaroo, September 2022* (SAQP, 2022). Any further in-situ or stockpile assessments should also be undertaken in accordance with DAWR, 2018a *Table 6.1 – Minimum soil sampling densities for ASS investigations* as shown in Figure 2 below. Other triggers for assessment will be based upon the following visual or olfactory evidence of ASS, where ASS were not anticipated. This includes:

- Waterlogged soils — unripe muds (soft, sticky and can be squeezed between fingers, blue grey or dark greenish grey mud with a high water content
- Silty sands or sands (mid to dark grey) or bottom sediments (dark grey to black for example monosulfidic black oozes)

- Peat or peaty soils
- Coffee rock horizons; and / or
- A sulfurous smell for example hydrogen sulfide or 'rotten egg' odour.

Refer to **Appendix C** for contingency scenarios and **Appendix D** for unexpected finds protocol to manage instances of the above.

Table 6.1 Minimum soil sampling densities for ASS investigations.

Type of disturbance	Extent of site	Sample point frequency
Small volumes (≤ 1000 m³) – prior to disturbance	Volume of disturbance (m³)	Number of boreholes
	< 250	2
	251–500	3
	501–1000	4
Large volumes (> 1000 m³) – prior to disturbance	Project area (ha)	Number of boreholes
	< 1	4
	1-2	6
	2-3	8
	3-4	10
	> 4	10 plus 2 per additional hectare
Linear	Width and volume	Intervals (m)
	Minor[1]	100
	Major[2]	50
Existing stockpiles & verification testing	Volume (m³)	Number of samples
	< 250	2
	251-500	3
	1000	4
	> 1000	4 plus 1 per additional 500 m³

Figure 2 Minimum Soil Sampling Densities

10.4 Treatment Area Setup

Responsible Party: Civil Contractor

An appropriate assessment/treatment area must be constructed for the treatment of excavated soils. The soils are to remain within this area until the treated soils are considered appropriate to be removed off-site. The assessment/treatment area should be constructed in accordance with the *ASSMAC Management Guidelines 1998* and DAWR, 2018.

Allowances should be made during construction planning to resume sufficient land to allow for these items. **Figure 1** below shows a cross section of a typical treatment pad. It should be noted that a treatment pad established on hardstand can achieve the outcomes of that described below without excavated drains. Final designs must be developed in reference to this ASSMP and approved by the supervising environmental consultant.

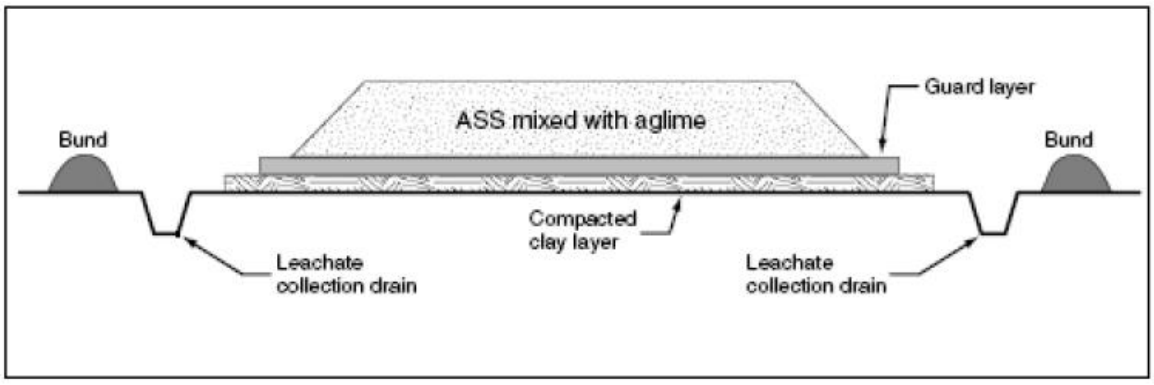


Figure 3 Schematic cross-section of a treatment pad, including clay layer, guard layer, leachate collection system and containment with bunding

The assessment/treatment area should be prepared as follows:

- Prepare a treatment pad of appropriate area for the volume of soil to be treated/stored. The pad should be prepared on relatively level or gently sloping ground to minimise the risk of any potential instability issues.
- It is recommended that the ASS assessment/treatment area must be constructed on hardstand or a similar impervious layer such as high-density polyethylene (HDPE) sheeting, and shall be within a portion of the site that does not lie in a natural drainage line.
- Apply a guard layer of fine agricultural lime (ag-lime) over the impervious layer, to neutralise downward seepage. This guard layer should be applied at a rate of 5 kg of ag-lime/m^2 per vertical meter of fill. The guard layer should be re-applied following removal of treated soils prior to addition of untreated ASS.
- Liming pads should be bunded with onsite soils not classified as PASS and a perimeter drain excavated to collect and contain leachate. The bunds should be preferably constructed of low permeability soil (i.e. clay) or, where suitable soil is not available, hay bales covered with impermeable plastic, with bunds at least 0.3 m high around the entire stockpile/treatment area. The drain and inner bund slopes should have a layer of ag-lime applied to neutralise any possible leachate migrating from the stockpiled material.

It should be noted that alternate methods for establishing an appropriate assessment/treatment area may be considered due to practicality constraints onsite. This would be subject to achieving the required treatment standard to the satisfaction of a suitably qualified environmental consultant.

10.5 Treatment Process for Soils

Responsible Party: Civil Contractor

The treatment process should involve the following:

- Transport ASS material requiring treatment to the assessment/treatment area;
- Manage ASS during stockpiling and treatment to minimise dust and leachate generation (eg. by covering, or lightly conditioning with water). If wet weather prevails, stop works and cover the stockpiled material with a HDPE sheeting to reduce the formation of leachate;
- Limit the surface area of the ASS exposed to oxygen by forming relatively high-coned stockpiles;
- Material must be treated as soon as practical. Several treatment areas may be required for stockpiling and treatment, depending on the quantity of ASS material excavated;
- Spread the ASS onto the guard layer in a layer of 0.2 to 0.3 m thickness. When spreading the first soil layer, care should be taken not to churn the lime guard layer;
- Let the ASS dry to facilitate lime mixing (if too wet, then adequate mixing of lime cannot be undertaken);
- Apply ag-lime (refer to **Section 10.7)** to the stockpiled soil, at the indicative liming rate in **Section 10.7** and mix thoroughly prior to spreading the next layer;

- Continue the spreading/liming/mixing cycle. This can be done one layer at a time, or with multiple ASS layers placed on top of each other;
- Assess the success of the treatment using validation testing in accordance with **Section 10.8**;
- If validation sampling indicates that additional neutralisation is required, add additional lime and mix;
- When validation testing indicates that lime neutralisation is complete in accordance with **Section 10.6**, then the stockpiled soil may be assessed for waste classification (if no previous classification exists for the material) or reuse purposes;
- Dispose off-site in accordance with **Section 10.9;**
- Management of leachate and wastewater in accordance with **Section 11.1**.

It is possible that excavation of both acidic and ASS will be required for the proposed development. The excavated soils should be stockpiled such that the acidic soils are segregated from the ASS and that these soils are also segregated from non-ASS.

Additionally, stockpiles of ASS should be kept moist to minimise oxidation, prior to lime treatment. They should be covered to prevent rainfall leaching through the stockpile and possibly creating acidic runoff and be located as far away as possible from any sensitive receptors (e.g. waterways, drainage channels etc.)

10.6 Neutralising Materials for Soils

Responsible Party: Civil Contractor and Aqualand

An appropriate neutralising agent must be selected for the works. Ag-lime is the preferred neutralisation material for the management of ASS. Ag-lime comprises calcium carbonate ($CaCO_3$), typically made from limestone that has been finely ground and sieved to a fine powder. Ag-lime with a purity of 95% or better should be used (i.e. ENV $\geq$95, where ENV is the effective neutralising value, a term used to rate the neutralising power of different forms of materials relative to pure, fine $CaCO_3$ which is designated ENV = 100). The ag-lime should be fine and dry, as texture and moisture can also decrease the ENV.

While ag-lime is the preferred, other inert materials such as crushed concrete or concrete fines could be used as a dosing agent. However, trials for the efficacy of neutralisation should be undertaken for alternate materials as these will likely have a lesser effect than ag-lime (pure CaCO3), and likely require greater quantities, refer **Section 10.7** for additional guidance.

10.7 Lime Application Rate

Responsible Party: Civil Contractor and Environmental Consultant

The amount of lime required for treatment of ASS material must be estimated based on the laboratory analytical results.

Based on the results of the Chromium Reducible Sulfur suite, a liming rate was calculated (kg of $CaCO_3$/tonne of soil), detailing the volume of lime required to neutralise the acidity present within the soils, based on total and potential acidity as well as the acid neutralising capacity of the soils. The indicative liming rate is provided in **Section 9.2**.

It should be noted that the acid production will vary both horizontally and vertically through the ASS profile due to the variability of natural systems. The liming rate to be calculated from the analytical results should therefore be considered as a 'starting point', and pH monitoring should be conducted during treatment to assess the progress of the neutralisation and need for additional mixing and/or addition of ag-lime.

Material will only be considered to have been successfully treated when all soil has been validated in accordance with **Section 9.3.** If an alternate neutralising product is used, a specific dosing rate will need to be calculated.

A useful online liming rate calculator provided by the Western Australian Government, Department of Environment Regulation can be used for updating liming rates if more analytical data becomes available during the works.

Liming Rate Calculator: https://www.der.wa.gov.au/your-environment/acid-sulfate-soils/67-lime-rate calculations-for-neutralising-acid-sulfate-soils

For material remaining in-situ at the base of the excavation, an application of lime should be applied by dusting the top surface of the soil following excavation. This step will not require validation, but is good practice, with the intent to form a thin crust of neutralised soil to prevent significant acid generation..

10.8 Validation Testing

Responsible Party: Civil Contractor and Environmental Consultant

A suitably qualified environmental consultant must conduct all validation inspections and validation sampling required during the treatment works. The validation assessment should be conducted progressively throughout the bulk excavation works, following the neutralisation and blending of each stockpile of material. The validation assessment shall be undertaken as follows:

- A visual and olfactory assessment to determine that indicators of ASS such as monosulfidic black oozes (MBO), unripe muds, peat or peat soils, coffee rock or sulfurous/hydrogen sulfide odours:
- During and following neutralisation, the stockpiled soils can undergo pH screening to provide an indication of that the appropriate quantities of lime have been added and the soils have been suitably mixed/blended
- NATA accredited laboratory testing. The preferred laboratory testing method is the Chromium Reducible Sulfur suite, and should be undertaken at a frequency of at least 1:250 m^3 from within the treated material with a minimum of 2 samples, to validate the lime neutralisation:
  - Validation sampling locations to be selected on:
    - Systematic sampling (gridded) pattern;
    - Visual inspection for indications of ASS during site inspection; and
    - Accessibility of the proposed sampling location.
  - Validation samples shall be collected using the following methodology:
    - Soil samples will be recovered from a minimum of 0.3 m beneath the soil surface of the stockpile utilising hand equipment;
    - Nitrile gloves will be used during sampling, with a change of gloves between each sampling location;
    - Soil samples will be collected in sampling containers provided by the analysing laboratory, ensuring sufficient sample is collected for the required analysis;
    - All containers will be clearly labelled with unique sample identification; and
    - All samples will be stored on ice prior to dispatch and during transportation to the nominated laboratory under chain of custody procedures.
- Compare the validation results with the verification criteria given in **Section 7.1**. If all results meet the verification criteria, the ASS will be considered to have been successfully treated and may be disposed off-site to an appropriately licensed waste facility following the procedures outlined in **Section 10.9**.
- Further treatment and verification testing of the soil will be required if the verification criteria are not met, or there is sufficient rationale to confirm the adequate treatment of soil.
- Analytical results are to be compiled into a ASS stockpile validation report and incorporated into this ASSMP.

Refer to **Appendix C** for contingency scenarios should verification testing fail.

10.9 Offsite Disposal or Reuse of Treated Soils

Responsible Party: Civil Contractor and Environmental Consultant

Following successful treatment of ASS, where a waste classification does not already exist for the material, the environmental consultant must undertake chemical assessment of the soils for comparison against NSW EPA 2014 criteria to facilitate off-site disposal. All testing must be undertaken in accordance with the Remedial Works Plan.

Stockpiled materials will need appropriate storage onsite while waste classification or ASS verification testing is undertaken. As a minimum, each stockpile will need to be maintained and secured within the

assessment/treatment area and covered with weighted HDPE sheeting to prevent leachate generation whilst awaiting waste classification assessment results.

Prior arrangements should be made with the waste facility to ensure that it is licensed to accept the waste. The waste facility should be informed that the PASS has been treated in accordance with the neutralising techniques outlined in this ASSMP and that the waste has also been classified in accordance with NSW EPA 2014.

If reuse of the soils is desired, chemical assessment (if not already undertaken), must be conducted and be commensurate or less than the chemical concentration assumptions used in the site Human Health and Environment Risk Assessment (HHERA) as outlined in the RWP.

11. WATER MANAGEMENT

11.1 Leachate and Wastewater Management

Responsible Party: Civil Contractor

Given the presence of a shallow groundwater table and the likelihood of the acidic and ASS being saturated during excavation, leachate generated from stockpiled soils is likely to be acidic once the soil oxidisation process commences. Any leachate / groundwater (from dewatering activities) generated must be collected for subsequent monitoring and treatment as required. The following is recommended:

- Eliminate need for dewatering, where possible.
- Minimise the time and volume of dewatering (i.e. staged dewatering and excavation over relatively short durations), if undertaken.

The pH of leachate water or water extracted during dewatering operations should be monitored and adjusted prior to discharge. Adjustment of pH should be undertaken if discharge water falls outside the discharge quality limits specified for discharge to the sewerage or stormwater system (subject to regulatory approval) or the land via evaporation/infiltration. The pH levels should also be compared to background levels of nearby waters.

The amount of neutraliser required to be added to the discharged leachate/groundwater can be calculated from the equation below:

$$\text{Alkali Material Required (kg)} = [(M_{Alkali} \times 10^{-pH\ initial}) / 2 \times 10^3] \times V$$

Where: pH initial = initial pH of leachate

V = volume of leachate (litres)

$M_{Alkal\ I}$ = molecular weight of alkali material (g/mole)

The alkali should be added to the discharged leachate/groundwater water as slurry. Mixing of the slurry is best achieved using an agitator. Leachate water collected from bunded areas and stockpiles (in catch ponds), and extracted groundwater should be neutralised as necessary before release. Calcined magnesia (magnesium hydroxide, burnt magnesite, or magnesia) is the recommended neutralising agent as it produces a two-step reaction, which proceeds rapidly at acidic pH and slows down as higher pH is approached, and hence reduces the potential for over neutralisation to occur. Furthermore, whilst ag-lime is well suited to the treatment of soils, it does not readily dissolve in water and is limited in effectiveness of adjusting the pH of water. Hydrated lime ($Ca(OH)_2$) is more soluble than ag-lime making it more suited to treating water, but it has a high pH value (pH ~12). Therefore, if hydrated lime is to be used to treat water, then it should be added incrementally with care and thoroughly mixed to prevent overshooting the desired pH. As a guide, the approximate quantities of hydrated lime provided in **Table 4**, would be required to neutralise acidic water.

Table 5: Recommended Approximate Liming Rates for Water

Water pH	Water Extraction Rate		
	2 m^3/hr	5 m^3/hr	10 m^3/hr
2	0.74	1.85	3.7
3	0.074	0.185	0.37
4	0.0074	0.0185	0.037
5	0.00074	0.00185	0.0037
6	0.000074	0.000185	0.00037

Notes: Liming rates are for hydrated lime (kg of $Ca(OH)_2$)

11.2 Acid Water Discharge Criteria

Notwithstanding any additional regulatory requirements placed on water disposal by City of Sydney Council or NSW EPA or through licensed discharge criteria, it is recommended that Council's Policy for the Discharge of Liquid Trade Waste and Septic Waste to the Council's Sewerage System and the ANZECC 2000 criteria are met before discharging any water, leachate or groundwater to the environment.

However, specific criteria which should be adopted to verify acidity in water has been appropriately treated is detailed in **Table 6**.

Table 6: Acid Water Discharge Criteria

Pollutant	Dry Weather Concentrations			Wet Weather Event Mean Concentrations		
	Forest	Rural	**Urban**	Forest	Rural	**Urban**
Suspended Solids (mg/L)	1-20	3-270	**1-49**	1-140	4-200	**20-1,000**
pH	N/A	N/A	**5.5 – 8.0**	N/A	N/A	**5.5 – 8.0**

Notes:
Source: Australian Guidelines for Urban Stormwater Management 2000 (p54), Geosyntec sampling results will also be used as a baseline.

11.3 Reporting

ASSMAC Manual 1998 or DAWG, 2018a does not require formal reporting of ASS management however, it is important to keep records of the management and validation process to show compliance with the guidelines.

A record of management, treatment, monitoring, validation and disposal of ASS should be maintained by the Civil Contractor and provided to Aqualand and should include the following details:

- Date(s) of works involving ASS;
- Location/area and depth of excavated ASS;
- Waste facility location and copy of licence;
- Where relevant for neutralisation of ASS, an ASS stockpile validation report should be prepared which includes:
  - Neutralisation process undertaken;
  - Liming rate utilised;
  - Results of analytical testing and comparison to acceptance criteria;
  - Neutralised ASS disposal (landfill) location; and
- Tonnages of material treated/disposed and waste dockets.

This detail should be captured in an ASS Verification Letter as required by the RWP, and should accompany a stockpile ITP for disposal tracking.

12. CONSULTATION AND COMMUNICATION

All project personnel, subcontractors and consultants will receive training in both Aqualand and their personal environmental obligations during the inductions and toolbox talks.

All project personnel will undergo a general project induction prior to commencing work with Aqualand. This will include an ASS component to reinforce the importance of management and the measures that will be implemented to address ASS issues at the site.

Site inductions and toolbox talks will highlight the specific environmental requirements and activities being undertaken at the site. These will be based on the measures outlined in the specific Safe Work Method Statements. Examples of topics that should be covered during project induction and toolbox talks include:

- Location and planned disturbance of ASS at the site;
- Management procedures in place for handling and treating ASS impacted soils;
- Site set up and location of ASS treatment areas; and
- Unexpected discovery of ASS.

13. ENVIRONMENTAL INCIDENT & COMPLAINTS MANAGEMENT

Details of all complaints received or incidents must be recorded on the Complaint/Incident Record Form provided in the site Environmental Management Plan, with the information to be recorded to include, as a minimum:

- Date and time that the complaint was received, or the incident occurred;
- The name, address and contact details of the person making the complaint, or reporting the incident;
- The name of the person who received the complaint, or received notification of the incident;
- A brief description of the issue; and
- A summary of the actions implemented to address the complaint/incident, including the dates that these actions were implemented and the signature of the persons responsible for resolving or rectifying the issue.

14. SITE SUPERVISION

Site supervision during excavation/earthworks must be undertaken by an appropriately qualified environmental consultant or personnel appropriately trained and competent in the identification of ASS Supervision is required to ensure that the excavated materials are appropriately handled and treated. Supervision is also needed to identify any materials which produce visual or olfactory evidence they are different to those assessed during the in-situ investigation (refer to **Section 10.3)**.

It is envisaged that written instruction would be issued to the site personnel at the completion of each inspection that would identify the materials encountered during excavation and the appropriate treatment or handling procedures required.

As part of the site supervision the environmental consultant or competent person shall be responsible for monitoring excavations, truck loading and recording the truck movements and load characteristics. Load information shall be verified by comparison with tip dockets. A daily record containing the following information must be prepared:

- Details of unusual materials or odours encountered during excavations;
- pH meter calibration details;
- Location and results of pH monitoring (where undertaken);
- Details of accidents or incidents on the site;
- Details of any environmental issues and any related corrective and preventive action taken;
- Details of any visitors relation to environmental or health issues;

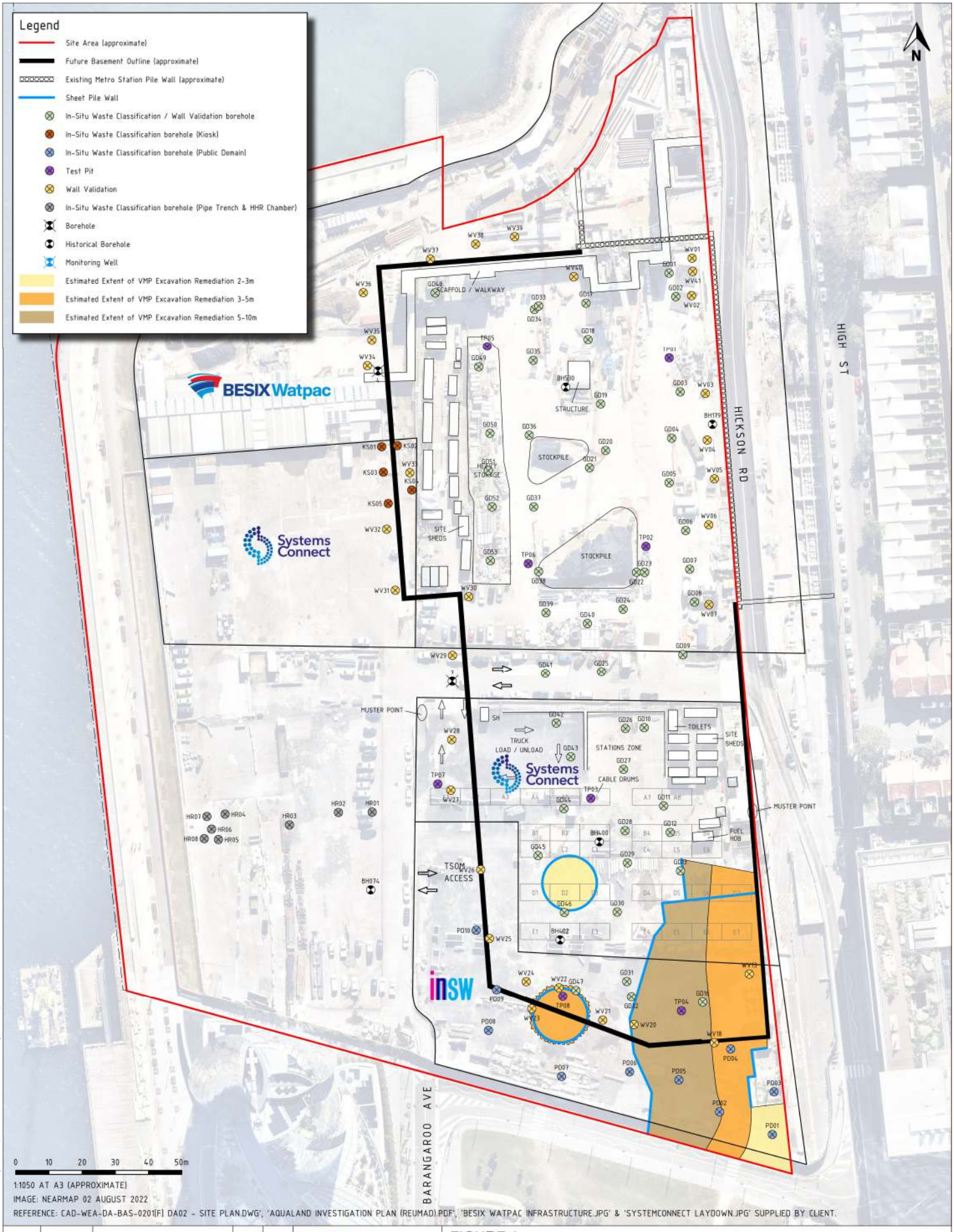
- Details of contractors engaged for the removal of waste;
- Record of soil volumes excavated, truck movements including destination/source, volumes of material exported/imported to the site;
- Daily site diagrams showing the location of stockpiles, excavations and sediment controls; and
- Records of soil sampling locations.

15. DOCUMENTATION AND RECORD KEEPING

All relevant documentation will be maintained by Aqualand. The documentation to be maintained may include (but not be limited to):

- Staff and contractor inductions provided as **Appendix E** of this ASSMP;
- NSW EPA Waste Transport Certificates;
- Transportation dockets for excavated soil removed from the site, with a summary of these to be included on the materials tracking forms provided as **Appendix F** of this ASSMP or otherwise tracked in the RWP MTMS;
- Soil classification documentation that relates to any soil that requires further investigation and sampling during the course of the excavation works;
- Ongoing management requirements for material to remain in-situ;
- Stockpile validation and classification records; and
- Complaints/incidents register.

Appendix A: Figures



1:1050 AT A3 (APPROXIMATE)
IMAGE: NEARMAP 02 AUGUST 2022
REFERENCE: CAD-WEA-DA-BAS-0201[F] DA02 - SITE PLAN.DWG', 'AQUALAND INVESTIGATION PLAN (REUMAD).PDF', 'BESIX WATPAC INFRASTRUCTURE.JPG' & 'SYSTEMCONNECT LAYDOWN.JPG' SUPPLIED BY CLIENT.

VER	DATE	AMENDMENTS	DRW	CKD
V1	22/12/2022	initial draft	LDW	

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FIGURE 1
SITE LAYOUT, INVESTIGATION AND LENDLEASE REMEDIATION

Project Ref:	S-04478.AQL.ASSMP_EWDA-02		
Project:	Aqualand Barangaroo		
Location:	Central Barangaroo, Hickson Road, Barangaroo NSW		
Client:	Aqualand Projects Pty Ltd		
Easting: 333637	Northing: 6251819	Datum mAHD; UTM MGA2020 56H	PRINT: A3 (L)

CENTRAL BARANGAROO WASTE CLASSIFICATION DEC 2022 V1.vwx | Thursday, 22 December 2022 5:18:48 PM | drawn by laurie white at www.reumad.com.au

Appendix B: Acid Sulfate Soil Definitions and Potential Impacts

Acid Sulfate Soils Definitions

ASS are naturally occurring sediments containing iron sulfides, primarily pyrite, commonly deposited in alluvial and estuarine environments. The occurrence of ASS is associated with areas or regions that have previously been or are currently estuarine environments. Due to changes in sea level or geomorphologic changes to the coastal systems, these sediments are often overlain by terrestrial sediments.

When ASS are exposed to air (e.g. due to excavation or dewatering), the oxygen reacts with iron sulfides in the sediment, producing sulfuric acid. This acid can be produced in large quantities and is highly mobile in water. The process can also release iron and other metals present in the soils.

The sulfuric acid (and metals) can drain into waterways causing severe short and long-term socioeconomic and environmental impacts, including damage to man-made structures and natural ecosystems.

ASS can either be classified as AASS that have already reacted with oxygen to produce acid, or PASS. AASS and PASS are often found in the same profile, with AASS generally overlying PASS horizons.

PASS are soils containing iron sulfide that have not been exposed to oxygen (e.g. soils below the water table). The field pH of these soils in the undisturbed state is 4 or more and is commonly neutral or slightly alkaline. However, they pose a considerable environmental risk when disturbed, as they will become more acidic when exposed to air and oxidised.

Potential Impacts of Acid Sulfate Soils Disturbance

The generation of AASS can result in the release of sulfuric acid and iron into the soil and surrounding waters. This in turn can release aluminium, nutrients and heavy metals (particularly arsenic) stored within the soil matrix. Once mobilised in this way, the acid, metals and nutrients can seep into waterways, killing fish, other aquatic organisms and vegetation.

Additionally, low levels of impact include reduced hatching, decline in growth rates, skin and health impacts for aquatic life. The potential impact on water leaching activities also include change in pH of soil and water, changes to water quality and changes to the hydraulic regime. Soil texture or sediment particle size distribution also affects the potential impacts of exposing ASS. Coarse-textured sulfidic sands are particularly vulnerable to rapid oxidation due to their relatively higher permeability and negligible buffering capacity. Water also moves through coarse material quickly, which may create large volumes of contaminated leachate.

AASS exposure can result in medium to long-term changes in soil chemistry. Changes in soil chemistry may affect the water quality of the tidally influenced area, resulting in reduced biodiversity and potentially death of flora and vegetation.

As the works will involve the disturbance of PASS adjacent to Brisbane Waters, the implementation of the controls detailed in this plan are required to minimise the potential acid generating impacts of the soils associated with the planned works at the site. Particular care should be taken with allowing air to penetrate sandy sediments as they have little buffering capacity. These materials can oxidise and leach very rapidly.

Acid Sulfate Soils Mapping

The Department of Land and Water Conservation has prepared Acid Sulfate Soil Risk Maps for the coastal areas in NSW that predicts the distribution of acid sulfate soils based on an understanding of the factors that led to their formation reinforced by extensive soil surveying. The Acid Sulfate Soil Risk Maps have also been converted into Acid Sulfate Soil Planning Maps for use with Local Environmental Plans.

The Acid Sulfate Soil Planning Maps establish five classes of land based on the probability of acid sulfate soils occurrence and the type of works that might disturb them. The five classes in the Acid Sulfate Soils Planning Maps are shown in the table below.

Acid Sulfate Soil Risk Classes

Class of land pertaining to ASS	Nature of works requiring ASS Assessment
1	▪ Any works
2	▪ Works below natural ground surface ▪ Works by which the water table is likely to be lowered
3	▪ Works beyond 1 m below natural ground surface ▪ Works by which the water table is likely to be lowered beyond 1 meter below natural ground surface
4	▪ Works beyond 2 meters below natural ground surface ▪ Works by which the water table is likely to be lowered beyond 2 meters below natural ground surface
5	▪ Works within 500 meters of adjacent Class 1, 2, 3 or 4 land which are likely to lower the water table below 1 m AHD on adjacent Class 1, 2, 3 or 4 land

Review of the City of Sydney's Acid Sulfate Soils Risk Map indicated that the site exists within unclassified land.

Appendix C: Contingency Procedures

Contingency Procedures

In the event of a non-conformance, the source and nature of the event should be investigated, the effectiveness of the existing controls reviewed and modified where practical, and necessary strategies implemented to minimise further impacts. Contingency strategies for stockpiles and water quality exceeding performance criteria are outlined in the table below.

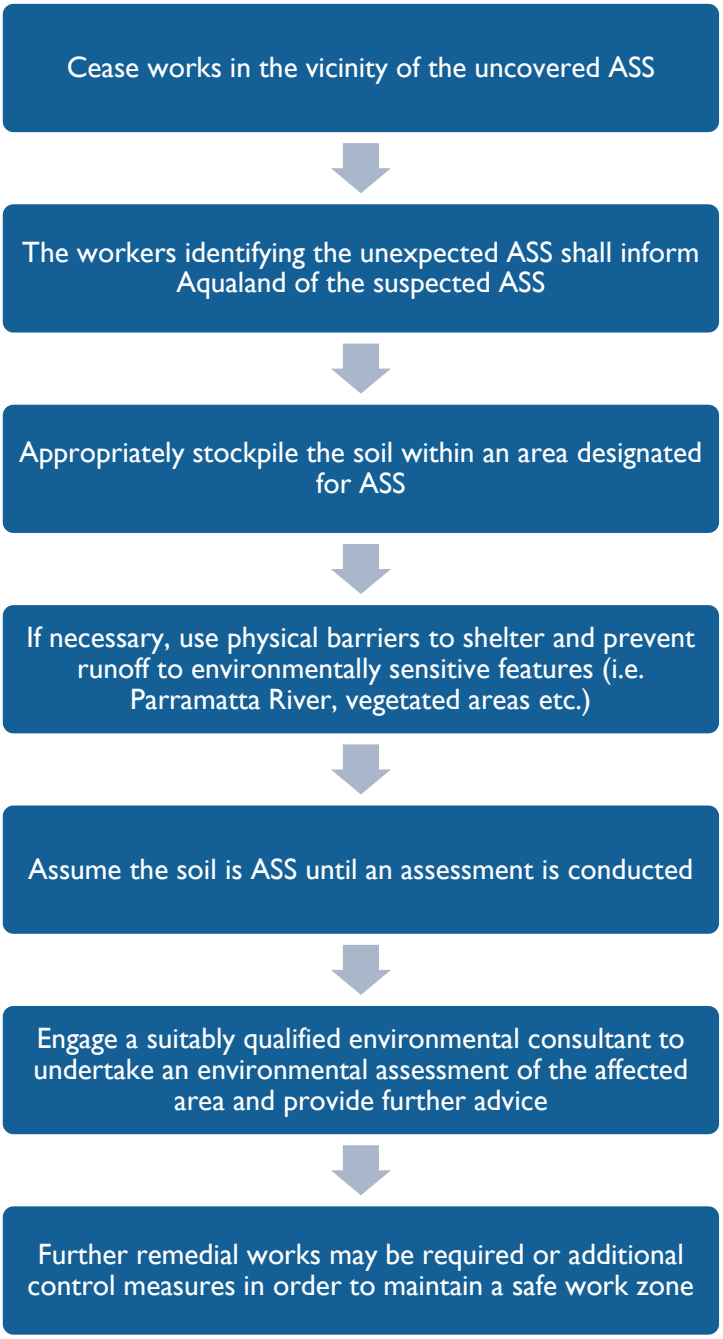
Contingency strategies for stockpile treatment and water quality exceeding performance criteria

Item	Event	Contingency Measures
Stockpile Treatment	Stockpile validation acceptance criteria are exceeded.	If pH_f and pH_{fox} and laboratory results of treated soil validation samples are outside the acceptable thresholds, further lime treatment of soils should be undertaken.
	Soils encountered during excavation works are not representative of the soils previously identified.	The soils should be treated as containing sulfidic components and assumed to be ASS unless sampling and analysis confirms otherwise.
Water Quality	Leachate or water generated from / in contact with ASS, exceed water quality performance criteria.	Cease discharging and assess control measures. Adjust lime treatment rates or other additives (such as flocculants) if required.
	EC, floatable matter and colours in the receiving water exceed performance criteria.	Cease discharging and assess control measures. A suitable treatment method such as aeration and/or filtration should be employed.

Appendix D: Unexpected Finds Protocol

Unexpected Acid Sulfate Soils

Should unexpected ASS be uncovered during the excavation works (i.e. the identification of soil displaying characteristics of the identified ASS geological units, refer **Section 10.3**), the following steps should be followed:



Appendix E: Induction Records

Acid Sulfate Soil Management Plan Induction Record

Name	Company	Date	Signature	Inducted by

Appendix F: Materials Tracking Record

Acid Sulfate Soil Materials Tracking Record

Site:			Site Supervisor:		Logged by:	
Date	Volume of Material Removed (m3)	Liming Dose (kg/t)	Location Description (location and extent)	Material Description	Off-site Disposal Classification	Comments

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