

Aqualand Projects Pty Ltd

Acid Sulfate Soils Management Plan

Central Barangaroo, Early Works DA – 02

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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
pH _f	Field pH with the addition of deionised water onsite
pH _{fox}	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 I - Appendix A.** .

The objective of this ASSMP is to detail management strategies to mitigate the risks posed by the potential acid sulfate soils (ASS) which will be disturbed as part of the proposed SSDS. The works subject of the SSDA are outlined in Section 8. .

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

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 I acid sulfate soil. Given this risk, and to 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 CaCO₃/t coming to an average rate of 19.14 CaCO₃/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 I** and the location of the site is shown on **Figure I** and site layout on **Figure 2**, provided in **Appendix A**.

Table I: 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:	<p>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.</p> <ul style="list-style-type: none"> ▪ 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 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. 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 Stage 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	Variouly 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 through 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 in SSD-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 CaCO₃/t. The median dose was 11.00 kg CaCO₃/t.

In accounting for the lime dose average and median, mixing of 40 kg CaCO₃/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.

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

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)	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 ($\leq 1000 \text{ m}^3$) – prior to disturbance	Volume of disturbance (m^3)	Number of boreholes
	< 250	2
	251–500	3
Large volumes ($> 1000 \text{ m}^3$) – prior to disturbance	501–1000	4
	Project area (ha)	Number of boreholes
	< 1	4
	1-2	6
	2-3	8
Linear	3-4	10
	> 4	10 plus 2 per additional hectare
	Width and volume	Intervals (m)
	Minor ¹	100
Existing stockpiles & verification testing	Major ²	50
	Volume (m^3)	Number of samples
	< 250	2
	251-500	3
	1000	4
> 1000	4 plus 1 per additional 500 m^3	

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 reserve sufficient land to allow for these items. **Figure I** 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.

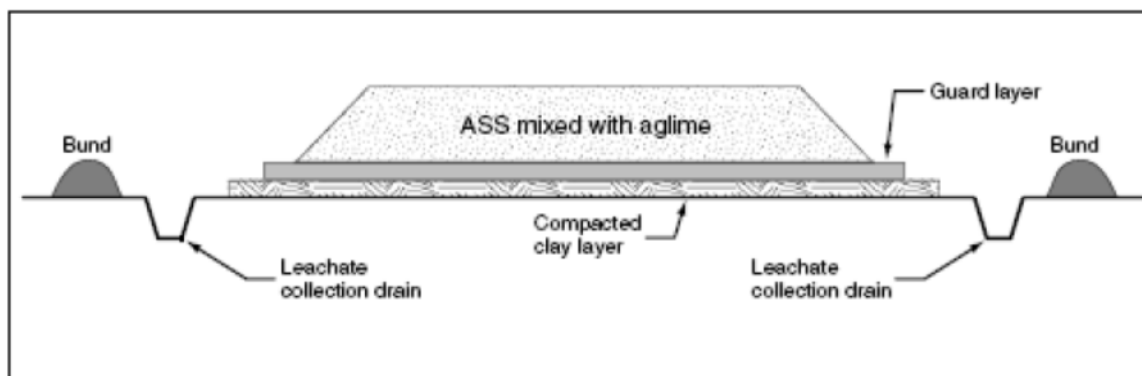


Figure 3 Schematic cross-section of a treatment pad, including clay layer, guard layer, leachate collection system and containment with bunding

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/m² 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. $\text{ENV} \geq 95$, 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 $\text{ENV} = 100$). 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 CaCO_3), 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 ooze (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 m³ 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.

II. WATER MANAGEMENT

II.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 oxidation 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:

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

Where: pH initial = initial pH of leachate

V = volume of leachate (litres)

M_{Alkali} = 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
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
Nutrients (mg/L)						
Total Phosphorus	0.006-0.24	0.008-0.81	0.001-2.2	0.01-0.42	0.03-1.3	0.12-1.6
Total Nitrogen	0.04-1.2	0.12-4.2	0.1-11.6	0.27-0.66	0.23-5.1	0.6-8.6
Micro-Organisms						
Faecal Coliforms (cfu/100mL)	0-200	10-100	40-40,000	260-4,000	700-3,000	4,000-200,000
Increased Water Temperature (Celsius)	N/A	N/A	5	N/A	N/A	N/A
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.

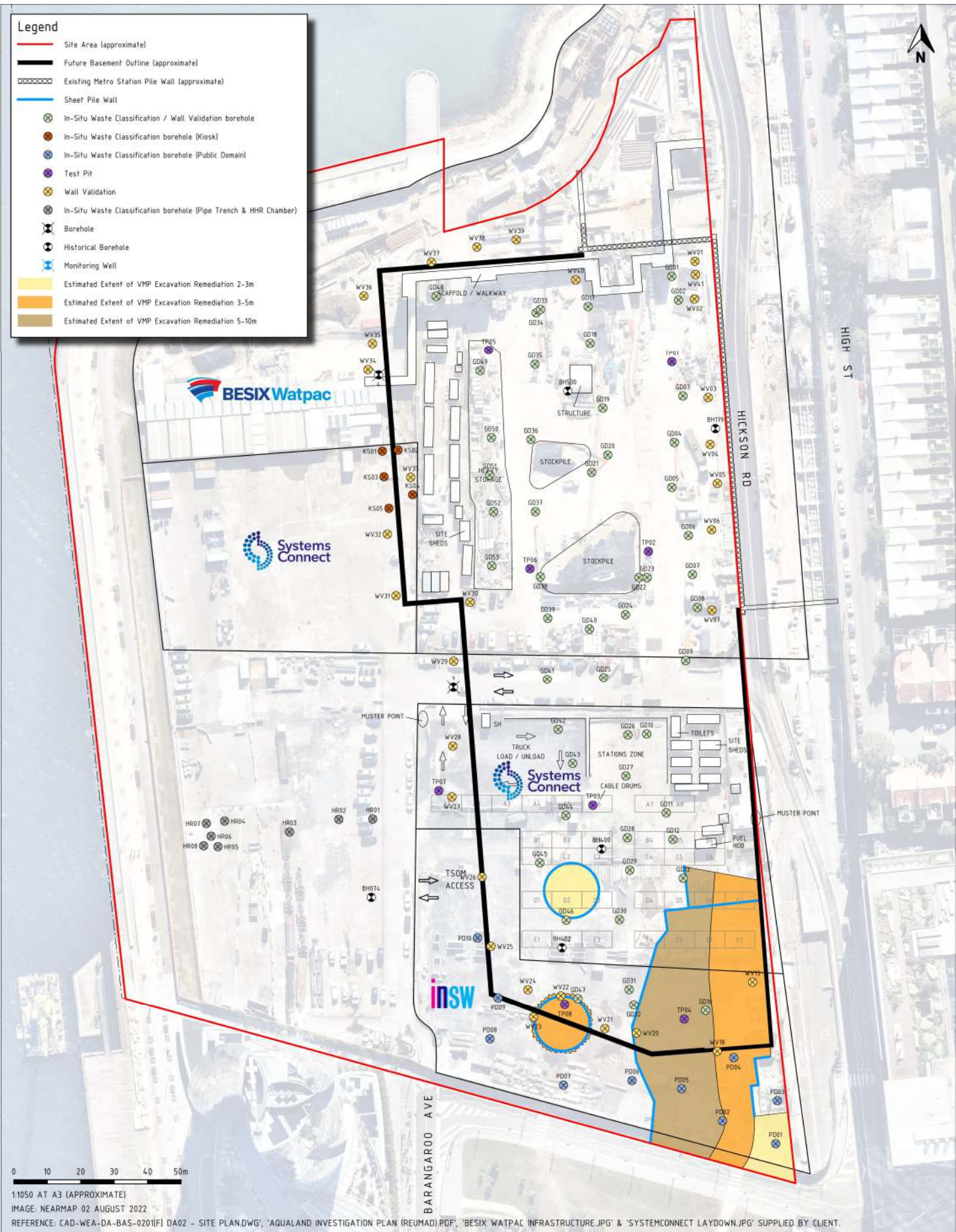
15. DOCUMENTATION AND RECORD KEEPING

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

- Legend**
- Site Area (approximate)
 - Future Basement Outline (approximate)
 - Existing Metro Station Pile Wall (approximate)
 - Sheet Pile Wall
 - ⊗ In-Situ Waste Classification / Wall Validation borehole
 - ⊗ In-Situ Waste Classification borehole (Kiosk)
 - ⊗ In-Situ Waste Classification borehole (Public Domain)
 - ⊗ Test Pit
 - ⊗ Wall Validation
 - ⊗ In-Situ Waste Classification borehole (Pipe Trench & HHR Chamber)
 - ⊗ Borehole
 - ⊗ Historical Borehole
 - ⊗ Monitoring Well
 - Estimated Extent of VMP Excavation Remediation 2-3m
 - Estimated Extent of VMP Excavation Remediation 3-5m
 - Estimated Extent of VMP Excavation Remediation 5-10m



0 10 20 30 40 50m

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.



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 V111111 | Thursday, 22 December 2022 5:18:48 PM | drawn by laurie white at www.reumad.com.au

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

COMMERCIAL IN CONFIDENCE

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	<ul style="list-style-type: none"> Any works
2	<ul style="list-style-type: none"> Works below natural ground surface Works by which the water table is likely to be lowered
3	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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.

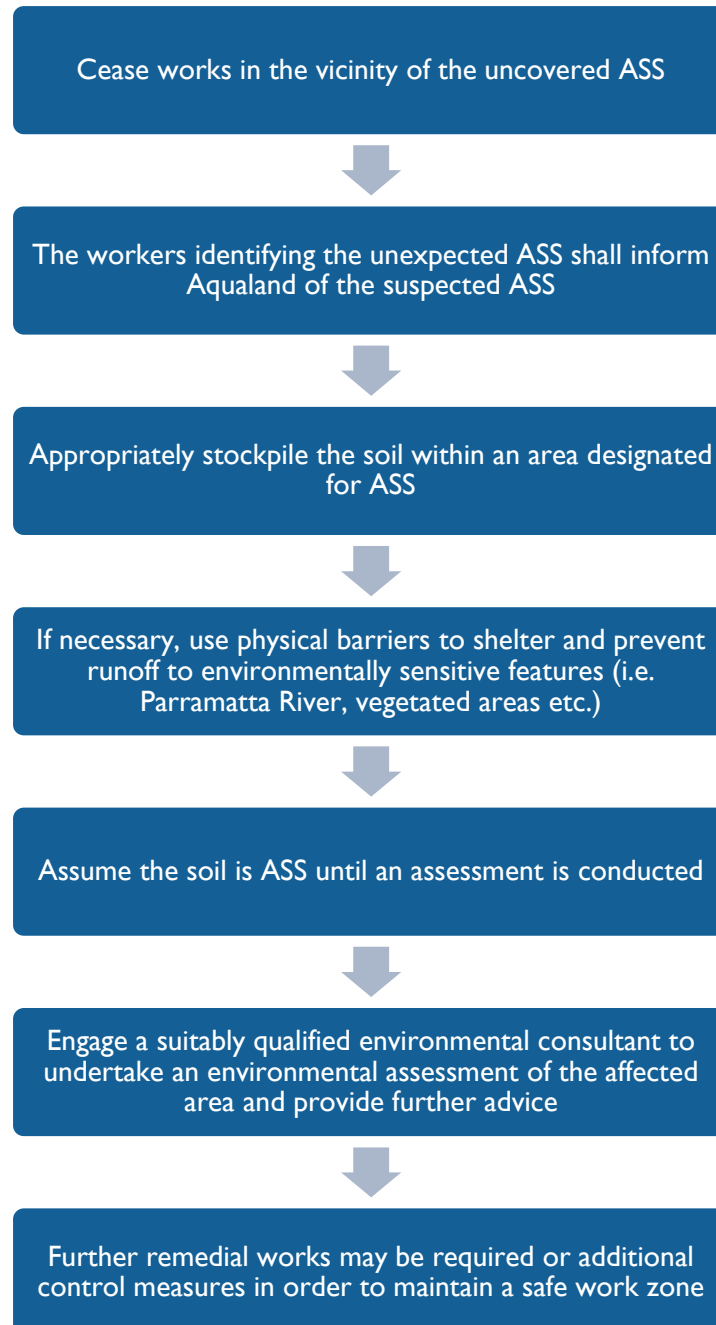
Contingency strategies for stockpile treatment and water quality exceeding performance criteria

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

Appendix F: Materials Tracking Record



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