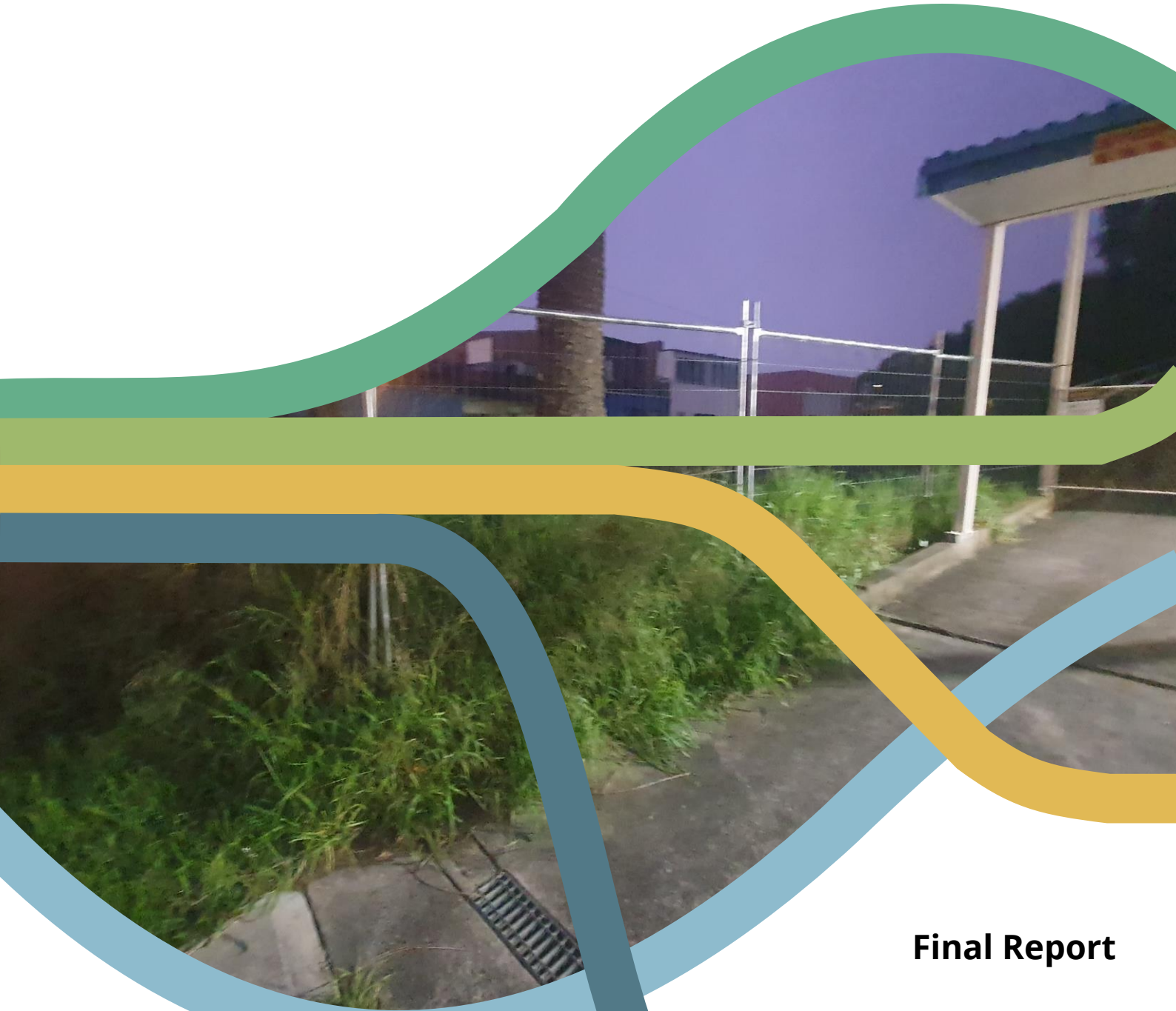
Acid Sulfate Soils Management Plan

1 – 3 Gondola Road, North Narrabeen, NSW



Final Report

P2310036JR04V01

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Prepared For Brett Crowther

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Project Details

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Client	Brett Crowther
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Director	Andrew Norris
Manager	Gray Taylor
Principal Author	Trystan Richards / Ali Kandil

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Suite 201, 20 George St, Hornsby, NSW 2077, Australia
ACN 070 240 890 ABN 85 070 240 890
P +61-2-9476-9999 | mail@martens.com.au | www.martens.com.au

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1 Introduction

1.1 Overview

This Acid Sulfate Soils (**ASS**) Management Plan (**ASSMP**) has been prepared by Martens and Associates (**MA**) on behalf of Brett Crowther. It documents the environmental risks and appropriate management of ASS for a proposed new three- storey mixed use development with basement carpark with bulk excavation up to approximately 1.1 mAHD at 1-3 Gondola Road, North Narrabeen, NSW (the **site**).

This ASSMP shall apply to all Site soil disturbance works that result in exposure of AASS or PASS. This will include spoil from bulk excavation, service trenching and piling / foundation works.

1.2 Objectives and Scope

The primary objective of this ASSMP is to provide recommendations for appropriate management of ASS so that construction works are undertaken in a way that minimises or negates ASS risk both on site and to the surrounding environment.

To achieve this objective the following scope of works have been completed.

- Review of previous ASS investigation results.
- Provide guidance on the environmental management of ASS for the project as a results of soil excavation during proposed construction works.
- Review impacts of ground dewatering (if proposed for the development) for short and / or long term purposes.
- Provide recommendations for further assessment or management of ASS.
- Preparation of a report in general accordance with Acid Sulfate Soils Manual 1998 (ASSMAC, 1998) and the National Acid Sulfate Soil Guidance: National acid sulfate soils sampling and identification methods manual (Sullivan et al., 2018b).

1.3 Regulatory Guidance Documents

The following regulatory guidelines have been considered for the preparation of this report:

- Australian Standard (AS 4969) Analysis of acid sulfate soil (2008). Joint Standards Australia/Standards New Zealand Committee, Sampling and Analysis of Soil and Biota, Working Group EV-009-02-01.

- Sullivan, L., Ward, N., Toppler, N. and Lancaster, G (2018a). National Acid Sulfate Soil Guidance: National acid sulfate soils identification and laboratory methods manual, Department of Agriculture and Water Resources, Canberra ACT.
- Sullivan, L., Ward, N., Toppler, N. and Lancaster, G (2018b). National Acid Sulfate Soil Guidance: National acid sulfate soils sampling and identification methods manual, Department of Agriculture and Water Resources, Canberra ACT.
- WA DER (2015). Identification and investigation of acid sulfate soils and acidic landscape. WA Department of Environment Regulation, Perth WA.
- NSW Acid Sulfate Soil Management Advisory Committee (1998), Acid Sulfate Soil Manual (ASSMAC, 1998).
- Qld Natural Resources, Mines and Energy (2004) Acid Sulfate Soils Laboratory Methods Guidelines.
- Qld Department of Science, Information Technology, Innovation and the Arts (2014) Acid Sulfate Soils Technical Manual.

2 Site Description

2.1 Site Identification

Site identification details and associated information is summarised in Table 1.

Table 1: Site background information.

Item	Description / Detail
Site address	1-3 Gondola Road, North Narrabeen, NSW
Legal Identifier	Lot 188 and 187 in DP16719
Approximate site area	Lots 187 and 188 will comprise a total area of 1289.3 m2 (GSS, 2017; TNSG, 2021).
Local Government Area	Northern Beaches Council
Current zoning and land use	Zoned E1 – Local Centre (ePlanning Spatial Viewer).
Site description	3 Gondola Rd is currently occupied by a two storey commercial building with a two storey open air carpark at the rear of the property with 1 Gondola Rd currently vacant with two mature trees in the front of the property.
Proposed land use	Construction of a new four storey mixed use building with one basement level.
Surrounding land uses	The site is surrounded by a commercial building to the east, south and west and commercial and residential buildings to the north.
Topography	The site is relatively flat with grades < 5%. 3 Gondola Rd elevation ranges from 5.61 mAHD in the centre to 1.95 mAHD along the northern boundary (GSS, 2017). 1 Gondola Rd elevations ranges from 1.91 mAHD in the northeast corner to 2.15 mAHD at the centre of the western boundary (GSS, 2017).
Expected geology	The *Sydney 1:100,000 Geological Sheet 9030* (Herbert, 1983) describes site geology as silty peaty quartz sand, silt and clay. Ferruginous and humic cementation in places. Common shell layers.
Soil Landscape	The NSW Environment and Heritage eSPADE website identifies the site as having soils of the Warriewood landscape having soils of deep, well sorted, sandy humus podzols and dark, mottled siliceous sands, overlying buried acid peats in depressions; deep podzols and pale siliceous sands on sandy rises.
Surface hydrology	3 Gondola Rd drainage is via overland flow to the Council stormwater network on Gondola Rd with 1 Gondola Rd via overland flow to Council stormwater and soil infiltration.
Groundwater	Two groundwater monitoring wells (MW01 and MW02) have been installed at the site as part of current and previous investigation works. Groundwater was encountered at approximately 1mbgl during installation of MW01 and 1.5 mbgl during installation of MW02. Groundwater was subsequently measured to be 1.26 mbgl at MW01 and 1.49 at MW02 on 4 April 2024.

Item	Description / Detail
ASS Class Risk	Based on the Pittwater Local Environment Plan 2014, Acid Sulfate Soil Map (Sheet ASS – 019), the site is located within Class 3 ASS risk.

3 Previous Investigations

3.1 Overview

The following documents relating to ASS investigation at the site were previously prepared by MA:

- Marten and Associates (2022) *Geotechnical Hydrogeological and Acid Sulfate Soils Assessment 3 Gondola Road, North Narrabeen, NSW.* Report ref. P2108694JR02V03.
- Maten and Associates (2024) *Geotechnical and Acid Sulfate Soil Assessment: 1 – 3 Gondola Road, North Narrabeen, NSW.* Report ref. P2310036JR02V01.

The above reports prepared by MA have been summarised in the following sections and should be read in conjunction with this report.

We note that an ASSMP was prepared for 3 Gondola Road only following completion of the MA (2022) investigation. Where relevant, recommendations and conclusions from the 3 Gondola Road ASSMP have been considered as part of the preparation of this report.

3.2 MA (2022) Geotechnical, Hydrogeological, and Acid Sulfate Soils Assessment.

Key findings of the previous ASS assessment at 3 Gondola Road, North Narrabeen, NSW are as follows:

1. Site soil profile consisted of a fill layer comprising of sand up to 1.0 mbgl underlain by marine deposits consisting of sand and silty sand to an investigation depth of 9.0 mbgl (Approximately -7.0 mAHD).
2. Groundwater inflow was observed at approximately 1.0 mbgl (approximately 1.0 mAHD).
3. Laboratory analysis for initial ASS field screening of natural material indicated:
    a. Sand layer above -0.5 mAHD and between -2.0 mAHD and -3.7 mAHD is considered to likely be potential acid sulfate soil (PASS) as $pH_{kcl} - pH_{ox}$ is >1.
    b. Silty sand layer between -0.5 mAHD and -2.0mAHD is considered to be pass due to returned pH_{ox} value of 2.4.
4. No actual acid sulfate soil (AASS) was identified on site.
5. Results from sPOCAS laboratory analysis exceeded the ASSMAC (1998 action criteria for 3 of 5 soil samples below 1.2 mbgl. Action criteria exceeded as follows:

a. The sulfur trail trigger level (S_{pos}) in three samples from BH101.

b. The acid trail trigger level (TPA or TSA) in one sample from BH101.

6. Indicative liming rate (based on laboratory testing) was prescribed as 40 kg/T

3.3 MA (2024) Geotechnical and Acid Sulfate Soil Assessment

Key findings of the previous ASS assessment at 1 - 3 Gondola Road, North Narrabeen, NSW are as follows:

1. Site soil profile consisted of a fill layer comprising of sand up to 1.2 mbgl underlain by marine deposits consisting of very loose to medium dense sands up to 14 mbgl, with stiff clay / silty clay with interbedded sand / silty sand to approximately 27.0 mbgl.

2. Groundwater inflow was encountered in all boreholes and CPT locations between 1.0 mbgl and 2.5 mbgl.

3. Laboratory analysis for initial ASS field screening of natural material indicated:

    a. Four samples taken from 0.5, 1.3 – 1.4, 2.0, 4.0, 5.5 – 5.95 (BH201) reported a drop of pH (pH_f - pH_{fox}) >1 but were considered unlikely to be PASS.

    b. One sample taken from 2.0 mbgl (BH201) reported a drop of pH (pH_f - pH_{fox}) >1 and a pH_{fox} of 4.5 and was considered to be PASS subject to additional laboratory suffer trail analysis (i.e. sulfur chromium suite testing).

4. Results from Reducible Sulfur Chromium Suite laboratory analysis indicated that one sample (10036/BH201/4.0) exceeded ASSMAC action criteria for Chromium Reducible Sulfur (0.13 %S)

5. No AASS was identified on site.

6. An ASSMP was recommend to be prepared to address risk associated with ASS works in accordance with ASSMAC (1998).

3.4 Conclusion

Based on the key findings from all investigations previous completed at the site and the new proposed development we recommend adopting the following conclusions for the purpose of this ASSMP.

- The site soil profile comprises a fill layer up to 1.2 mbgl underlain by natural material encountered up to 27.0 mbgl.

- The adopted permanent groundwater depth, allowing for seasonal fluctuation, is 0.5 mbgl (approximately 1.5mAHD).

- No actual acid sulfate soils were identified up to approximately 5.50 mbgl.
- Fill material at the site is not considered AASS or PASS.
- Natural site soils from approximately 1.2 mbgl to 5.50 mbgl are consider to contain PASS.

4 Acid Sulfate Soil Management Plan

4.1 Application of ASSMP

This ASSMP shall apply to all site soil disturbance works that result in exposure of PASS to air. Based on the current proposed development, bulk excavation excluding excavation for the lift well and pilling works and is expected to be limited to the fill layer.

4.2 Training and Awareness

All project personnel, subcontractors and consultants are to receive training in their personal environmental obligations during site inductions and toolbox talks. All project personnel are to undergo a general project induction prior to commencing work with the contractor. This includes an ASS component to reinforce the importance of management and the measures that will be implemented to address ASS issues.

4.3 Potential Mitigation Strategies

Potential mitigation strategies are reviewed and assessed in Table 2.

Table 2: Mitigation strategies and their appropriateness for the Site.

Strategy	Details	Application to Site
Avoidance	Avoid areas containing ASS or PASS.	Development would not be possible – identified PASS is present within the entire site, construction and excavation works cannot avoid PASS material.
Minimisation	Modification of site design to minimise disturbance.	Not possible while maintaining proposed basement extents.
Neutralisation	Treatment and neutralisation.	Yes – Treatment by neutralisation is an option for management of excavated PASS.
Strategic reburial	Burial of ASS or PASS to prevent adverse impacts.	Not possible onsite as no areas are available to permit reburial of ASS or PASS material. Possible as part of offsite spoil (waste) management process. Generated untreated waste spoil may be strategically buried offsite in an appropriately licenced waste management facility subject to waste classification and receiving facilities approval conditions.
Discharged water	pH buffering of leachate control (where produced)	Yes – if leachate is produced during PASS treatment it will require management prior to discharge.

4.4 PASS Treatment Layers

Identified soil layers have been separated based on information from borehole logs to determine treatment requirements (Table 3).

Table 3: Soil layers and required treatment.

Soil layers	Depth	Treatment Required
Fill layer	Surface to 1.2 mbgl.	**Does not require treatment.** Encountered fill material does not display characteristics of PASS or AASS (based on laboratory testing) and therefore no ASS management is required during excavation and or offsite disposal. Fill material must be waste classified in accordance with NSW EPA (2014) Waste Classification Guidelines and disposed to a suitably licenced waste facility.
Sand and silty sand	Below 1.2 mbgl up to 5.95 mbgl.	Excavated soil material below 1.2 mbgl up to 5.95 mbgl **may require treatment** subject to the conditions of the receiving licenced waste management facility.
Sand	Below 5.95 mbgl	Soil below 5.95 mbgl did not undergo laboratory analysis. Any excavation including piling works extending into this layer and past **may require treatment** subject to the conditions of the receiving licenced waste management facility.

Fill, including material from below the hardstand at 1-3 Gondola Road up to 1.2mbgl, will not require treatment for ASS management purposes. The management plan for PASS below 1.2 mbgl depends on the conditions and requirements of the receiving licenced waste management facility.

4.5 Approach

Spoil generated by bulk excavation (primarily fill material) is not expected to require treatment. Spoil generated from piling works (PASS) shall require classification in accordance with NSW EPA (2014) Waste Classification Guidelines and may require treatment prior to offsite disposal. The requirements for treatment shall be determined in consultation with receiving licenced waste management facility to which the material is to be taken.

Requirements for treatment if required, are provided in Section 4.6

4.6 PASS Treatment Plan

Where treatment of PASS is required, it is to be undertaken by blending the soil material with agricultural lime (calcium carbonate). The rate of lime application is expected to vary based on the laboratory results to date. Lime purity will impact liming rates. Where lime purity has not been certified, it must be analysed prior to use.

4.6.1 Treatment of Piling Spoil

Table 4 describes the processes and measures for managing spoil generated from piling works likely required for excavation support / dewatering cut off walls and foundations.

Table 4: Treatment of PASS material from piling wall.

Stage	Management and Mitigation Measures
1 – Establish treatment area	Prior to the commencement of piling works, a designated treatment area for untreated PASS stockpiling and treatment is to be prepared within the Site boundary. This area is to be formed with drainage controls and bunded to prevent surface water flow into and out of the area. Prescribed maximum stockpile times prior to liming shall prevent the generation of acidified leachate.
2 – Excavate soil	All excavated spoil between 1.2 – 5 mbgl shall be mixed with agricultural lime at the initial rate of **40 kg/t** to neutralise impact of PASS. All excavated spoil below 5.5 mbgl shall be mixed with agricultural lime at a rate **determined from future testing** if required to neutralise impact of AASS and/or PASS. Untreated soil should not be retained onsite for more than the period in Table 5
3 – Treatment validation	Treated PASS and/or AASS shall be sampled and tested for validation purposes, using the approach described in Section 4.10, to confirm adequacy of treatment.
4 – Retreatment	Where treated PASS and/or AASS does not meet adopted validation criteria of Section 4.10, repeat retreatment and validation is required until validation is successful.
5 – Disposal	Once PASS and/or AASS is treated and validated, material shall then be waste classified in accordance with NSW EPA Waste Classification Guidelines (2014) and disposed of offsite to an appropriately licensed waste management facility.

4.6.2 Treatment of Bulk Excavation Spoil and Service Trenches

Provided bulk excavation and excavations for service trenches do not exceed 1.2 mbgl, generated spoil is not expected to require treatment prior to waste classification and disposal.

Given that the lift well excavation may extend below 1.2mbgl, it is recommended that generated spoil be treated in conjunction with or as per pilling spoil.

Following completion of bulk excavation, the base of the excavation should be treated with an agricultural lime layer (at the rate of **5 kg/m^2**) to act as a guard layer prior to placement of the basement concrete slab.

4.7 Stockpiling of Untreated PASS

Where feasible, treatment of PASS should occur immediately following excavation. The maximum periods for stockpiling of untreated PASS are provided in Table 5 for coarse and medium grained material. Where material is to be stockpiled for periods longer than those described in Table 5 an impermeable storage area with adequately designed guard layer would be required. Leachate generated from any material stockpiled longer than specified in Table 5 shall require collection, testing and likely, treatment prior to discharge.

Table 5: Recommended maximum periods for stockpiling untreated PASS.

Type of Material Texture Range	Duration of Stockpiling[1] Approx. Clay Content (%)	 Short Term
Coarse texture Sands to loamy sands	≤5	18 hours
Medium texture Sandy loams to light clays	5 – 40	72 Hours

Notes:

1. Stockpiling time frames are based on Table 11-1 of Qld DSITIA (2014).

4.8 Groundwater Treatment

In addition to the proposed cut off wall system described in MA's Geotechnical and Acid Sulfate Soils Assessment (MA, 2024) we recommend ensuring dewatering external to the excavation to remain within the natural fluctuation of the local groundwater system and limit the potential ASS impacts generated through significant dewatering of PASS outside the basement excavation.

Groundwater collected from within the basement excavation as part of the dewatering process is to be managed and disposed of in accordance with any future WaterNSW requirements, the site groundwater dewatering management plan and the requirements of Northern Beaches Council as to not cause pollution.

4.9 Leachate Treatment

Leachate may discharge from PASS material during stockpiling and treatment of piling spoil and service trench spoil and is also to be managed to ensure risk of discharge of acidified leachate to the environment is minimised.

Treated leachate shall only be discharged when it meets the discharge criteria as set in the site groundwater dewatering management plan. Details of the treatment system are to be provided at the construction certificate stage of works.

4.10 Validation Testing

The effectiveness of AASS and/or PASS treatment is to be validated to confirm soil material no longer possesses acid generation potential in excess of neutralisation capacity.

4.10.1 Validation Rates

Validation sampling should be undertaken at the rate of 1 sample per 250 m^3, with a minimum of three validation samples collected for every batch regardless of volume removed. Validation samples are to be sent for laboratory analysis for SCr suite.

4.10.2 Validation Criteria

Validation is confirmed when net acidity results are less than the laboratory practical quantity limit (PQL).

If validation of treated PASS fails, additional neutralisation is needed until results meet validation criteria.

4.11 Waste Classification

All material removed from the Site should be classified in accordance with the NSW EPA Waste Classification Guidelines (EPA 2014). Disposal shall be to a waste facility licenced by the EPA to receive that type of waste and records of the disposal are to be maintained on site and made available to regulators as required.

4.12 Contingency Plan

A contingency plan is to be followed in the unlikely event of situations where management practices do not achieve desired outcomes or when surrounding environments have been impacted by construction activities.

4.12.1 Validation Fail

Where validation of spoil fails, the following should be undertaken:

1. Laboratory testing should be analysed by the environmental consultant to determine the potential acid generation and appropriate rates of reliming for neutralisation.

2. Material to be relimed at rates as assessed by the environmental consultant.

3. Revalidation of material to be undertaken as documented in Table 4.

4.12.2 Spoil Material Not Managed Within Exposure Timeframes

Where piling or service trench spoil material is stockpiled and not treated with appropriate amounts of lime within the timeframes stipulated in Table 5 (i.e., inclement weather stops work on site), the following contingency plan should be implemented:

- All stockpiled material shall be covered by impermeable covering (such as secured tarpaulin or builder's plastic) to prevent rainfall seeping into soil and creating leachate.

- Liming of spoil should be undertaken at the earliest opportunity following the recommencement of work.

4.12.3 Groundwater Inflow

During the basement excavation stage, should groundwater inflow be observed into the excavation, the following contingency plan must be implemented:

- Notify site construction manager.
- Site construction manager to report site conditions to relevant authorities if necessary, and engage environmental and engineering consultant to conduct site investigation.
- Determine reason for groundwater inflow and develop remedial strategy to attenuate inflows.
- Environmental consultant (or project engineer) to conduct testing at and around the site to assess groundwater drawdown and to assess ASS impacts. Where on or offsite impacts are identified the environmental consultant is to provide recommendations for remedial action(s).
- Site construction manager to implement the recommendations of the environmental consultant subject to appropriate consent and / or approvals as required from the relevant authorities.

If the assessment demonstrates the need for the modification of any part of the ASSMP, the site construction manager is to be notified of all proposed changes prior to the recommencement of the activity causing the non compliance.

4.13 Record Keeping and Reporting

Complete records of all spoil treatment, groundwater inflow / treated discharge and lime use shall be maintained by the site construction manager. Records should include as a minimum:

- Amount of PASS excavated for treatment.
- Register of all agricultural lime and other treatment chemicals delivered to Site and location of use, including rate of application.
- Laboratory test results detailing validation for treated soil material.
- Laboratory test results for any water treatment prior to offsite disposal.
- Waste classifications for spoil removed from the Site.

Records should be made available to regulators if requested.

The environmental consultant is to prepare a post construction ASS validation report documenting the above.

5 Roles and Responsibilities

This section outlines the roles that are responsible to manage, document and report on ASS issues for the project:

- The site construction manager is responsible for ensuring that all requirements of the ASSMP are met during the project.
- The engaged environmental consultant is responsible for:
    1. Record keeping and reporting.
    2. Validation sampling of treated PASS and water.
    3. Conducting site specific investigation in the event of exceedance(s) of trigger value(s) and provide recommendations / remediation strategies if necessary.
- All other site personnel are responsible for implementing the strategies and procedures prescribed in the ASSMP, as applicable to their work activities.

Any nonconformance to the ASSMP must be addressed as soon as is practical. The personnel responsible for the nonconformance must be notified immediately for purpose of issuing rectification instructions.

6 Limitations

The recommendations presented in this report include specific issues to be addressed during future planning and construction phases of the project.

In the event that any of the recommendations presented in this report are not implemented, the general recommendations may become inapplicable and Martens & Associates Pty Ltd accept no responsibility whatsoever for the performance of the works undertaken where recommendations are not implemented in full and properly tested, inspected and documented.

Occasionally, subsurface conditions between and below the completed boreholes or other tests may be found to be different (or may be interpreted to be different) from those expected. Variation can also occur with groundwater conditions, especially after climatic changes. If such differences appear to exist, we recommend that you immediately contact Martens & Associates Pty Ltd.

7 References

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