

Acid Sulfate Soils Management Plan

Lot 17.2 Hamilton – Multi-Storey Residential Development, 17 Karakul Road, Hamilton, Lot 1 on SP337697



Prepared for:

Silverstone Developments

tdaffy@silverstonedevelopments.com.au

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Definitions

Environmental Protection Act 1994

- Environmental Harm -** Any adverse effect, or potential adverse effect (whether temporary or permanent and of whatever magnitude, duration or frequency) on an environmental value, and includes environmental nuisance.
- Environmental Nuisance -** Any unreasonable interference or likely interference with an environmental value caused by
- (a) noise, dust, odour, light; or
 - (b) an unhealthy, offensive or unsightly condition because of contamination; or
 - (c) another way prescribed by regulation.
- Material Environmental Harm -** Is environmental harm (other than environmental nuisance)
- (a) that is not trivial or negligible in nature, extent or context; or
 - (b) that causes actual or potential loss or damage to property of an amount of, or amounts totalling, more than the threshold amount but less than the maximum amount; or
 - (c) that results in costs of more than the threshold amount but less than the maximum amount being incurred in taking appropriate action to
 - (i) prevent or minimise the harm; and
 - (ii) rehabilitate or restore the environment to its condition before the harm.
- “Maximum amount” means the threshold amount for serious environmental harm.
- “Threshold amount” means \$5000 or, if a greater amount is prescribed by regulation, the greater amount.
- Serious Environmental Harm -** Is environmental harm (other than environmental nuisance)
- (a) that causes actual or potential harm to environmental values that is irreversible, of a high impact or widespread; or that causes actual or potential harm to environmental values of an area of high conservation value of special significance; or
 - (b) that causes actual or potential loss or damage to property of an amount of, or amounts totalling, more than the threshold amount; or
 - (c) that results in costs of more than the threshold amount being incurred in taking appropriate action to
 - (i) prevent or minimise the harm; and
 - (ii) rehabilitate or restore the environment to its condition before the harm.
- “Threshold amount” means \$50,000 or, if a greater amount is prescribed by regulation, the greater amount.

GLOSSARY

ANC	Acid Neutralising Capacity
ANZECC	Australian & New Zealand Environmental Conservation Council
ARMCANZ	Agricultural and Resource Management Council of Australia and New Zealand
DES	Department of Environment and Science
ASS MP	Acid Sulfate Soils Management Plan
EM	Environmental/Construction Manager
NATA	National Association of Testing Authorities
PASS	Potential Acid Sulfate Soil
pH _F	Field pH
pH _{FOX}	pH following rapid oxidation with hydrogen peroxide
TAA	Titrateable Actual Acidity
TPA	Total Potential Acidity
CRS	Chromium Reducible Sulfur

1. INTRODUCTION

This Acid Sulfate Soils Management Plan (ASS MP) has been updated for the proposed developments for the site located at 17 Karakul Road, Hamilton also known as Lot 1 on SP337697 and referred to as 'Lot 17.2 Hamilton'.

This ASS MP references the results of previous investigations undertaken by Core Consultants Pty Ltd (Core). Refer to Core reports:

- J002388-001-R-Rev2 – Preliminary Site Investigation.
- J002388-002-R-Rev0 – Geotechnical and Acid Sulfate Soils Investigation.
- J002388-004-R-Rev0 – ASSMP.

The procedures contained within this ASS MP should be updated and revised to address conditions encountered that vary from those indicated by further investigations or where alternative construction methodologies are adopted.

The MP was prepared with consideration of the following documents:

- State Planning Policy, July 2017.
- State Planning Policy – State Interest Guideline Water Quality April 2016 (Policy 9).
- Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines V5.1, 2014. Dear, S-E., Ahern, C. R., O'Brien, L. E., Dobos, S. K., McElnea, A. E., Moore, N. G. & Watling, K. M. Department of Science, Information Technology, Innovation and the Arts, Queensland Government.
- National acid sulfate soils identification and laboratory methods manual, National Acid Sulfate Soils Guidance, Water Quality Australia, June 2018.
- National acid sulfate soils sampling and identification methods manual, National Acid Sulfate Soils Guidance, Water Quality Australia, June 2018.
- Environmental Protection Act 1994.
- Environmental Protection Policy (Water) 2009.

A copy of the MP and associated forms, registers and records shall be kept onsite during the construction stage of the development.

2. OBJECTIVE

The objective of the MP is to mitigate or control potential impacts relating to the disturbance of Acid Sulfate Soils. Disturbance includes the excavation of ASS and potential dewatering of ASS impacted groundwater.

3. PROPOSED DEVELOPMENT

Details of the proposed development provided by SD indicates two buildings of 7 to 10 storeys over a single level common basement is proposed, similar to neighbouring Lots. Bulk excavation levels are to be approximately RL 2 to 3 m Australian Height Datum (AHD).

The local natural subsurface conditions comprise fill overlying deep alluvial soils with dense gravel and weathered rock about 30 to 32 m below ground level (BGL). Historical images indicate the site was filled by reclamation and then used for car storage until recently. Acid sulfate soils (ASS) are present at the site with existing ASS Management Plan.

It is understood that the neighbouring Lots known as Site 17 and Site 18 are currently being redeveloped by Silverstone Developments with the same building structures. It is also understood that the earthworks on this site are seeking to conduct on-site lime treatment of soils on-site prior to transport from the site.

It is also understood that existing groundwater monitoring wells, from previous investigations, are still present and maybe useful for monitoring during the earthworks stage of construction.

The proposed development is shown in Images 1 to 3.



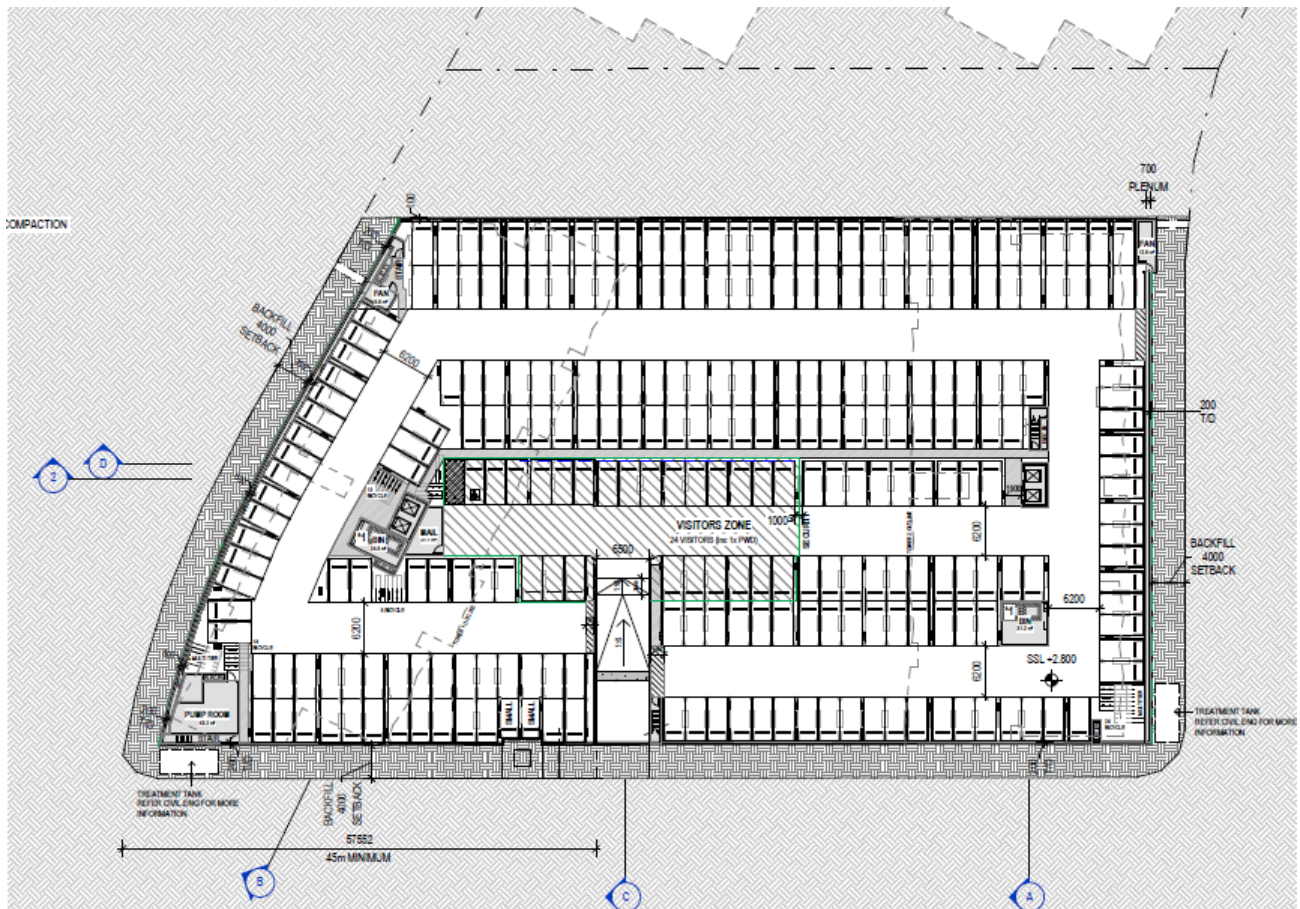


Image 3: Proposed development of Basement (Source: Plus Studio DA100-725048).

4. SITE DESCRIPTION

The site is located at 17 Karakul Road, Hamilton. It comprises a portion of Lot 1 on SP337697 and covers an area of approximately 7980 m². The site location is shown in Image 4 below.

At the time of the investigation, the site comprised a vacant lot covered with grass. In 2025, the site was utilised for stockpiling of spoil during the construction of the neighbouring property known as Site 17 (Lot 4 SP326594).

The elevation of the site ranges between about RL 4 m and 5 m AHD, generally sloping down towards the south-eastern boundary.

Macarthur Avenue bounds the site to the north, with Chevron Commercial building and Old Shoreline Park beyond, then followed by a drainage line. To the east the site is bounded by vacant grassed land followed by Macarthur Avenue and high-density residential dwellings. Karakul Road and Barcham Road form the southern and western site boundaries, respectively, followed by industrial development areas. The Brisbane River is located approximately 300 m to the south.

Site conditions at the time of our investigation are shown in Photograph 1 below.



Image 4: Site locality and proposed development areas (Source: Nearmap, dated November 5, 2025).



Photograph 1: General site conditions at the time of fieldwork.

5. GROUND CONDITIONS

The subsurface conditions encountered in the previous Core investigation are summarised in Table 1 below.

Table 1: Summary of Subsurface Conditions

Strata Name	Approximate Depth Range (BGL)	Description
Site 16		
Fill	0 m to 0.75 m	Firm to stiff gravelly clay.
Dredge Spoil/ Fill Soil	0.75 m to 5 m	Soft silty clay (material dredged from the adjacent Brisbane River channel)
Upper Alluvial	5 m to ~15 m	Interbedded loose sand and firm clay layers
Lower Alluvial	15 m to 32 m	Loose to medium dense sand and stiff clay, becoming medium dense from approximately 30m.

Note: The upper fill and dredge spoil is deemed 'uncontrolled' because of lack of geotechnical inspection and density testing records.

Groundwater seepage was encountered in the auger boreholes at about RL 2 m to 3.45 m AHD and was measured at standing depths within the monitoring wells at approximately RL 1.1 m to 1.4 m AHD. Ordinarily near the Brisbane River where sands are present, groundwater levels would be tidally dominated and occur at or around high tide level about RL 1 m to 1.5 m and rise temporarily and locally due to ingress after rainfall. It is understood the storm tide level for this site is RL 3.1 m (i.e. below basement level). Groundwater conditions can vary over distance and time and apart from tide and rainfall be influenced by changes to surface and subsurface drainage conditions and human influences.

6. OVERVIEW OF ASS ENVIRONMENTAL ISSUES

This section provides a brief overview of environmental issues related to ASS associated with the excavations for the proposed development.

6.1 Acid Sulfate Soils

The results from this investigation indicate low levels of actual and high levels of potential acidity are distributed throughout the soil profile (up to 4.0 m BGL).

The SPPI4 Guidelines require that the level of treatment for management of ASS is based on treatment of all existing and potential acidity. The results of the laboratory testing have been accumulated in an Acid-Base Account to give the Net Acidity for each sample in units of mol H⁺/tonne as presented in Table E1, attached. This value has been calculated from sulfur trail potential acidity (S_{cr}) plus actual acidity (TAA) (refer Core report J002388-002-R-Rev0 – Geotechnical and Acid Sulfate Soil Investigation).

A preliminary liming rate has been calculated in kg CaCO₃/t and kg CaCO₃/m³ using a factor of safety (fineness factor) of 1.5 and an assumed bulk density of 1.6 tonne/m³. Consideration of the tabulated laboratory results indicates that high levels of potential acidity are fairly uniformly distributed throughout the soil profile.

Due to the difficulty in mixing the soft silty clay material and the presence of lime within the dredge spoil fill, it is considered that adoption of a uniform liming rate, not exceeding the 90th percentile of relevant test results for 'net acidity', i.e., 34 kg CaCO₃/m³, will be sufficiently conservative to limit the risk of environmental impact. Soils have been separated into two types the surface Gravelly Clay Fill to 0.75m BGL and the lower alluvial Clays and dredging spoil from 0.75 m BGL. Table 1 below provides the recommended liming rates calculated for each soil type.

The Guidelines require that the level of treatment for management of ASS is based on treatment of all existing and potential acidity. The following liming rates shown in Table 2 below are considered appropriate for full neutralisation of combined actual and retained acidity.

Table 2: Recommended liming rates.

Soil Type	Colour	Depth Range	Treatment Rate**
Gravelly Clay (Fill)	Brown	0.0 – 0.75 m BGL	4 kg CaCO ₃ /m ³ ***
Alluvial Clays / Fill Dredging Spoil	Grey, dark grey, dark brown and black	0.75 – 4.0 m BGL*	30 kg CaCO ₃ /m ³ **

Note: * Maximum depth of ASS sampling and analysis

** Liming rate based on 90th percentile values.

*** Additional testing in the gravelly clay to confirm any treatment (likely low risk – no treatment)

All excavated soil must be managed by full neutralisation of the net acidity. It is proposed that fine agricultural lime, thoroughly mixed with the soil, is used as the neutralising agent. It is recommended that the purity of the lime to be used be determined by assay or otherwise as at least 90% pure, otherwise liming rates indicated herein will need to be adjusted up, accordingly.

6.2 Groundwater

Groundwater seepage was encountered at about RL 2 m to 3.45 m AHD and was measured at standing depths at approximately RL 1.1 m to 1.4 m AHD. Ordinarily near the Brisbane River where sands are present, groundwater levels would be tidally dominated and occur at or around high tide level about RL 1 m to 1.5 m and rise temporarily and locally due to ingress after rainfall. It is understood the storm tide level for this site is RL 3.1 m (i.e. below basement level). Groundwater conditions can vary over distance and time and apart from tide and rainfall be influenced by changes to surface and subsurface drainage conditions and human influences.

All groundwater seepage (if encountered) and stormwater collected in excavations should be directed to a holding point for regular monitoring and treatment as necessary before discharging off site.

The background groundwater quality for the site is:

- Neutral conditions (pH 7.0 to 7.2).
- Electrical conductivity reported saline conditions.
- Alkalinity (Bicarbonate as CaCO₃) was reported in groundwater above 200mg/L. This value is usually observed within limestone bedrock aquifers.
- Elevated heavy metals have been reported including iron and aluminium. This is common in these groundwater environments.

Water quality monitoring should be undertaken for the full duration of earthworks activities in accordance with Procedure C (Appendix A).

6.3 Potential Environmental Impacts

Potential environmental impacts associated with ASS disturbance during earthworks and construction for the proposed development are summarised below in Table 3 along with the level of risk and management strategies to mitigate the risk.

Table 3: Potential Environmental Impacts.

Activity	Issue	Level of Risk to the Environment	Mitigation Strategies
Proposed Earthworks	Acid formation and transport due to disturbance (by excavation) of existing and potential acidity.	Medium to high level risk	Lime neutralisation treatment of excavated ASS and verification testing.
	Release of acidic and/or metals impacted waters from within excavations to surface waters.	Medium to high level risk	Regular water quality monitoring and treatment prior to discharge off-site.

Activity	Issue	Level of Risk to the Environment	Mitigation Strategies
	Potential adverse impacts to groundwater quality due to earthworks activities.	Medium to high level of risk	Regular water quality monitoring and treatment prior to discharge off-site.

6.3.1 Summary of Acid Sulfate Soils Management Requirements

Provided the proposed management procedures are effectively implemented and monitored throughout the construction phase of the development, it is considered that there should be limited internal or external ASS environmental impacts attributable to soils with existing or potential acidity.

The relevant issues, which are of significance when considering existing and potential acidity management for the earthworks phase of this development, are:

- Treatment and validation of excavated soils with existing or potential acidity.
- Stockpiling, handling and transport of soils with existing or potential acidity.
- Potential adverse impacts to groundwater or surface water quality on site or within the surrounding environment arising from the disturbance of soils with existing or potential acidity (if not managed correctly).

7. MANAGEMENT PROCEDURES

The management procedures required to address the potential issues associated with the earthworks phase of the proposed development are presented in Appendix A, and include the following:

Procedure A: Management of Acid Sulfate Soils

Procedure B: Treatment and Verification of Excavated Acid Sulfate Soils

Procedure C: Monitoring of Water Quality

8. RESPONSIBILITIES

This section outlines the responsibilities to manage, document and report on ASS issues for the project.

- The *Project Manager* is responsible for ensuring that all requirements of the ASS are met during the project.
- The *Site Supervisor* is responsible for ensuring the strategies and procedures prescribed in the MP are implemented at the site in accordance with the specified performance criteria.
- The *Environmental Manager* is responsible for reviewing compliance with the MP and development of actions to address non-conformance.
- All other site personnel are responsible for implementing strategies and procedures prescribed in the MP, as applicable to their work activities.

9. NON-CONFORMANCE AND CORRECTIVE ACTION

Any non-conformance to the ASS MP must be addressed as soon as is practical. The personnel responsible for the non-conformance must be notified immediately for purposes of issuing rectification instructions.

10. AUDITING

The Environmental/Construction Manager (EM) will be responsible for ensuring that an auditing program is implemented for construction and treatment works. The audit program shall aim to ensure compliance with the MP and relevant statutory requirements.

11. COMMUNITY RELATIONS

Concerns raised by the community (or other parties) in relation to ASS will be directed to the EM for action.

The EM shall maintain a concerns register recording the following information:

1. Details: Name, address and phone number of party raising the concern.
2. Nature of concern: Detail of issue, date of incident, people involved, and location.
3. Action taken or required: Any action proposed or undertaken to address the concern, including time and date.
4. Response to action: Was the complainant satisfied with the outcome of the actions taken, if not, what else needs to be done, or is it outside the scope of the development works.
5. Prevention or re-occurrence: What action has been taken by the nominated responsible person to ensure the problem will not re-occur.

12. TRAINING

All site staff and contractors will be required to undergo a site induction covering all the elements of the MP. The induction will aim to instil environmental awareness in personnel, and:

- Introduce and explain the duty of care required under the Environmental Protection Act 1994.
- Introduce the MP and responsibilities it places on all contractors and consultants.
- Explain the various subordinate components of the MP and the reporting and monitoring procedures of the MP and how they work.
- Explain how to use the environmental procedures and plans in the MP.

The content of the induction program will be endorsed and presented by the Site Supervisor, or delegate.

13. LIMITATIONS

We draw your attention to the document, Limitations, which is included in Appendix B.

Should you require any further information please contact the undersigned.

SIGNATURES



Christie Johnson
BEng(Env(Hons)) MIEAust
Geo-Environmental Engineer



Cameron Kay
BSc MEIANZ CEnvP MACLCA ALGA
Director, Principal Environmental Consultant

Core Consultants Pty Ltd
ABN 75 603 384 050

Appendix A:

Acid Sulfate Soils Management Procedures

PROCEDURE A

Management of Acid Sulfate Soils

A1. GENERAL

The procedures outlined below are provided for the management of the excavation, stockpiling, handling and transport of acid sulfate soils. The following options are proposed for the treatment of soils:

- Onsite at an ASS treatment area.
- Offsite at an approved ASS treatment area/site.

ASS materials should be transported to an ASS treatment area (on or off-site) as soon as practicable. The Site Supervisor or their delegated representative will be responsible for the excavation, stockpiling, handling and transport of excavated ASS materials. The Site Supervisor or their delegated representative will also be responsible for the supervision and management of the treatment area and for ensuring that the excavated ASS is remediated and verified in accordance with the ASS MP and associated procedures.

A2. OBJECTIVES

1. Appropriately manage the stockpiling, handling and transport of confirmed and suspected acid sulfate soil materials.
2. Comply with conditions of licences, permits or other approvals issued for the project.

A3. STATUTORY REQUIREMENTS AND GUIDELINES

3. State Planning Policy, July 2017.
4. State Planning Policy – State Interest Guideline Water Quality April 2016 (Policy 9).
5. Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines V5.1, 2014. Dear, S-E., Ahern, C. R., O'Brien, L. E., Dobos, S. K., McElnea, A. E., Moore, N. G. & Watling, K. M. Department of Science, Information Technology, Innovation and the Arts, Queensland Government.
6. National acid sulfate soils identification and laboratory methods manual, National Acid Sulfate Soils Guidance, Water Quality Australia, June 2018.
7. National acid sulfate soils sampling and identification methods manual, National Acid Sulfate Soils Guidance, Water Quality Australia, June 2018.
8. Environmental Protection Act 1994.
9. Environmental Protection Policy (Water) 2009.

A4. MANAGEMENT MEASURES

A4 (A). MANAGEMENT OF EXCAVATIONS

An earthworks strategy shall be developed to plan and track movement, treatment and verification of ASS materials. This includes the location of the proposed off-site treatment area/site if off-site treatment is proposed.

All waters collected from groundwater and surface water inflow into excavations via seepage and runoff must be retained, monitored and appropriately treated to comply with the appropriate discharge criteria (Procedure C) prior to discharge off site or re-use on site.

A4 (B). STOCKPILING, HANDLING AND TRANSPORT OF ASS

Wherever practical the earthworks handling should involve transport directly from cut to treatment areas (both on or off-site). Stockpiling of untreated soils with existing and retained acidity should be avoided. The recommended maximum time period for which soils can be temporarily stockpiled without treatment is 18 hours (overnight) for coarse sandy material, and 3 days (e.g., a weekend, 66 hours) for fine-textured silty clay material.

All confirmed ASS materials encountered during excavations will be transported to the designated ASS treatment area (on or off-site). Accurate details of material movements must be kept by the Site Supervisor or their delegated representative with respect to volumes, origin, material type and destination.

Due care is to be taken when transporting saturated/supersaturated soils and sediments (e.g., wet, silty/sandy material).

Any ASS materials that cannot be transported in the time frame detailed above must be stockpiled on site on a suitably prepared storage area, and the following additional management measures should be followed:

- Stockpiles are to be contained by bunds with stormwater runoff directed to a collection sump. Bunds are to be constructed from low permeability materials that are not ASS.
- A guard layer of neutralising agent (minimum 5 kg/m²) should be spread across the soil surface prior to placement of the stockpile. The rate of neutralising agent applied should be based on 0.3 times the average total potential plus existing acidity for every 1 m height of soil in the stockpile.
- The surface area of the stockpile is to be minimised by shaping and possibly capping or covering to prevent moisture loss and rainfall entry

A5. RESPONSIBILITIES

During stockpiling, handling and transport the following levels of responsibility shall exist:

- The Site Supervisor or their delegated representative is responsible for ensuring that the requirements of the MP are communicated to site staff.
- The Site Supervisor or their delegated representative is responsible for ensuring the management strategies and procedures prescribed in the MP are implemented at the site.
- All other site personnel are responsible for implementing and undertaking the management strategies and procedures prescribed in the MP, as applicable to their work activities.

A6. MONITORING AND REPORTING

Records shall be kept by the Site Supervisor or their delegated representative to verify volumes of soils excavated and transported for treatment.

In addition, specific details regarding volumes, origin, material type and destination in conjunction with a photographic record of site development works associated with soil movements should be maintained by the Site Supervisor or their delegated representative.

The Site Supervisor or their delegated representative shall be responsible for ensuring that the excavated materials are managed in accordance with details provided above.

PROCEDURE B

Treatment and Verification of Excavated Acid Sulfate Soils

B1. GENERAL

The procedures outlined below are provided for the on-site treatment and verification of identified ASS materials located across the proposed development site to be excavated during earthworks and construction. If off-site treatment is the preferred method, then the approved off-site treatment facility must have an approved ASS MP to receive the material excavated.

B2. OBJECTIVES

- Appropriately treat and manage ASS materials to minimise adverse effects on the natural and built environment (including infrastructure).
- Comply with conditions of licences, permits or other approvals issued for the project.

B3. STATUTORY REQUIREMENTS AND GUIDELINES

1. State Planning Policy, July 2017.
2. State Planning Policy – State Interest Guideline Water Quality April 2016 (Policy 9).
3. Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines V5.1, 2014. Dear, S-E., Ahern, C. R., O'Brien, L. E., Dobos, S. K., McElnea, A. E., Moore, N. G. & Watling, K. M. Department of Science, Information Technology, Innovation and the Arts, Queensland Government.
4. National acid sulfate soils identification and laboratory methods manual, National Acid Sulfate Soils Guidance, Water Quality Australia, June 2018.
5. National acid sulfate soils sampling and identification methods manual, National Acid Sulfate Soils Guidance, Water Quality Australia, June 2018.
6. Environmental Protection Act 1994.
7. Environmental Protection Policy (Water) 2009.

B4. TREATMENT MEASURES

B4 (A). EARTHWORKS STRATEGY

An earthworks strategy shall be developed to plan and track movement, treatment and verification of confirmed ASS materials.

B4 (B). TREATMENT FACILITY

A treatment area shall be constructed within the site in general accordance with the requirement detailed in Soil Management Guidelines, 2024 (refer Image 1 below). If off-site treatment is the preferred option, then the off-site location must also have a treatment area constructed and an approved ASS MP to receive and treat ASS material. The results of the ASS investigation and liming rates must also be provided to the off-site treatment site.

The onsite treatment areas (if applicable) must also have the following additional requirements:

- The treatment area should be located within a suitable area on non-ASS materials.
 - The treatment area shall be prepared by stripping vegetation, topsoil and soil containing significant amounts of organic material and compacting the surface with a smooth drum roller. An area of at least 1 m width shall be left between the treatment area and bunds to allow collection of runoff and direction to sumps. Refer to Procedure C for monitoring and treatment requirements applicable to collected waters.
-

- A guard layer of fine ground agricultural lime shall be applied to the treatment areas prior to placement of soils at a minimum rate 10 kg/m² for each 1 m height of soil to be treated, due to the difficulty in mixing soft clays.
- Reapplication of the guard layer will be necessary under areas of repeated temporary stockpiling.

The treatment facility shall be inspected daily and maintained to prevent escape of soils or water from the facility.

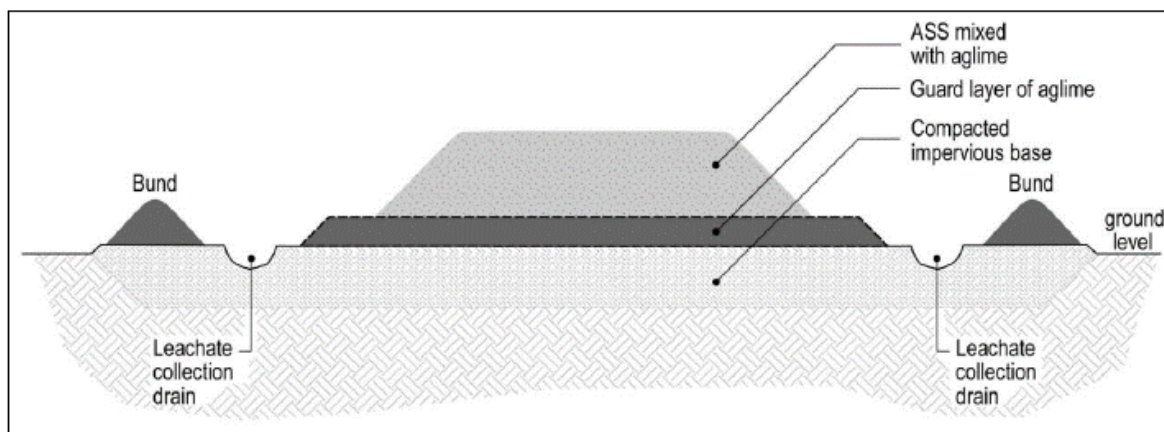


Image 1: Schematic cross section of a treatment pad.

B4 (C) ASS TREATMENT

Excavated ASS materials shall be stockpiled into identified treatment lots (not more than 250 m³) within the treatment area where the material shall be spread in layers and allowed to dry (if required). The overall layer thickness shall be in layers with a maximum 300 mm loose thickness. ASS material will need to be excavated and disposed in a time frame as per Procedure A4(B).

Where required, drying shall be enhanced by mechanical methods (rotary hoe, disc plough, etc) to create a relatively homogenous, friable material prior to addition of lime for neutralisation.

Maintain soil moisture through the following methods: controlled irrigation; covering with plastic to reduce evaporation; or application of lime soon after excavation of moist soils. These measures will improve the dispersion of lime throughout the soil profile.

Add and thoroughly mix lime (again using appropriate mechanical means e.g., a disk plough or harrows) using the calculated liming rate.

B4 (D) LIMING RATES

Liming rate have been calculated by Core, using a factor of safety (fineness factor) of 1.5 and an assumed bulk density of 1.6 tonne/m³. The following liming rates shown in Table B1 below are considered appropriate for full neutralisation of combined actual and retained acidity.

Table B1: Recommended liming rates.

Soil Type	Colour	Depth Range	Treatment Rate**
Gravelly Clay (Fill)	Brown	0.0 – 0.75 m BGL	4 kg CaCO ₃ /m ³ ***
Alluvial Clays / Fill Dredging Spoil	Grey, dark grey, dark brown and black	0.75 – 4.0 m BGL*	30 kg CaCO ₃ /m ³

Note: * Maximum depth of ASS sampling and analysis

** Liming rate based on 90th percentile values.

*** Additional testing in the gravelly clay to confirm any treatment (likely low risk – no treatment)

B4 (E) VERIFICATION TESTING

Verification samples shall be collected for treated material at a rate of one sample per 250 m³. The samples shall be formed by compositing materials from three randomly selected locations. Samples shall be collected over the full thickness of the treated lot. The Chromium Suite shall be conducted on each sample to confirm net acidity by Acid Base Accounting.

B5. PERFORMANCE CRITERIA

To confirm adequate lime treatment, laboratory testing must demonstrate the following:

- A neutralising capacity of more than 1.5 times the sum of existing plus potential acidity, all measured in the same units (and using a minimum safety factor of 1.5).
- A pH_{KCL} value of equal or greater than 6.5.

B6. CONTINGENCY MEASURES

Additional lime treatment and further verification testing shall be conducted where adequate neutralisation is not initially indicated.

B7. PERFORMANCE INDICATORS

Table B2: Performance indicators.

Item	Performance Indicator
Earthworks strategy	An appropriate earthworks strategy has been prepared to track characterisation, treatment and verification of each earthworks lot.
Liming rates	Correct liming rates are applied.
Treatment verification	Verification samples collected for each identifiable 250 m ³ of treated material. If verification shows material has a positive net acidity, additional treatment has been employed.
Non conformance	All non-conformances are reported and rectified.

B8. MONITORING AND REPORTING

Records shall be kept to verify volumes of soils transported to the treatment facility.

The Site Supervisor shall be responsible for ensuring that lime neutralisation and verification tests are completed for each 250 m³ of excavated ASS material.

The Site Supervisor shall maintain a register of testing results and a record of inspections.

A summary report of all test results and inspections shall be compiled by the Site Supervisor each week and retained on site.

PROCEDURE C

Monitoring of Water Quality

C1. GENERAL

The procedures outlined below are provided to monitor and manage water quality in open excavations and run-off collection in treatment areas. Contingency measures are also provided for treatment and discharge of minor amounts of water.

C2. OBJECTIVES

- Appropriately monitor waters entering open excavations.
- Appropriately manage waters to be discharged from open excavations.
- Appropriately monitor and treat (if required) run-off collected in treatment areas.
- Appropriately monitor groundwater to identify water quality changes that may indicate ASS impact.
- Comply with conditions of licences, permits or other approvals issued for the project.

C3. STATUTORY REQUIREMENTS AND GUIDELINES

1. State Planning Policy, July 2017.
2. State Planning Policy – State Interest Guideline Water Quality April 2016 (Policy 9).
3. Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines V5.1, 2014. Dear, S-E., Ahern, C. R., O'Brien, L. E., Dobos, S. K., McElnea, A. E., Moore, N. G. & Watling, K. M. Department of Science, Information Technology, Innovation and the Arts, Queensland Government.
4. National acid sulfate soils identification and laboratory methods manual, National Acid Sulfate Soils Guidance, Water Quality Australia, June 2018.
5. National acid sulfate soils sampling and identification methods manual, National Acid Sulfate Soils Guidance, Water Quality Australia, June 2018.
6. Environmental Protection Act 1994.
7. Environmental Protection Policy (Water) 2009.

C4. IMPLEMENTATION MEASURES

The following provides a list of the environmental control measures for management of surface water and groundwater at the site:

- Water quality monitoring will be undertaken in accordance with Section C5.
 - All surface water run-off and groundwater seepage within excavations is to undergo monitoring to determine if treatment is required for quality correction prior to off-site discharge, or reuse on site.
 - Agricultural lime or caustic soda will be kept on site at all times for pH adjusting of waters before discharging.
 - Discharge to surface waters, sewers or stormwater should meet the requirements and conditions of the disposal permit issued for the project.
 - **Three groundwater monitoring wells** (*one up gradient and two down gradient*) shall be installed external to proposed excavations around the development site (and in locations where they won't be disturbed development works). Groundwater monitoring wells should be monitored four times over a period of two months before earthworks and construction commence to establish baseline levels of the following parameters:
 - Field measurements of pH, redox potential (Eh or ORP), dissolved oxygen, standing water level and electrical conductivity (EC).
 - Laboratory measurements chloride, sulfate, total acidity, total alkalinity, dissolved aluminium (filtered), and dissolved iron (filtered).
-

C5. INSPECTION AND MONITORING

C5 (A). SURFACE WATER MONITORING

Waters from dewatering (if required) and all surface water run-off and groundwater seepage within excavations shall be monitored prior to discharge during bulk earthworks and construction works. Surface water shall be monitored for pH, dissolved oxygen, suspended solids, oil, grease floating scum, litter and total and dissolved aluminium and iron.

Surface water not meeting the performance criteria specified in Section C6 will require treatment prior to discharge.

C5 (B) GROUNDWATER MONITORING

During construction (excavation works) monitoring of groundwater shall comprise monthly monitoring of the following:

- Field measurements of pH, redox potential (Eh or ORP), standing water level and electrical conductivity (EC).
- Laboratory measurements chloride, sulfate, total acidity, total alkalinity, and total and dissolved aluminium and iron.

Post construction monitoring comprising four groundwater monitoring events over a period of two months for the following parameters:

- Field measurements of pH, redox potential (Eh or ORP), standing water level and EC.
- Laboratory measurements chloride, sulfate, total acidity, total alkalinity, dissolved aluminium (filtered), and dissolved iron (filtered).

Extension of the post construction monitoring program beyond this will be determined by a suitably qualified Environmental Consultant following review of post construction results.

C6. PERFORMANCE INDICATORS

C6 (A). SURFACE WATER INDICATORS

The following adopted performance indicators, refer table C1, are considered as acceptable outcomes in relation to ASS and disposal of all waters including stormwater run-off, groundwater seepage and leachate from ASS will achieve the following quality prior to release from the site.

Table C1: Adopted performance indicators.

Parameters	Units	Performance Indicator
pH	pH	Within the range of 6.5 to 8.5 pH units
Suspended Solids	mg/L	< 50 mg/L
Dissolved Oxygen	mg/L	> 6.0 mg/L
Oil, grease, floating scum, litter	n/a	No visible plume or evidence
Dissolved Iron	mg/L	< 1000 µg/L (National ASS Guidelines)
Dissolved Aluminium	mg/L	< 150 µg/L (National ASS Guidelines)

C6 (B) GROUNDWATER PERFORMANCE INDICATORS

Table C2: Groundwater baseline performance range.

Parameters	Units	Baseline Performance Range	Site Specific Criteria
pH	pH	Yet to be determined	Baseline - 0.3 pH unit change below the lower baseline range and an upper limit of 8.5
Aluminium (dissolved)	mg/l	Yet to be determined	+/- 10% of baseline range
Aluminium (total)	mg/l	Yet to be determined	+/- 10% of baseline range
Iron (dissolved)	mg/l	Yet to be determined	+/- 10% of baseline range
Iron (total)	mg/l	Yet to be determined	+/- 10% of baseline range

* Note that total acidity/alkalinity & chloride: sulfate ratio should also be monitored, but no performance limits are set

C7. CONTINGENCY MEASURES

All surface waters (any waters collected in excavations) and precipitates that cannot be contained and treated for discharge off site are to be removed and disposed of through trade waste or another lawful method.

C8. MONITORING & REPORTING

The Site Supervisor shall be responsible for ensuring all on-site monitoring listed in section C5 is conducted at the required frequency.

The Site Supervisor shall maintain a register of all on-site testing results and a record of inspections.

A summary report of all test results and inspections shall be compiled by the Site Supervisor each week and submitted to the Project Manager.

The Site Supervisor shall inform the Project Manager of non-compliance upon detection. The Project Manager shall inform Council of such non-compliances as soon as practicable and instigate an assessment of the impact.

Appendix B:

Limitations

Limitations

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