



Aluminium Dross Processing Facility

Acid Sulfate Soil Management Plan

Tomago Aluminium Company Pty Ltd

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→ The Power of Commitment



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1. Introduction

GHD Pty Ltd (GHD) has prepared an Acid Sulfate Soil Management Plan (ASSMP) for the construction of a new Aluminium Dross Processing Facility (the Project) at the Tomago Aluminium Smelter located at 638 Tomago Road, Tomago (the site), refer Figure 1.1. The site is located approximately 600 metres north of the Hunter River and seven kilometres north of the Newcastle central business district.

This management plan has been prepared to outline acid sulfate soil management procedures to address Conditions of consent for DA 391/80 Mod 9 and DA4980/90-Mod-8:

Acid Sulfate Soil Management

The Applicant must, prior to the commencement of construction, prepare an acid sulfate soil management plan in accordance with the Acid Sulfate Soil Manual 1998. The plan must be implemented during the construction of DA 391/80 Mod 9 and DA4980/90-Mod-8.

1.1 Purpose of this ASSMP

The purpose of this ASSMP is to inform the handling and treatment of ASS disturbed during construction works for the Project. This ASSMP was prepared in accordance with National Acid Sulfate Soils Guidance: National Acid Sulfate Soils Sampling and Identification Methods Manual (Sullivan et al, 2018) and national best practice as outlined in this guidance. The NSW Department of Planning and Environment indicates that this updated guidance document supplements the existing NSW ASSMAC guidelines.

This ASSMP is a 'living document' that is to be referred to and updated on an ongoing basis throughout the duration of the construction programme as works progress and site-specific information for the various works being undertaken becomes available.

The construction works are subject to compliance with conditions of consent presented DA 391/80 Mod 9 and DA4980/90-Mod-8.

1.2 Ownership of this ASSMP

This ASSMP is to be referred to and updated by the site environmental or stakeholder manager / site manager / project manager / delegated party on an ongoing basis throughout the construction period.

1.3 Limitations

This ASSMP: has been prepared by GHD for Tomago Aluminium Company Pty Ltd and may only be used and relied on by Tomago Aluminium Company Pty Ltd for the purpose agreed between GHD and Tomago Aluminium Company Pty Ltd as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Tomago Aluminium Company Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.4 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

An understanding of the site conditions depends on the integration of many pieces of information, some regional, some site specific, some structure-specific and some experienced-based. Hence this report should not be altered, amended or abbreviated, issued in part or issued in any way incomplete without prior checking and approval by GHD. GHD accepts no responsibility for any circumstances that arise from an issue of the plan that has been modified, other than by GHD.

1.4 Assumptions

- This ASSMP has been prepared using information available at the time of preparation.
- This ASSMP shall be updated as additional information relevant to this ASSMP becomes available for potential ASS risk areas, such as laboratory test results for ASS, identification or change of construction elements requiring subsoil disturbance such as excavation and dewatering.

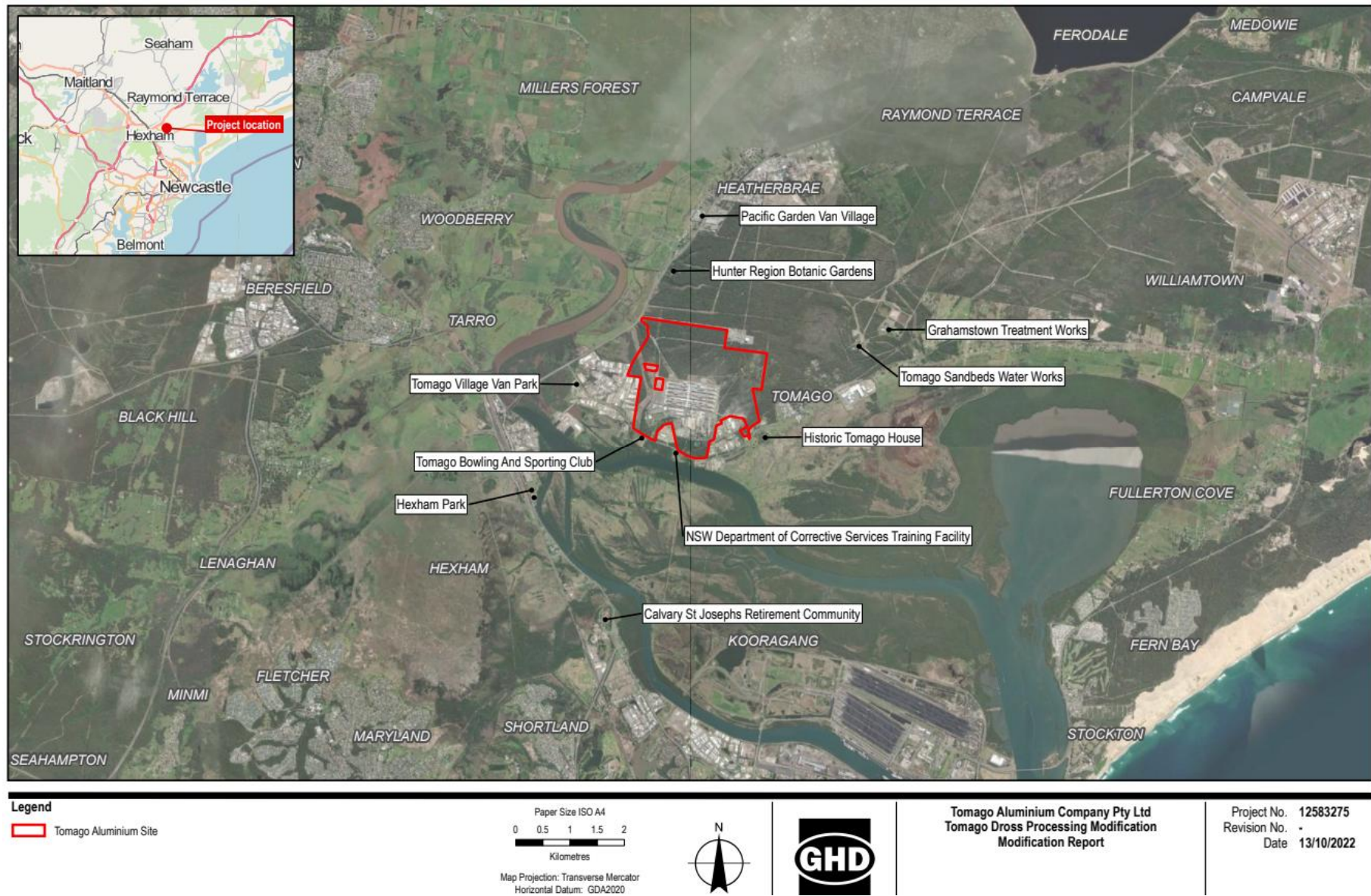


Figure 1.1 Regional location

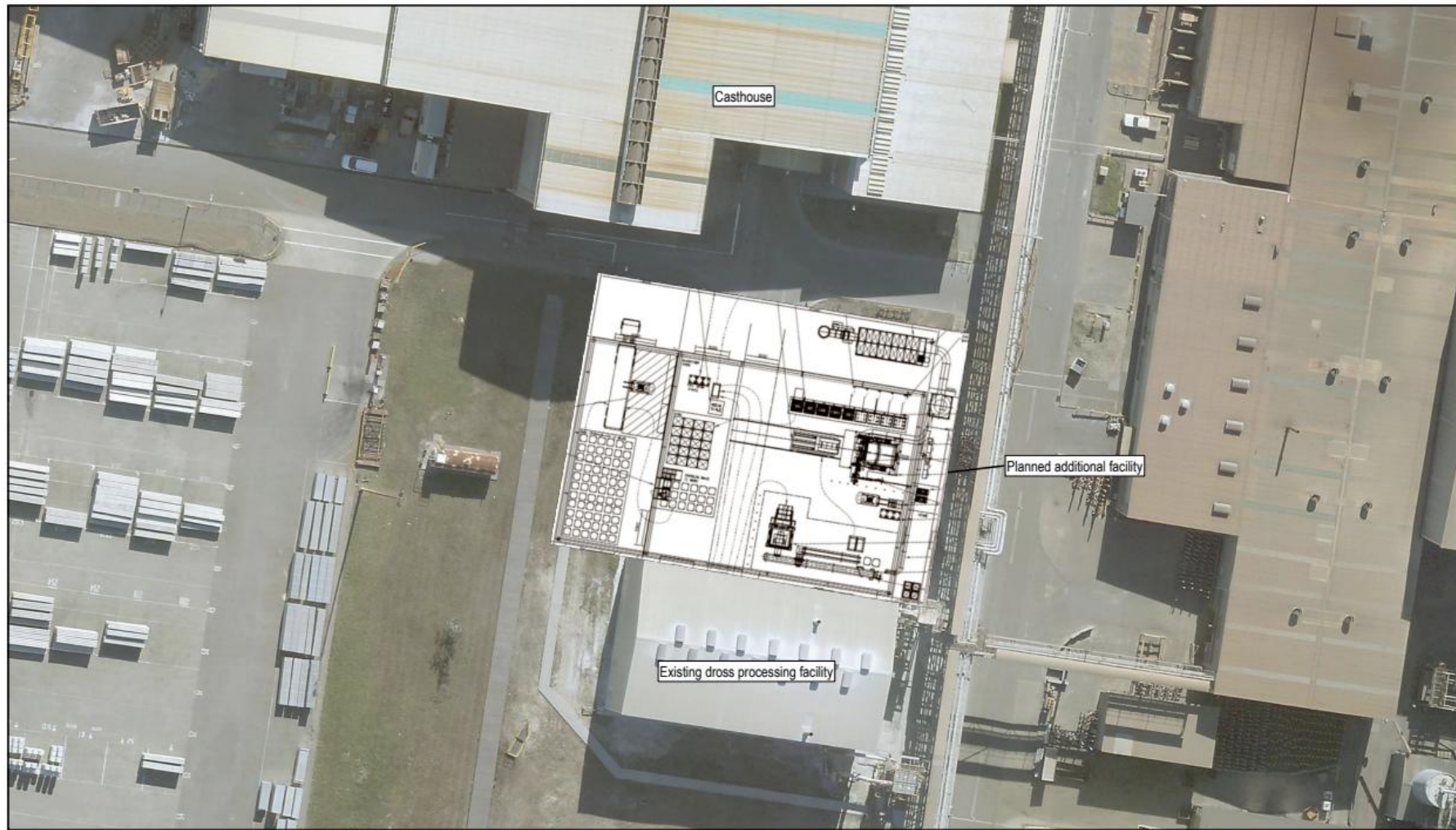
2. Anticipated site activities

2.1 General

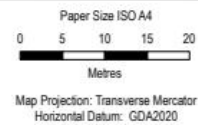
The proposed secondary dross facility will be located centrally in a new building within the existing Site (refer Figure 2.1). It will be situated between the casthouse and the existing dross facility that is used for primary separation. Construction and initial operation will be undertaken by a contractor who operates similar facilities at other smelters. The smelter will continue to operate in accordance with the approved development and there is no overall change proposed to production volumes or dross throughput at the site. The Project would be contained within a new enclosed building.

2.2 Proposed disturbance activities

The maximum depth of excavation is expected to be in the area of the furnace, which will be to a depth of 1.2 metre below the finished floor level. The building column footings will be excavated to a depth of 1.0m. No dewatering is anticipated to be required as part of the excavation works associated with the project. Figure 2.1 shows the building footprint.



Legend



Tomago Aluminium Company Pty Ltd
Tomago Dross Processing Modification
Modification Report

Project No. 12583275
Revision No. -
Date 13/10/2022

Figure 2.1 Project site

3. Site information

Site information is summarised in Table 3.1. This information was sourced from searches of publicly available databases (e.g. eSPADE, NSW Planning Portal Spatial Viewer, SIX Maps, and Geoscience Australia Portal).

Table 3.1 Site description and environmental setting

Item	Detail
Location	The site is located approximately 600 metres north of the Hunter River and seven kilometres north of the Newcastle central business district.
Street Address	638 Tomago Road, Tomago, NSW
Lot and DP number	Lot 104, DP 1125747
Land owner	Tomago Aluminium Company Pty Ltd (TAC)
Building footprint area	Approximately 100m ²
Local Government Area	Port Stephens Council
Land use zoning	IN1 – General industrial
Site use	Aluminium manufacturing
Surrounding land use	Land use in the surrounding locality is a mixture of industrial, rural-residential and infrastructure including water supply. Other land uses near and adjacent to the project location include: – North – Bushland incorporating AGL's Newcastle gas storage facility and Tomago Sand Beds groundwater aquifer and water supply infrastructure managed by Hunter Water Corporation – South – A NSW Department of Corrective Services training facility on Tomago Road 450 metres south-west of the project, the Hunter River, Kooragang Island – East – Tomago industrial area, Tomago Sand Beds groundwater aquifer, water supply infrastructure managed by Hunter Water Corporation, and open space connecting to Fullerton Cove – West – The Tomago industrial area and the Hunter River.
Topography and site drainage	The Project site is effectively on level ground and consists of open and mostly sealed ground surface and small buildings. The site already has in place a first flush stormwater control system which consists of a drainage network, sumps, and first flush pond capture. The stormwater control system also redirects off-site stormwater from entering the site, and controls stormwater as follows: – Off-site stormwater entering the site is directed to a grass swale catch drain and drains to flat ground away from the site. – First flush stormwater is directed through sumps and towards the first flush stormwater pond prior to discharge to the Hunter River.
Hydrology	Regional rainfall runoff is expected to drain into south to the Hunter River or south- east to Dunns Creek and its tributaries via overland flow and/or surrounding stormwater drains.
Hydrogeology	Groundwater is inferred to flow (generally) south towards the Hunter River. The aquifer underlying the site is described as fractured or fissured, extensive and of low to moderate productivity.
Soils	Soils on site are dominated by the Tea Gardens Aeolian Soil Landscape, defined as: – Landscape – Pleistocene sand sheets on the Tomago Coastal Plain. Local relief <1m, slopes <5%, elevation 5-8m. – Soils – deep (>200 cm), well-drained Humus Podzols on ridges with deep (>200 cm), poorly drained Peaty/Humus Podzols in swales and deep (>200 cm), very poorly drained Acid Peats in swamps. – Limitations of this soil landscape include: • Permanently high water tables • Seasonal waterlogging

Item	Detail
	• Groundwater pollution hazard • Strongly to extremely acid soils of low fertility.
Geology	According to the Newcastle 1:250,000 Geology Sheet geology at the site is classified as Quaternary Alluvium comprising of sedimentary deposits comprising mixtures of sands, silts, clays, gravels and "Waterloo Rock". The alluvium within the Hexham, Tomago and Raymond Terrace area is made up of barrier sand and channel deposits that exist within the soil profile and are erratically distributed, and both vertically and laterally discontinuous.
Acid Sulfate Soils	The Port Stephens Local Environmental Plan (LEP) 2013 indicates that the site is situated on Class 4 ASS land, which requires a ASSMP to be prepared and implemented when: – Works more than 2 metres below the natural ground surface; or – Works by which the water table is likely to be lowered more than 2 metres below the natural ground surface.
Sensitive ecological receptors	– Flora and fauna within the site and surrounding land – Dunns Creek and tributaries (approximately 1.0 km south east of the site) – Northern Channel Hunter River (approximately 1.0 km south of the site) – Groundwater beneath the site.

4. Acid sulfate background information

4.1 Acid sulfate soil

ASS are soils containing naturally-occurring, fine-grained metal sulfides typically pyrite (FeS_2), formed under saturated, anoxic/reducing conditions. They generally occur in Quaternary (1.8 Ma – Present) marine or estuarine sediments, predominantly confined to coastal lowlands (elevations generally below 5 meters AHD). Within these sediments, the majority of soils that present an environmental risk are generally confined to Holocene aged material (<10 000 years). Where these materials have oxidised, they commonly have a mottled appearance (orange and yellow discolouration) due to the presence of oxidised iron minerals. Although soils described above represent typical conditions where ASS occurs, the presence of ASS materials is not limited to these soil types.

ASS comprise either existing soils where pyrite has oxidised to result in a soil $\text{pH} < 4$, termed Actual Acid Sulfate Soils (AASS) or soils containing sufficient pyrite (FeS_2) to produce enough sulfuric acid on exposure to form AASS, termed Potential Acid Sulfate Soils (PASS). PASS are typically found below the water table in estuarine conditions, while AASS are usually the result of exposure or drainage of PASS deposits.

Although soils described above represent typical conditions where ASS occurs, the presence of ASS materials is not limited to these soil types. In Western Australia, ASS materials have been identified in other soil types such as leached sands and silts. Accordingly, for areas where no data is available, the extent of ASS materials should be established through field investigations.

4.2 Potential risks of AASS and PASS

When PASS are disturbed, either by excavation or lowering of the water table below natural seasonal levels, sulfides present are exposed to air allowing oxidation and consequently, the formation of sulfuric acid (H_2SO_4). AASS are capable of generating acidity *in situ* in their natural state; disturbance is not required for acidic discharges to develop.

As a result of the presence of AASS or the oxidation of PASS, the surrounding land (soil) and nearby waterways may become acidic ($\text{pH} < 6.5$). Under acidic conditions, metals such as aluminium (generally at $\text{pH} < 4.5$) and iron, as well as trace heavy metals (including arsenic), become more mobile in the environment and can be taken up by infiltrating waters.

4.3 Potential effects of dewatering groundwater

4.3.1 Water quality

Dissolved metals including iron and aluminium may cause environmental issues if the dewatering effluent is discharged prior to retention. Discharge without retention may cause iron hydroxides to precipitate out where effluent is discharged into water bodies (particularly surface water). These chemical reactions may release large quantities of acid and consume oxygen causing de-oxygenation of the water column in nearby ecosystems or the local groundwater system and decreasing local acid buffering capacity (alkalinity), where available. In cases where alkalinity can no longer buffer acidity, then acidification of the groundwater may occur.

Acidic conditions generated by ASS can also corrode concrete and steel (pipes, bridge abutments, underground services, and other infrastructure) and can result in the rapid deterioration of asphalt surfaces where they overlie AASS or PASS. Acidic groundwater plumes can impact on vegetation health of deep rooted vegetation, and affect the water quality of any downstream groundwater receptors including surface water bodies and domestic and industrial water supply bores.

4.3.2 Water level

Groundwater dependant ecosystems (GDEs) rely on groundwater to provide some or all of their water requirements. GDEs may include (but are not limited to) terrestrial vegetation and/or fauna, wetlands, and rivers with groundwater base flow.

Draw down of standing groundwater level caused by dewatering may impact groundwater dependant ecosystems within the cone of depression, by reducing or removing their water supply for the duration of dewatering.

Reduced groundwater level may also impact human groundwater users, by reducing water level and flow rate in groundwater bores (for example, backyard bores used to irrigate gardens). Dewatering may also potentially draw in groundwater of differing water quality to that usually found in the dewatering area, potentially affecting the water quality of any downstream groundwater receptors including surface water bodies and domestic and industrial water supply bores.

4.4 Management

4.4.1 Management of ASS

Avoiding or minimising disturbance of ASS is the primary method of management. Where avoiding disturbance is not possible, management techniques available for ASS can include:

- Chemical neutralisation (use of pure fine agricultural lime (AgLime) or a similar neutralising agent).
- Anoxic storage or placement of PASS below the water table and beneath clean non-ASS fill.
- Hydraulic separation of pyrite from the soil (high maintenance process suitable for coarse grained sediment).

The addition of agricultural lime is the most common amelioration technique applied to acid producing soils, where mechanical mixing is completed by plough or excavator to provide adequate homogeneity of the soil/sediment-lime mix.

4.4.2 Management of dewatering effluent

If groundwater is likely to be encountered in areas of ASS disturbance, dewatering and groundwater management will need to be considered during construction. A Dewatering Management Plan, which outlines appropriate management measures, monitoring trigger actions and contingency strategies to prevent the degradation of groundwater during construction, if required shall be prepared as part of the Construction Environment Management Plan (CEMP).

4.5 Legislation and guidance

The following legislation is relevant to the excavation of ASS and dewatering activities proposed as part of this project:

- Water Sharing Plan for the North Coast Coastal Sands Groundwater Sources 2016 (under the Water Management Act 2000)
- Environmental Planning and Assessment Act 1979 (EP&A Act)
- Local Government Act 1993
- National Environment Protection Council Act 1994 (NEPC Act)
- Protection of the Environment Operations Act 1997 (POEO Act)

ASS relevant policy and guidelines include:

- NSW Aquifer Interference Policy
- NSW State Groundwater Policy
- National Acid Sulfate Soils guidance: National acid sulfate soils sampling and identification methods manual (Sullivan et al. 2018)
- Australian Water Quality Guidelines for Fresh and Marine Waters (ANZECC 2000)
- Management of Contaminated Land Policy No. 5.61.

The *Acid Sulfate Soils Manual* (Acid Sulfate Soil Advisory Committee, 1998) are considered significantly out of date according to the *National Acid Sulfate Soil Guidance* (Sullivan et al. 2018). The guidance indicates that the *QASSIT Queensland Acid Sulfate Soil Technical Manual – soil management guidelines* (Dear et al., 2014) is

widely accepted as the national best practice of contemporary ASS disturbance. Consequently, this ASSMP was prepared with consideration to the QASSIT guidelines (Dear et al., 2014).

The Waste Classification Guidelines (Environment Protection Authority, 2014) apply to ASS which are unable to be managed on-site and need to be transported and managed off-site.

5. Acid sulfate soil assessment

As ASS testing has not been undertaken within the Project area and excavation is likely to occur as part of construction works, a soil sampling program will be required to assist in characterising the extent and severity of ASS prior to construction. The soil sampling program shall be undertaken in accordance with the *National Acid Sulfate Soils Guidance -National acid sulfate soils sampling and identification methods manual* (Sullivan et al.,2018) and Net Acidity results, obtained from chromium reducible sulfur (CRS) laboratory analysis, compared to action criteria provided in Table 5.4 of the guidance to determine if the ASSMP will be triggered.

6. Management actions

6.1 Introduction

This plan outlines the preferred management strategy for dealing with any potential disturbed ASS and acidified waters generated within the project area during construction activities. Once laboratory results have been obtained and the presence of ASS confirmed, this ASSMP will need to be updated by a suitably qualified person detailing the specific management requirements to be adopted during construction works.

6.2 Outline of management approach

6.2.1 Excavations

Where possible excavation and disturbance of ASS should be avoided. Any excavations required shall be limited in size and depth and undertaken in a staged approach to ensure a minimum exposure timeframe is achieved. No excavation shall remain open overnight. The maximum time any excavation shall remain open without treatment is eighteen (18) hours. Should this timeframe be exceeded this shall trigger the requirement for in pit treatment (i.e. liming at rates consistent with laboratory reported data).

6.2.2 Excavated soils

Excavated soils shall be managed by neutralisation and disposal/re-use on site, where possible. In order to be effective, the neutralising agent shall be thoroughly mixed with the soil and added in sufficient quantities to neutralise all acid generated.

The Construction Contractor shall undertake the excavation in stages with the excavated material treated and stockpiled in a bunded area. It is integral that liming of excavated soils be undertaken at the specified rate the same day the soil is stripped to neutralise any acid potentially produced. Following confirmation by laboratory testing, that the soils have been neutralised, soils can be disposed/re-used on site unless contaminated in which case soils shall be managed in accordance with a Contaminated Soil Management Plan (CSMP).

6.2.3 Dewatering

If groundwater is encountered during construction, the requirement for a Dewatering Management Plan will be triggered. All dewatering activities shall be undertaken in accordance with the Dewatering Management Plan.

6.2.4 Acidified water

Acidic water generated during excavation, dewatering and soil treatment works shall be managed through neutralisation with a suitable agent to a pH equivalent to receiving waters. Acidified water shall be stored and treated within suitable containment structures to prevent migration of untreated water into nearby sensitive environments. The Construction Contractor shall have the appropriate equipment in place to treat and store water to prevent unexpected overflow from excavations and storage areas.

Disposal options for treated water shall be confirmed once laboratory results have been obtained and the presence of ASS confirmed. The ultimate level of treatment required, and the configuration of water remediation facilities, will be dependent on the volumes and quality of water generated from the excavations and stockpile areas as well as the water quality of the receiving aquifer. Treated water that will be used onsite (i.e. for dust suppression or compaction) shall comply with discharge criteria, which will be confirmed once laboratory results have been obtained and the presence of ASS confirmed.

6.3 Management methodology

6.3.1 Neutralising agents

Soil treatment

Fine agricultural grade lime shall be used for soil neutralisation. The specifications of the lime are as follows:

- Neutralising Value (NV) of 96
- Particle size < 0.5 mm
- Moisture content ≤ 5%

Note that not all agricultural lime products will meet the above specifications. Products with a larger particle size will need to be added to the soil at greater rates. The contractor must check the agricultural lime specification before applying at the specified rate. Hydrated lime should not be used for soil treatment works.

Water treatment

Calcined limes (aglimes such as hydrated lime or calcined magnesia) are the preferred neutralising agents for the treatment of acidified water. Hydrated lime is highly soluble and very alkaline (pH 12), but poses potential risks to the surrounding environment and those individuals handling the agent due to its highly alkaline nature. Calcined magnesia poses less of an exposure risk to those handling the agent. However, this compound can react to produce soluble magnesium sulfate during neutralisation reactions, which could impact on water quality if large quantities of this sulfate salt are discharged to freshwater ecosystems. Using calcined magnesia will reduce the risk of over neutralisation of the treated water due to the two-step neutralisation reaction sequence of this compound, which is faster under acidic conditions and slower under alkaline conditions.

A suitable mixing technique adequate for the volumes and quality of water to be treated shall be implemented. The hydrated lime or other neutralising agent shall be thoroughly mixed with the water to be treated, and preferably completely dissolved in a smaller aliquot of water prior to addition to the total volume. Further mixing may be encouraged by agitation of the water.

6.3.2 Liming rates

The liming rate to be adopted will be obtained from CRS laboratory analysis results. Subsequent soil testing shall follow treatment to verify the sufficiency of the treatment or whether additional lime should be added. Soil testing shall be done at a rate of one test per 250 m³ treated material and at least one test per material type. Successful treatment success shall be verified with a full acid base account (CRS including retained acidity) in accordance with Section 8.2 of the QASSIT guidelines.

6.3.3 Management of soil stockpiles

All excavated material shall be transported by the Construction Contractor to a specified on site ASS treatment area and stockpiled for treatment and containment. Trucks transporting excavated soil shall be appropriately covered and sealed to prevent the loss of soil or acidic water during transport. Fill material will not require lime treatment.

Both short term (i.e. soil stockpiled, treated, tested and removed within 24 hours) and long term remediation areas may be developed. Short term remediation areas may be setup alongside the working excavation, but shall be prepared with the appropriate controls outlined below to prevent acidic runoff and seepage.

Preparation of the remediation areas by the Construction Contractor shall involve the construction of bunded treatment pads to prevent acid leaching to the subsurface and acidic runoff. All stockpiles in the remediation areas shall be placed on treatment pads. The treatment pads may consist of either:

- An impervious liner (e.g. geo-membrane liner or concrete slab or compacted clay) with a layer of -6 mm particle size crushed agricultural limestone with a minimum thickness of 0.15 m added on top of the liner prior to the placement of excavated material.

- A guard layer (calculated as per QASSIT guidelines, a minimum of 5 kg fine aglime per m² per vertical m of fill for soil) with a layer of compacted non-ASS (0.3 to 0.5 m thick) placed below the guard layer. Reapplication of the guard layer may be necessary under temporary treatment pads, if the guard layer is disturbed or removed with the treated soil. Upon arrival at the remediation areas all soil material shall be:
 - Stockpiled on treatment pads.
 - Thoroughly mixed with fine agricultural lime at the calculated rate. Lime shall be spread over stockpiled material of a manageable size, and placed in layers of a workable depth (approximately 300 mm), which will allow thorough mixing and aeration using mechanical application methods, such as rotary hoeing or tillage. Alternatively, excavated material could be treated in batches in a pugmill.
 - Tested and disposed according to the procedures outlined in the QASSIT guidelines and the CSMP (if required).

6.3.4 Water management

A leachate collection and treatment system shall be established by the Construction Contractor at the treatment area and involve the following:

- Establish diversion banks upslope to prevent run-on water.
- Bund remediation areas with non-ASS soils to prevent the migration of leachate and stormwater runoff.
- Establish catch drains down slope to capture any runoff water.
- Establish enclosed acid-resistant storage tanks to contain potentially contaminated water. The tanks shall be adequately sized to store the expected volumes of water originating from within the remediation area as well as from the bottom of excavations.
- Construct erosion and sediment control structures.

If groundwater is intercepted and removed from excavations, it and any water collected from the treatment area shall be collected, stored and if required treated in accordance with the Dewatering Management Plan.

The required quality of treated water shall be confirmed once laboratory results have been obtained and the presence of ASS confirmed. The quantity of neutralising agent shall be determined by laboratory assessment of the total acidity of water, such as described by Kirby and Cravotta (2005) whose method includes acidity that can be generated from dissolved metal content rather than just pH.

Caution shall be used to avoid adding too much neutralising agent and “overshooting” the target pH range. If the pH of stored water “overshoots” the maximum allowable pH, an appropriate quantity of acid should be added to neutralise excess alkalinity. Suitable acidifying agents include citric acid (99.5% granular or 50% liquid) or sulfuric acid (35% liquid).

If the water is too turbid, gypsum shall be used to clarify water prior to release. Other settling agents, such as alum and ferric sulfate, shall not be used without approval as they can deplete alkalinity and reduce pH, which may adversely impact aquatic species.

6.4 Monitoring

A monitoring program shall be developed that is commensurate with the level of ASS and associated environmental risks and the objectives of the mitigation measures. The monitoring program shall be designed to verify that the proposed mitigation strategies are effective in minimising negative environmental impacts due to acid generation.

The Construction Contractor shall be responsible for ensuring implementation of the monitoring program. This shall include appropriately qualified personnel to undertake soil and water monitoring, audits and inspections of all construction activities in known ASS areas, calibration of monitoring equipment and recording all results of monitoring.

6.4.1 Acid sulfate soil management

The following performance criteria for treated soil shall be met:

- All samples must have a Net Acidity <0.03% S or 18 mol H⁺/t using a safety factor of 1.5.
- No single result exceed a Net Acidity 0.1% S or 64 mol H⁺/t.
- Average Net Acidity of all samples collected and analysed must be <0.03% S or 18 mol H⁺/t.
- >90% of samples must have a pH > 5.5 and ANC > 1.5 times the Net Acidity.
- Post-neutralisation, the soil pH (pH_{KCl}) is to be greater than 6.5 but less than 8.5.

The key components of the ASS monitoring program are as follows:

- Following treatment with lime, soils shall be monitored using CRS laboratory analysis to verify that the liming treatment is adequate. There is no specification for when these analyses should be carried out following soil treatment, although they must be carried out while the soil is in the remediation areas. The methodology for sample collection includes:
 - Taking bulk soil samples of a consistent volume representative of the full depth of the stockpile using random or stratified-random protocol (no less than 1 test per 250 m³ treated material, and at least 1 test per material type). Care shall be taken not to sample the underlying guard layer.
 - Mixing the subsamples thoroughly. Subsample approximately 400 g from the composited material to be submitted for analysis.
- If laboratory testing indicates that stockpiled soils have not been adequately neutralised in accordance with performance criteria, stockpiles must be re-worked and additional lime added until the performance criteria are met. Aglime quantities shall be calculated as part of CRS validation testing. Laboratory analysis typically takes up to 10 working days. During this time excavated soils that have not been validated for disposal will need to remain on treatment pads within the remediation area.
- Treated soils that are taken offsite shall be classified for waste disposal in accordance with the NSW Waste Classification Guideline Part 4: Acid sulfate soils (NSW EPA, 2014).

6.4.2 Acidified water management

Procedures for the management of acidified water generated during construction works shall be confirmed once laboratory results have been obtained and the presence of ASS confirmed.

6.4.3 Groundwater monitoring

Groundwater monitoring (if required) shall be undertaken in accordance with the Dewatering Management Plan, and shall include:

- Continuous monitoring of groundwater extraction rates during dewatering.
- Ongoing visual assessment of odour, colour and sheen undertaken for the duration of the dewatering.
- Regular inspection of dewatering equipment.
- Daily sample collection of water produced from dewatering to be tested for key analytes (including field parameters (pH, EC, DO, temperature and redox), major ions, heavy metals, total acidity, and total suspended solids).

6.5 Reporting

All details regarding soil and water testing and treatment shall be recorded and kept on site. Details include but are not limited to:

- Staff members conducting testing and treatment
- Treatment measures implemented including quantities of neutralising agents used and treatment methodology
- pH and other monitoring results.

6.6 Contingency plan

The following contingency plan shall be implemented, if the procedures outlined in this ASSMP fail to:

- Treat stockpiled ASS
- Control discharge of ASS or acid water from remediation areas or trucks
- Protect receiving environments from low pH and dissolved metals
- Prevent acidification of surface and groundwater.

The following contingency plan shall be implemented. The contingency plan is split into two phases: Remedial Action and Restoration Action. The actual scope of Remedial and Restoration Actions will be unknown until the construction phase. The Construction Contractor is responsible for the implementation of the Contingency Plan, in consultation with TAC.

6.6.1 Remedial action

Immediate Remedial Action shall be required if monitoring results indicate that the performance indicators or quality requirements as specified in this ASSMP are not being achieved, due to the ineffectiveness of the prescribed management strategies.

The strategies for immediate remedial action (in order of preference) include:

- Re-flooding the excavation (if PASS is disturbed)
- Changing the excavation methodology or mixing and treatment techniques
- Direct treatment of receiving waters (drainage areas).

Although the least preferred option, sufficient additional lime (both fine agricultural grade and hydrated lime/calcined magnesite) shall be stored in a dry location on-site in order to treat unexpected declines in soil or water pH on site or to treat spills from remediation areas or trucks. The frequency of monitoring shall be increased to determine the effectiveness of this remedial treatment, and more lime added where and when necessary.

If pollution of creeks or receiving environments is detected during monitoring, the NSW EPA shall be immediately notified.

6.6.2 Restoration action

When the specified remedial actions fail or if monitoring results identify a severe failure of the management strategy to meet the specified criteria (i.e. change in background water quality of $\pm 50\%$), the construction works shall cease and all attempts be made to contain the affected soils or water to minimise the possible spread of acidity to non-impacted areas. If additional liming fails to treat the generated acidity, a Restoration Action Plan shall be implemented.

Prior to the implementation of Restoration Actions an assessment of the site shall be undertaken to determine if the failure is:

- Related to the ineffective implementation of ASS management strategies.
 - In this case the ASSMP shall be audited by a qualified environmental scientist to ensure that it can be implemented effectively. Monitoring shall be increased to ensure compliance with nominated criteria.
- Related to management strategies themselves being ineffective.
 - In this case, the ASSMP shall be reviewed, including an assessment of remedial actions, by a qualified environmental scientist. Consultation with the TAC shall occur if changes to the ASSMP are proposed.
- Due to there being no suitable management strategies that can be implemented so that the project can meet the criteria as specified in this ASSMP.
 - In this case, rehabilitation actions shall be undertaken and regular monitoring at agreed intervals shall continue until the rehabilitation action has been completed and the situation is deemed to pose no significant risk to the environment.

If the assessment demonstrates the need for the modification of any part of the ASSMP, TAC shall be notified of all proposed changes, justification for the changes and plans for implementation.

6.7 Occupational and environmental risk management

The more soluble, strongly alkaline neutralising agents such as hydrated lime or acidifying agents may carry a significant risk to the environment and workers and shall be stored and handled in accordance with procedures outline in the Material Safety Data Sheet (MSDS). The risks associated with chemical use shall be controlled and managed as outlined below.

6.7.1 Chemical spillage

Any spillage of chemicals during transport to the site, transfer or handling shall be contained and cleaned up immediately in accordance with the procedures consistent with the product MSDS.

Adequate spill containment and clean-up equipment shall be provided at all locations where chemicals are being used or stored.

Only authorised contractors shall be used for the delivery of chemicals. Contractors must be able to show that they have adequate safeguards in place to contain any spill events.

6.7.2 Chemical handling

Prior to the delivery of any chemicals the supplier shall provide a MSDS that identifies all of the safety precautions that must be taken when handling the chemical.

All workers involved in the handling of the chemicals shall be made aware of these safety precautions and adequate safety equipment must be provided.

6.7.3 Chemical storage

Neutralising agents shall be stored onsite for the treatment of the soil and water. It is recommended that the lime is stored in a bunded area and covered to prevent the lime dissolving and creating its own environmental impacts. Quantities in excess of the projected requirement (allowing for contingencies) shall not be stored on site.

7. References

ASSMAC (1998) Acid Sulfate Soil Manual, New South Wales Acid Sulfate Soil Management Advisory Committee.

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NSW EPA, 2014, Waste Classification Guidelines, Part 1: Classifying Waste



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