Broadwater Public School
9 Byrnes Street, Broadwater NSW 2472

Acid Sulfate Soils Management Plan

ADCO Constructions Pty Ltd

Reference: 754-SYDGE319200-R07

28 July 2023

BROADWATER PUBLIC SCHOOL

Acid Sulphate Soils Management Plan

Report reference number: 754-SYDGE319200-R07
ADCO document reference: BRO-ASS-PP-RPT-0001
28 July 2023

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QUALITY INFORMATION

Revision history

Revision	Description	Date	Author	Reviewer	Approver
-	Final	28 July 2023	Elliot Wood	Edward Wu	Edward Wu

Distribution

Report Status	No. of copies	Format	Distributed to	Date
Final	1	PDF	ADCO	28 July 2023

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ABBREVIATIONS

Abbreviations	Definition
AASS	Actual Acid Sulfate Soils
ASS	Acid Sulfate Soils
ASSMP	Acid Sulfate Soils Management Plan
AHD	Australian Height Datum
pHf	Field pH value
pHfox	pH value following oxidation
SCR	Chromium Reducible Sulfur
SPOCAS	Suspension Peroxide Oxidation Combined Acidity and Sulfur
PASS	Potential Acid Sulfate Soils
POEO Act	Protection of the Environment Operations Act 1997

1. INTRODUCTION

1.1 GENERAL

Tetra Tech Coffey Pty Ltd (Coffey) was engaged by ADCO Constructions Pty Ltd (ADCO) to prepare an Acid Sulfate Soils Management Plan (ASSMP) to inform/support a programme of refurbishments and development (referred to as the development area herein) within a portion of Broadwater Public School, 9 Byrnes Street, Broadwater NSW 2472 (the site) previously damaged by flood events in February/March 2022. The site location, development area and site boundary are illustrated in Figure 1.

This ASSMP was prepared in general accordance with Coffey's fee proposal dated 25 July 2023 (ref: SYDGE319200-AJ).

1.2 PROPOSED DEVELOPMENT

It is understood that no basements are proposed for the school site. Excavations may be required for the following:

- Installation of underground services
- Shallow footing construction
- Minor/superficial earthworks to achieve design levels
- Lift pit
- Installation of piles for building foundation

Based on available information to date, it is understood that driven piles (pre-cast concrete) or screw piles have been recommended for the site.

1.3 OBJECTIVES

The objective of the ASSMP is to assess the potential to encounter acid sulfate soils (ASS) and reduce the potential environmental impacts associated with the disturbance of ASS within the area of the proposed works. The ASSMP is prepared in general accordance with the Acid Sulfate Soils Assessment Guidelines (Ahern et al, 1998a) and the Acid Sulfate Soils Management Guidelines (Ahern et al, 1998b) in the Acid Sulfate Soil Manual, published by the Acid Sulfate Soils Management Advisory Committee (ASSMAC).

This ASSMP presents a framework for the approach and methodology of ASS management at the site during the construction phase to be followed by the contactor and its subcontractors.

1.4 PREVIOUS REPORTS

Coffey has prepared the following reports in relation to the site:

- Coffey (July 2023); *"Geotechnical Investigation Report – Broadwater Public School"* (Ref: BRO-GEO-PP-RPT-0001)
- Coffey (July 2023); *"Contamination Investigation Report – Broadwater Public School"* (Ref: BRO-CI-PP-RPT-0001)

The site conditions, geological and hydrogeological information included in Section 2 of this ASSMP has been reproduced from the above reports.

2. SITE INFORMATION

2.1 SITE LOCATION

The site location information is summarised in Table 2.1 below:

Table 2.1: Site Information

Item	Description
Site Address	Broadwater Public School, 9 Byrnes Street, Broadwater
Site Area	Approximately 9,000 m^2
Development Area	7530m^2
Title Identification	Lot 4, 5, DP 1043232 / Lot 501, DP755624
Current Land Zoning	RU1 – Primary Production
Local Government Authority	Richmond Valley Council
Current Land Use	Educational Establishment
Proposed Land Use	Educational Establishment

2.2 SITE DESCRIPTION

The site is located along the eastern riverbank of the Richmond River. The site occupies an area of approximately 9,000m^2 and the development area approximately 7,530 m^2. The location of the site and development area is shown in Figure 1.

2.3 REGIONAL TOPOGRAPHY

Available topographic mapping shows regional topography is relatively flat. From east to west of the site, the elevation is recorded to be between 2-3mAHD. As the site is predominantly unsealed it is expected that surface water runoff would percolate into sub-surface soils, except during intense rainfall when surplice water would drain into the stormwater system or into the adjacent Richmond River.

2.4 SOILS AND GEOLOGY

Based on the NSW Seamless Geology Map, the Broadwater Public School site is primarily composed of Quaternary alluvium (Q_al), which consists of “fluvially deposited fine to medium grained lithic to quartz-rich sand, silt and clay”.

Available soil landscape information from the eSPADE website2 indicated the site is located within the Empire Vale soil landscape, which is characterised as ‘Prairie Soils and Dense Clays overlying poorly drained mixed sediments’.

Subsurface conditions are summarised in Table 2.2.

Table 2.2: **Vertical Profile Overview**

Fill/ Natural	Depth (mbgl)	Material Description
Fill	0.0 – 0.2	SAND – fine to coarse grained, brown, trace rootlets
Natural	0.2 – 1.0	Sandy CLAY – brown
Natural	1.0 – 7.0	CLAY – brown mottled orange, trace sand
Natural	7.0 – 10.0	Silty SAND – fine to coarse grained, brown/yellow

2.5 HYDROGEOLOGY

Groundwater was intercepted at 2.1 mbgl and 2.4 mbgl. It is likely groundwater flows through permeable alluvial deposits on site. It is expected that groundwater level varies at this site in response to climatic conditions and tidal influences due to its proximity to Richmond River. Those responses may not be immediate.

Available records from Water NSW indicated that within 500m of the site there is one licensed groundwater bore (GW305936) listed for monitoring.

2.6 ACID SULFATE SOILS

The site is situated within a Class 3 Acid Sulfate Soil area under the Richmond Valley Local Environment Plan 2012.

The site is within an area determined to have a high probability of encountering acid sulfate soils at 1-3mBGL according to the Acid Sulfate Soil Risk maps prepared by the Department of Land and Water Conservation 1998.

Review of the eSPADE website for acid sulfate soil (ASS) risk mapping indicated the site is within an area of high probability for ASS to occur <1-3m below ground surface.

A number of tests were carried out during the recent geotechnical investigation and contamination investigation. Screening tests reported pH following oxidation (pHfox) from 2.6 to 3.3 in the deeper soils, likely indicating the presence of potential ASS in deeper soils. The screening test results for the shallow soils were borderline with the lowest pHfox at 3.3 (with high reaction rating), possibly indicative of potential ASS in the shallow soils.

2.7 PROPOSED ACTIVITIES

Based on information provided by ADCO, minor excavations are proposed but are not expected extend beyond 0.5 to 1.0mBGL. Installation of a lift pit may require excavations of up to 2mBGL. Installation of driven piles or screw piles have been recommended for the site. Based on the above information, it is likely that ASS, if present, may be disturbed by excavation and piling works. However, driven piles are not expected to general much spoil. If screw piles are adopted, the volume of spoil generation is likely to be small.

No dewatering is proposed at this stage.

If not appropriately managed, exposure and oxidation of potential ASS may lead to the generation of acidic leachate. Acidic leachate can be detrimental to the environment and the quality of in ground structures and services. Materials and machinery used may be susceptible to acidic corrosion. Acidic leachate can also mobilise toxic concentrations of metals.

3. MANAGEMENT PLAN AND PROCEDURES FOR ACID SULFATE SOILS

3.1 GENERAL

This management plan will address the issues associated with excavation and construction activities on site.

The following general management procedures are considered applicable for this site based on the current understanding of the proposed development:

i. Appoint an appropriately qualified person to manage the acid sulfate soil issues during the construction activities;

ii. Excavation and temporary stockpiling of excavated material;

iii. Assess the potential presence of acid sulfate soils and liming rates within stockpiled soils for treatment and disposal purposes;

iv. Undertaking liming (if required);

v. Dispose of the limed stockpile to an appropriately licensed landfill.

These procedures are further discussed in the following sections.

3.2 TRAINING AND RESPONSIBILITIES

The Contractor should appoint an appropriately trained person who is responsible for managing the acid sulfate soil issues at the site during the earthwork activities. This person could be the site Foreman trained in acid sulfate soils management.

The person should be familiar with:

- Details in this ASSMP
- Council and other relevant statutory requirements
- Recognition of acid sulfate soils
- Acid sulfate soil testing and treatment procedures
- Onsite management of acid sulfate soils, including implementing management procedures.

If required, Coffey should be engaged to assist or train the Contractor in managing the acid sulfate soil issues and activities.

3.3 EXCAVATION AND TEMPORARY STOCKPILING

The excavated soils (eg. trenches, footings, lift pit, piling) should be temporarily stockpiled and treated (if required) on a specially prepared treatment (or liming) pad, located at least 25m away from any waterway. The treatment pad should be located on a concrete paved area, or in a skip bin. If no concrete area (or skip bin) is available, an area should be covered by timber boards on a minimum of two layers of polythene or low-density polyethylene sheet of at least 0.25mm thickness. Once the soils have been stockpiled, the stockpile should be covered by polythene or low-density polyethylene sheet of at least 0.25mm thickness to prevent erosion of stockpiled materials. Heavy objects not containing any sharp edges should be placed on the sheets to prevent them from being blown by the wind. Straw bales or a silt fence should be placed on the perimeter of the stockpile area to filter runoff. Infiltration of water to the stockpile, such as run-on water from upslope, should be managed with diversion banks. The surface area of the stockpile exposed to oxidation should be minimised, and the stockpile should be covered when not in use.

Extended periods of stockpiling (more than a couple of days) will require leachate collection and monitoring. Where monitoring of the leachate indicates low pH (below 6.5), the addition of lime will be required prior to discharge to sewer/drain[1], subject to requirements/approvals from the relevant authorities. Alternatively, the collected leachate should be disposed of at a licensed facility.

3.4 LABORATORY SPOCAS TESTING

Laboratory testing should be carried out for representative soil samples collected from the stockpile to assess the level of acid sulfate strength and the required liming rate. Depending on the volume of the stockpile, representative soil samples should be collected at a rate of 1 per 25m^3 (minimum 3 samples). The soil samples will be tested by a NATA accredited laboratory for the presence of acid sulfate soils based on the Suspension Peroxide Oxidation Combined Acidity and Sulfate (SPOCAS) method (or another acceptable method).

3.5 TREATMENT PAD & LIMING METHODOLOGY

If acid sulfate soils are identified based on the laboratory results, liming should be applied to the stockpile. The type and amount of lime to be applied will be such that a neutralising value (NV) of 100 can be achieved. The NV should be identified prior to mixing. NV relates to the purity of the lime and an NV of 100 is required to ensure that the lime is effective in neutralising the potential acid. Fine powdered agricultural lime ($CaCO_3$) generally has an NV of 90% to 100% whilst other manufactured forms of lime can have an NV as low as 80%. Where NV is below 100, the factor of safety, hence the amount of lime, will have to be adjusted accordingly.

The following liming procedures (or other equivalent) should be undertaken:

- Spreading of the soil in thin (<200mm) layers on specially prepared impervious pads; and
- Addition of lime by hand or machinery followed by mixing, using light weight rotovators or similar tools. The amount of lime to be added shall be assessed from the results of the laboratory SPOCAS testing, with a factor of safety of 1.5 applied to account for incomplete mixing. This factor of safety is in addition to any correction factors for purity or particle size.

In order to demonstrate that appropriate quantities of lime have been applied, a lime register shall be maintained by the Contractor. The register shall list all lime delivered to the site, verified by delivery dockets, and where the lime has been used. The lime register shall record stockpile ID, quantify soil volumes treated, liming rates and quantities of lime applied per stockpile.

3.6 VALIDATION PRIOR TO OFFSITE DISPOSAL

Field screening tests or laboratory testing should be carried out for representative soil samples collected from the treated stockpile to confirm sufficient lime has been applied. Depending on the volume of the stockpile, representative validation soil samples should be collected at a rate of 1 per 25m^3 (minimum 3 samples). The samples will be subject to field screening tests based on Appendix I of the Acid Sulfate Soils Assessment Guidelines (Ahern et al, 1998a). Alternatively, the samples will be analysed using the SPOCAS or other acceptable method.

If the results meet one of the following validation criteria, the stockpile can then be assessed against waste classification requirements for offsite disposal:

- Field pH (pHf) > 7 and pH following oxidation (pHfox) > 7 (using the field screening method); or
- Net acidity (including acid neutralising capacity) level below 18mol H^+/tonne (using the SPOCAS method)

[1] Discharge to sewer/drain would also be subject to other criteria such as the presence of contaminants and suspended solids.

3.7 WASTE CLASSIFICATION AND OFFSITE DISPOSAL

The treated soil may be disposed of to an appropriately licensed landfill following a waste classification. The waste classification and disposal should be undertaken in accordance with relevant standards and requirements, including the NSW EPA (2014) Waste Classification Guidelines, Part 1: Classifying Waste. The waste classification should also take into account the acid sulfate soil requirements. It is noted that the treated soil cannot be classified as Virgin Excavated Natural Material (VENM) as per the NSW EPA definition.

Alternatively, the treated soil could be reused on site following monitoring as per Section 3.8, subject to other contamination and engineering requirements.

3.8 MONITORING PRIOR TO REUSE

Lime treatment typically requires at least a few weeks for chemical reactions to take place and for the treated materials to be neutralised prior to being considered suitable for reuse.

If the treated soil cannot be disposed of to a licensed landfill, the soil may be reused (subject to other contamination and engineering requirements) following completion of a monitoring program (or other equivalent) as outlined below, based on a testing rate of 1 per 25m^3 (minimum 3 samples):

- Monitoring of soil pH weekly based on Appendix I of the Acid Sulfate Soils Assessment Guidelines (Ahem et al, 1998a); and
- Laboratory testing of representative soil samples for SPOCAS (or similar) after four weeks.

The following acceptance criteria will be used over a four week period to assess whether the soils have sufficient neutralising capacity to account for the quantities of acid produced:

- Soil pH ≥ 6.5;
- Actual acidity level below18mol H^+/tonne; and
- Potential acidity level below 18mol H^+/tonne.

Should the soil pH fall below 6.5 and continue to fall, then additional lime will be added to the material and monitoring will continue for a further four weeks, at which time a review of the monitoring frequency will take place.

3.9 CONTINGENCY

3.9.1 Dewatering

Should dewatering activity be required, Coffey should be consulted prior to any dewatering activities. This ASSMP should be reviewed and amended, where applicable.

3.9.2 Large Excavation

If larger than expected excavation is required (eg. bulk excavation exceeding 200m^3), Coffey should be consulted and this ASSMP should be reviewed and amended, where applicable.

This may include additional visual assessment and field screening tests to segregate ASS from non-ASS. A visual assessment of excavated soils will be undertaken based on material type, colour and consistency. Dark grey/brown sands and sandy clays will be classified as suspected acid sulfate soils. Jarosite staining, indicative of acid sulfate conditions, will be noted and used as further field evidence of acid sulfate soils presence. In addition, soil samples will be collected regularly and subject to field screening tests based on Appendix I of the Acid Sulfate Soils Assessment Guidelines (Ahern et al, 1998a).

3.9.3 Other Unexpected Issues

Should other unexpected issues be encountered, Coffey should be consulted. This ASSMP should be reviewed and amended, where applicable.

4. LIMITATIONS

This ASSMP is prepared based on the current level of understanding of the site and the proposed development. It should be reviewed and updated if changes to the development is made.

This plan does not address dewatering, geotechnical or contamination issues.

5. REFERENCES

Ahern C R, Stone Y and Blunden B (1998a) Acid Sulfate Soils Assessment Guideline*s*, Acid Sulfate Soils Management Advisory Committee, Wollongbar, NSW.

Ahern C R, Stone Y and Blunden B (1998b) Acid Sulfate Soils Management Guideline*s*, Acid Sulfate Soils Management Advisory Committee, Wollongbar, NSW.

NSW EPA (2014) Waste Classification Guidelines, Part 1: Classifying Waste.

IMPORTANT INFORMATION ABOUT YOUR TETRA TECH COFFEY ENVIRONMENTAL REPORT

Introduction

This report has been prepared by Tetra Tech Coffey for you, as Tetra Tech Coffey's client, in accordance with our agreed purpose, scope, schedule and budget.

The report has been prepared using accepted procedures and practices of the consulting profession at the time it was prepared, and the opinions, recommendations and conclusions set out in the report are made in accordance with generally accepted principles and practices of that profession.

The report is based on information gained from environmental conditions (including assessment of some or all of soil, groundwater, vapour and surface water) and supplemented by reported data of the local area and professional experience. Assessment has been scoped with consideration to industry standards, regulations, guidelines and your specific requirements, including budget and timing. The characterisation of site conditions is an interpretation of information collected during assessment, in accordance with industry practice.

This interpretation is not a complete description of all material on or in the vicinity of the site, due to the inherent variation in spatial and temporal patterns of contaminant presence and impact in the natural environment. Tetra Tech Coffey may have also relied on data and other information provided by you and other qualified individuals in preparing this report. Tetra Tech Coffey has not verified the accuracy or completeness of such data or information except as otherwise stated in the report. For these reasons the report must be regarded as interpretative, in accordance with industry standards and practice, rather than being a definitive record.

Your report has been written for a specific purpose

Your report has been developed for a specific purpose as agreed by us and applies only to the site or area investigated. Unless otherwise stated in the report, this report cannot be applied to an adjacent site or area, nor can it be used when the nature of the specific purpose changes from that which we agreed.

For each purpose, a tailored approach to the assessment of potential soil and groundwater contamination is required. In most cases, a key objective is to identify, and if possible quantify, risks that both recognised and potential contamination pose in the context of the agreed purpose. Such risks may be financial (for example, clean up costs or constraints on site use) and/or physical (for example, potential health risks to users of the site or the general public).

Limitations of the Report

The work was conducted, and the report has been prepared, in response to an agreed purpose and scope, within time and budgetary constraints, and in reliance on certain data and information made available to Tetra Tech Coffey.

The analyses, evaluations, opinions and conclusions presented in this report are based on that purpose and scope, requirements, data or information, and they could change if such requirements or data are inaccurate or incomplete.

This report is valid as of the date of preparation. The condition of the site (including subsurface conditions) and extent or nature of contamination or other environmental hazards can change over time, as a result of either natural processes or human influence. Tetra Tech Coffey should be kept appraised of any such events and should be consulted for further investigations if any changes are noted, particularly during construction activities where excavations often reveal subsurface conditions.

In addition, advancements in professional practice regarding contaminated land and changes in applicable statues and/or guidelines may affect the validity of this report. Consequently, the currency of conclusions and recommendations in this report should be verified if you propose to use this report more than 6 months after its date of issue.

The report does not include the evaluation or assessment of potential geotechnical engineering constraints of the site.

Interpretation of factual data

Environmental site assessments identify actual conditions only at those points where samples are taken and on the date collected. Data derived from indirect field measurements, and sometimes other reports on the site, are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions.

Variations in soil and groundwater conditions may occur between test or sample locations and actual conditions may differ from those inferred to exist. No environmental assessment program, no matter how comprehensive, can reveal all subsurface details and anomalies. Similarly, no professional, no matter how well qualified, can reveal what is hidden by earth, rock or changed through time.

The actual interface between different materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions.

For this reason, parties involved with land acquisition, management and/or redevelopment should retain the services of a suitably qualified and experienced environmental consultant through the development and use of the site to identify variances, conduct additional tests if required, and recommend solutions to unexpected conditions or other unrecognised features encountered on site. Tetra Tech Coffey would be pleased to assist with any investigation or advice in such circumstances.

Recommendations in this report

This report assumes, in accordance with industry practice, that the site conditions recognised through discrete sampling are representative of actual conditions throughout the investigation area. Recommendations are based on the resulting interpretation.

Should further data be obtained that differs from the data on which the report recommendations are based (such as through excavation or other additional assessment), then the recommendations would need to be reviewed and may need to be revised.

Report for benefit of client

Unless otherwise agreed between us, the report has been prepared for your benefit and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendation and should make their own enquiries and obtain independent advice in relation to such matters.

Tetra Tech Coffey assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report.

To avoid misuse of the information presented in your report, we recommend that Tetra Tech Coffey be consulted before the report is provided to another party who may not be familiar with the background and the purpose of the report. In particular, an environmental disclosure report for a property vendor may not be suitable for satisfying the needs of that property's purchaser. This report should not be applied for any purpose other than that stated in the report.

Interpretation by other professionals

Costly problems can occur when other professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, a suitably qualified and experienced environmental consultant should be retained to explain the implications of the report to other professionals referring to the report and then review plans and specifications produced to see how other professionals have incorporated the report findings.

Given Tetra Tech Coffey prepared the report and has familiarity with the site, Tetra Tech Coffey is well placed to provide such assistance. If another party is engaged to interpret the recommendations of the report, there is a risk that the contents of the report may be misinterpreted and Tetra Tech Coffey disowns any responsibility for such misinterpretation.

Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, laboratory data, drawings, etc. are customarily included in our reports and are developed by scientists or engineers based on their interpretation of field logs, field testing and laboratory evaluation of samples. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

This report should be reproduced in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties.

Responsibility

Environmental reporting relies on interpretation of factual information using professional judgement and opinion and has a level of uncertainty attached to it, which is much less exact than other design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. As noted earlier, the recommendations and findings set out in this report should only be regarded as interpretive and should not be taken as accurate and complete information about all environmental media at all depths and locations across the site.

APPENDIX A: FIGURES

LEGEND

- 2022 Geotechnial boreholes by DP
- 023 Geotechnical boreholes by Coffey
- 2023 Environmental boreholes by Coffey
- Approximate Surface Sample

drawn	IG
approved	VN
date	13/07/2023
scale	NTC
original size	A4

TETRA TECH COFFEY

client:	ADCO Construction Pty Ltd
project:	Northern River School Cluster
title:	Site Plan (Reproduced from Contamination Report)
project no:	SYDGE319200
figure no:	1