ENVIRONMENTAL INVESTIGATION SERVICES

23 October 2017
Ref: E30907Klet-ASS

TKD Architects
Level 1, 19 Foster Street, Surry Hills
Sydney NSW 2010

Attention: Ms Anna Harris

ACID SULFATE SOIL ASSESSMENT
PROPOSED NEW SCHOOL FACILITIES
ALEXANDRIA PARK COMMUNITY SCHOOL, 7- 11 PARK ROAD, ALEXANDRIA

1 INTRODUCTION

Tanner Kibble Denton (TKD) Architects ('the client') commissioned Environmental Investigation Services (EIS)[1] to undertake an acid sulfate soil (ASS) assessment for the proposed community school development at Park Road, Alexandria. The site is identified as:

- Lot 11 DP615964;
- Lot 2 and 3 DP69494;
- Lot 1 DP74696; and
- Lot A and B DP109038.

The site location is shown on Figure 1 and the investigation was confined to the site boundaries as shown on Figure 2.

The investigation was undertaken generally in accordance with an EIS proposal (Ref: EP457723K3K) of 21 September 2017 and written acceptance from TKD Architects by email of 22 September 2017. A geotechnical investigation was undertaken in conjunction with the ASS assessment by JK Geotechnics[2] and the results are presented in a separate report (Ref. 30907Zrpt, dated 23 October 2017).

The aims of the assessment were to establish whether actual ASS or potential ASS (PASS) may be disturbed during the proposed development works, and to assess whether an ASSMP is required.

[1] Environmental consulting division of Jeffery & Katauskas Pty Ltd (J&K)
[2] Geotechnical consulting division of J&K

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1.1 Assessment Guidelines

The ASS assessment and preparation of this report were undertaken with reference to the Acid Sulfate Soil Management Advisory Committee (ASSMAC) Acid Sulfate Soil Manual (1998[3]). Background information on ASS and the assessment process is provided in the appendices.

1.2 Proposed Development Details

The proposed development includes the construction of 4 to 5 storey buildings across the site. EIS understand that the floor slabs will be on-grade and there will there will be no significant excavation for basements

2 SITE INFORMATION

2.1 Summary of Previous Investigations

A detailed environmental site assessment has been prepared by Coffey Services Australia (Ref: SYDEN199382-R01-Rev1). The report identified a number of contamination issues including the presence of fragments of asbestos cement sheeting in the fill, elevated concentrations of lead above the health Investigation Level A criterion and the presence of chlorinated hydrocarbons in the groundwater. The fill material at the site was assigned a preliminary waste classification of General Solid Waste (non-putrescible) to be managed as Special Waste (asbestos).

Coffey noted the potential for acid sulfate soil at the site based on a review of the Acid Sulfate Soil Risk Map for Botany Bay (Map 9130S#), however no analysis was undertaken to confirm this.

2.2 Site Description

The site is located on the west side of Park Road to the south of the junction between Park Road and Buckland Street, Aleaxandria. The regional topography is gently undulating and the site itself is approximately level with some gentle undulation.

At the time of inspection the site was a pre-school. The main buildings were located in the south section of the site. The school field occupied the north section of the site. Temporary demountable classrooms were located on the school field in the north-west section of the site. The school fields were grassed and included some areas of exposed soil. There were large trees and some shrubs scattered around the site in landscaped areas. No signs of dieback or plant stress were observed.

Apart from Alexandria Park located to the east of the site, the surrounding land use was a mixture of residential, commercial and light industrial.

[3] Acid Sulfate Soils Management Advisory Committee (ASSMAC), (1998). *Acid Sulfate Soils Manual* (ASS Manual 1998)

2.3 Regional Geology

The geological map of Sydney (1983[4]) indicates the site to be underlain by Quaternary aged deposits of medium to fine-grained marine sands with podsols (Botany Sands).

2.4 Sydney Council Local Environmental Plan (LEP) 2012

A review of the Sydney council LEP indicates that the south section of the site is located in ASS Class 3 zone and the north section of the site is and ASS Class 5 (refer to appendices for further details on each risk class).

2.5 Acid Sulfate Soil Risk Map

A review of the ASS risk maps prepared by Department of Land and Water Conservation (1997[5]) indicates that the site the south section of the site is located in an area classed as 'disturbed terrain'

The 'disturbed terrain' classification is adopted in large scale filled areas which often occur during reclamation of low lying swamps for urban development, in areas which may have been mined or dredged or have undergone heavy ground disturbance through general urban development or the construction of dams and levees. The majority of landforms within these areas are not expected to encounter PASS. However, localised occurrences may be found at depth. Disturbance of these materials will result in a risk that will vary with elevation and depth of disturbance. Soil investigation is required to assess these areas for PASS.

3 INVESTIGATION REQUIREMENTS AND ASSESSMENT CRITERIA

3.1 Investigation Requirements

The ASS Manual 1998 recommends a minimum of four sampling locations for a site with an area up to 1ha (10,000m^2). For sites greater than 4ha, the manual recommends the use of a reduced density of two locations per hectare subject to the proposed development. For lineal investigations, the manual recommends sampling every 50-100m.

The sampling locations should include all areas where significant disturbance of soils will occur and/or areas with a high environmental sensitivity. In some instances a varied sampling plan may be more suitable, particularly for sites less than 1,000m^2 in area.

The depth of investigation should extend to at least 1m beyond the depth of proposed excavation/disturbance or estimated drop in water table height, or to a minimum of 2m below existing ground level, whichever is greatest.

[4] Department of Mineral Resources, (1983). *1:100,000 Geological Map of Sydney (Series 9130)*

[5] Department of Land and Water Conservation, (1997). *1:25,000 Acid Sulfate Soil Risk Map –Botany Bay(Series 9130S3, Ed 2).*

3.2 Action Criteria

The ASS Manual 1998 presents 'action criteria' for the interpretation of laboratory results. The 'action criteria' define the need to prepare an ASSMP and are based on soil pH, potential acidity and the percentage of oxidisable sulfur for broad categories of soil types. Where disturbance of greater than 1,000 tonnes of ASS is proposed, the action criteria for 'coarse textured soils' apply to all soil types.
The following action criteria are presented in the ASS Manual:

Table 3-1: ASS Action Criteria

Category	Description	Criteria
Coarse Textured Soils	Sands to loamy sands	• pH - less than 5; • Total Actual Acidity (TAA)/Total Sulfide Acidity (TSA)/ Total Potential Acidity (TPA) (pH5.5) – greater than 18mol H^+/tonne; and • S_{pos} – greater than 0.03% sulfur oxidisable.
Medium Textured Soils	Sandy loams to light clays	• pH - less than 5; • TAA/TSA/TPA (pH5.5) – greater than 36mol H^+/tonne; and • S_{pos} – greater than 0.06% sulfur oxidisable.
Fine Textured Soils	Medium to heavy clays and silty clays	• pH - less than 5; • TAA/TSA/TPA (pH5.5) – greater than 62mol H^+/tonne; and • S_{pos} – greater than 0.1% sulfur oxidisable.

3.3 Site Specific Action Criteria

The action criteria for coarse textured soils soils has been adopted for this assessment. This is based on the predominant soil type encountered at the sampling locations (i.e. sand).

4 INVESTIGATION PROCEDURE

4.1 Subsurface Investigation and Soil Sampling Methods

Field work for this investigation was undertaken on 3 October 2017. Soil samples were collected from two locations in conjunction with the JK Geotechnics investigation, to a maximum borehole depth of 11m. Samples were collected form two deep boreholes drilled in the north section of the site (BH1) and the south section of the site (BH7). The number of sampling points was restricted by time constraints. Due to very deep rock the geotechnical investigation had to be completed using the electric friction cone penetrometer (EFCP) that does not return any sample.

It is noted that the number of sampling locations is below the recommended density for a site of the size, however, EIS are of the opinion that the reduced sampling density is adequate considering that no significant excavation works are proposed and the only soil disturbance is likely to be associated with piling spoil.

The sampling locations are shown on the attached Figure 2.

Soil samples were obtained at various depths, based on observations made during the field investigation. All samples were placed in plastic bags and sealed with plastic ties with minimal headspace. Each sample was labelled with a unique job number, the sampling location, sampling depth and date. All samples were recorded on the borehole logs attached in the appendices.

The samples were preserved by immediate storage in an insulated sample container with ice and frozen upon return to the EIS office. Samples were subsequently delivered in the insulated sample container (on ice or with ice packs) to a NATA registered laboratory for analysis under standard chain of custody (COC) procedures.

4.2 Laboratory Analysis

One selected fill and eight selected natural soil samples obtained from the site were analysed for ASS/PASS using the suspension Peroxide Combined Acidity and Sulfur (sPOCAS) analytical methods detailed in AS4969-2008/09[6]. The laboratory testing was undertaken by Envirolab Services (NATA Accreditation Number – 2901). Reference should be made to the laboratory reports (Ref: 177103) attached in the appendices for further information.

5 RESULTS OF THE INVESTIGATION

5.1 Subsurface Conditions

A summary of the subsurface soil conditions encountered in the boreholes during the investigation is presented in the table below. Reference should be made to the borehole logs attached in the appendices for further details. Reference should be made to the geotechnical report for a detailed discussion of the sub-surface conditions and interpretation of the EFCP data.

Table 5-1: Summary of subsurface conditions

Profile	Description (depth in m below ground level)
Pavement	Asphaltic concrete pavement (40mm thick) was encountered in BH7.
Fill	Fill material was encountered in all boreholes and extended to depths of approximately 0.6m to 2.1m. The fill typically comprised gravelly sand, sand, silty sand and clay. The fill contained inclusions of igneous and sandstone gravel

[6] Standards Australia, (2008/2009). *Analysis of acid sulfate soil – Dried samples – Methods of test, Parts 1 to 14.* (AS4969-2008/09)

Profile	Description (depth in m below ground level)
Natural Soil	The fill was underlain by fine to medium grained sand that extended to 9.5m in BH1 to 10.5m in BH7. A band of peat was observed within the sands in BH7 that extended from 8m to 10.5m. The sand was underlain by medium plasticity silty clay that extended to 16.7m in BH1 to 19m in BH7.
Bedrock	The silty clay was underlain by fine to medium grained sandstone.
Groundwater	Seepage was encountered at depths of 3.1m in BH6 and 3.4m in BH7. On completion of drilling groundwater was recorded at depths 3m in BH6 and BH7. Seepage was measured a depth of 3.8m in BH1, however the borehole collapsed and no final measurement could be taken.

5.2 Laboratory Results

The soil laboratory results were assessed against the action criteria adopted for the assessment. The results are presented in the attached report tables and summarised below.

Table 5-2: Summary of ASS Results

Analyte	Results Compared to ASS Guidelines
pH_{kcl} and pH_{ox}	The pH_{KCl} results ranged from 4.2 to 9.3. Prior to oxidation the pH values of seven of the soil samples suspended in potassium chloride solution were above the action criterion of pH 5. Two of the results were below the action criterion. Following oxidation, the pH_{ox} results for the samples ranged from 2.2 to 7.6. The pH of the samples typically dropped by 1 or more units following oxidation. Sample BH1 (5.5-6.0m) recorded a slight increase of 0.6 pH units. The greatest drop in pH was recorded in sample BH7 (8.7-9.15m) that fell from pH4.6 to pH2.2 (2.4 pH units).
Acid Trail	• TAA results ranged from less than the practical quantitation limit (PQL) to 38mol H^+/tonne. The BH1 (10.5-11m) result was above the action criterion of 18mol H^+/tonne; • TPA results ranged from less than the PQL to 440mol H^+/tonne. Three of the results were above the action criterion of 18mol H^+/tonne; and • TSA results ranged from less than PQL to 420mol H^+/tonne. Three of the results were above the action criterion of 18mol H^+/tonne. The highest TSA result (420 mol H^+/tonne) was recorded in sample BH7 (8.7-9.15m).
Sulfur Trail	The S_{pos}% results ranged for LPQL to 0.2%. The S_{pos}% results in samples from BH1 (10.5-11.0m) and BH7 (8.7-9.15m) exceeded the action criterion of 0.03%. The majority of the results were below the action criterion of 0.03% as shown on Table A.

Analyte	Results Compared to ASS Guidelines
Liming Rate	The liming rate required for neutralisation ranged from 4.8 kg$CaCO_3$/tonne to 11 kg$CaCO_3$/tonne.

6 CONCLUSIONS

The soil samples analysed for this investigation encountered results which were above the action criteria adopted for the assessment. The investigation identified two soil strata that are potential acid sulfate soil

The results indicate that the principal zone of acid sulfate soil is associated with a layer of sand/peat that extends from RL5m AHD to RL3.5m AHD that was encountered in BH7 located in the south section of the site. The peat bands were not encountered in BH1 in the north section of the site therefore this band of acid sulfate soil appears to be confined to the south section of the site.

A sample of the medium plasticity silty clay from BH1 also displayed acid sulfate soil characteristics. A similar band silty clay was encountered in BH7 therefore it would be reasonable to assume that the medium plasticity silty clay across the entire site is potential acid sulfate soil. In BH1 this clay band extends from RL 4.2m AHD to RL -3.4m AHD whilst in BH7 this clay band extends from RL 3.5m AHD to RL -6m AHD

Based on these results, there is considered to be a high potential for ASS to be disturbed during the proposed development if piling works extend into either (or both) of the zones described above. If the proposed works will potentially disturb either of the two zones described above a site specific Acid Sulfate Soil Management Plan (ASSMP) should be prepared.

Although sample BH1 (4.0-4.5m) showed some acidic characteristics (including a pH_{ox} less than 5 and elevated TPA and TSA results) this was not considered to be potential acid sulfate soil due to the very low concentration of peroxide oxdisable sulfur (S_{POS}) result. The acid characteristics in this sample are most likely the result of humic acids in the soil.

7 LIMITATIONS

The report limitations are outlined below:

- EIS accepts no responsibility for any unidentified ASS or PASS issues at the site. Any unexpected problems/subsurface features that may be encountered during development works should be inspected by an environmental consultant as soon as possible;
- This report has been prepared based on site conditions which existed at the time of the investigation; scope of work and limitation outlined in the EIS proposal; and terms of contract between EIS and the client (as applicable);

- The conclusions presented in this report are based on investigation of conditions at specific locations, chosen to be as representative as possible under the given circumstances, visual observations of the site and immediate surrounds and documents reviewed as described in the report;
- Subsurface soil and rock conditions encountered between investigation locations may be found to be different from those expected. Groundwater conditions may also vary, especially after climatic changes;
- The investigation and preparation of this report have been undertaken in accordance with accepted practice for environmental consultants, with reference to applicable environmental regulatory authority and industry standards, guidelines and the assessment criteria outlined in the report;
- Where information has been provided by third parties, EIS has not undertaken any verification process, except where specifically stated in the report;
- EIS accept no responsibility for potentially asbestos containing materials that may exist at the site. These materials may be associated with demolition of pre-1990 constructed buildings or fill material at the site;
- EIS have not and will not make any determination regarding finances associated with the site;
- Additional investigation work may be required in the event of changes to the proposed development or landuse. EIS should be contacted immediately in such circumstances;
- Material considered to be suitable from a geotechnical point of view may be unsatisfactory from a soil contamination viewpoint, and vice versa;
- This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose;
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If you have any questions concerning the contents of this letter please do not hesitate to contact us.

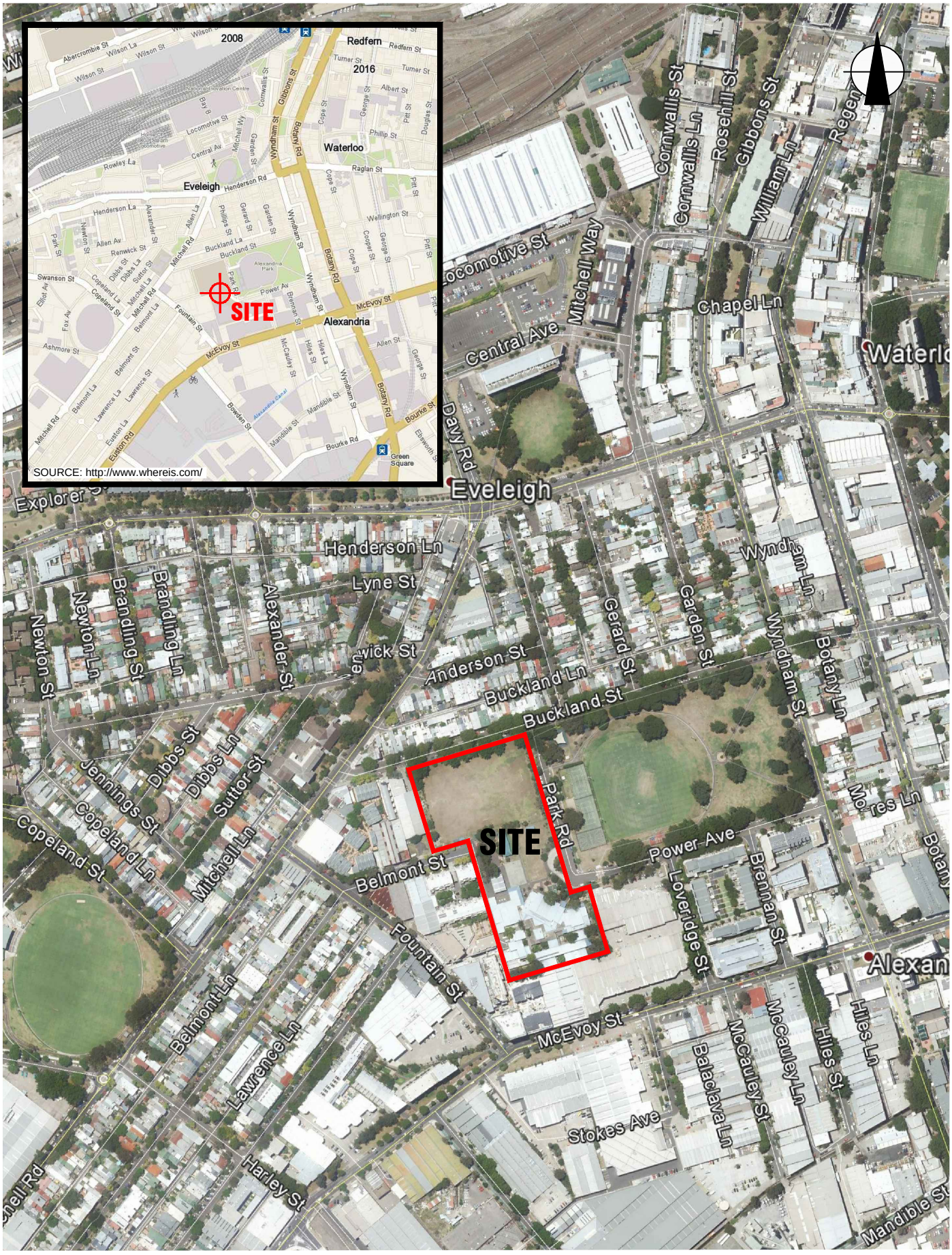
Kind Regards

Adrian Kingswell
Principal

Attachments:

1) Report Figures
2) Report Tables
3) Appendices –
    a. Information on Acid Sulfate Soils
    b. Borehole Logs
    c. Laboratory Analysis Report and Chain of Custody Documentation

REPORT FIGURES



AERIAL IMAGE SOURCE: GOOGLE EARTH PRO 7.1.5.1557
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This plan should be read in conjunction with the JK Geotechnics report.

Title: **SITE LOCATION PLAN**

Location: ALEXANDRIA PARK COMMUNITY SCHOOL
ALEXANDRIA, NSW

Report No: 30907Z

Figure No: 1

JK **Geotechnics**

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