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DLA environmental

ASSESSMENT REPORT

ACID SULFATE SOILS

176 – 184 George Street

Concord West NSW 2134

Prepared for

George Concord Pty Ltd
Rear 53-57 Cosgrove Road
South Strathfield NSW 2136

Prepared by

DAVID LANE ASSOCIATES

February 2010

DL2853

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1.0 INTRODUCTION

1.1 General

George Concord Pty Ltd commissioned DLA Environmental (DLA) to conduct preliminary assessments for the presence of Acid Sulfate Soils (ASS), on the property located at 176-184 George Street, Concord West NSW (Site) (refer to **Table 1a** for lot and development plan numbers) to support a Development Application to be submitted to the City of Canada Bay Council.

Table 1a – Site Development Plan and Lot Numbers

Development Plan Number	Lot Numbers
15973	4, 5, 6, 7, 8, 9, 10, 11, 12, 15 and 16
226350	1 and 2

Refer to **Figure 1** – *Site Location*

The Site is located within the City of Canada Bay Council Local Environmental Plan 2008 Acid Sulfate Soils Map. The Site is located in a Class 5 Acid Sulfate Soils zone, denoting that it falls within 500m of a Class 1-4 ASS zoning. Class 5 Acid Sulfate Soils require investigation due to their proximity to other ASS (Class1-4) zoned areas. Class 5 ASS generally are not occupied by ASS though and act as a buffer zone to protect the environment from the potential effects of ASS release. Preliminary testing is required to be conducted to confirm the presence of potential or actual acid sulfate soils (see **1.3 What are Acid Sulfate Soils?**).

Refer to **Figure 3** – *City of Canada Bay Acid Sulfate Soil Map*.

Testing is to be conducted in accordance with the City of Canada Bay Council Local Environmental Plan 2008 requirement, that developments on land identified as being subject to actual acid sulfate soils or potential acid sulfate soils be assessed in accordance with the Acid Sulfate Soils Assessment Guidelines (NSW ASSMAC August 1998).

Where the presence of such soils are confirmed suitable management techniques are to be implemented by way of an Acid Sulfate Soil Management Plan (ASSMP) that should contain the results of the soils assessment and provide adequate guidance and procedures to be implemented where necessary to prevent the generation of acid leachate.

The Acid Sulfate Soil Management Plan should be developed to address the Department of Planning and NSW EPA’s requirements and to ensure that the proposed excavation activities can be undertaken without undue impact on the environment.

1.2 Proposed Development

The Site is currently occupied by a disused industrial and commercial building. The warehouse is L shaped with offices in the north and approximately 0.49ha with surrounding car parking. The Site is to be redeveloped to accommodate a new residential tower block with basement parking.

1.3 What are Acid Sulfate Soils?

Acid sulfate soil is the common name given to sediment and soil containing iron sulphides (principally contain iron pyrite or iron di-sulfide). The exposure of pyrite in these soils to oxygen by drainage or excavation leads to the generation of sulfuric acid. Acidic leachate can dissolve clay and release toxic concentrations of aluminium, iron or other metals into water bodies . Drainage waters from areas of acid sulfate soils will affect water quality and can lead to death or disease of aquatic organisms.

Acid sulfate soils, which have already been exposed to air, are called “actual acid sulfate soils and tend to have a pH of 4.5 or less as they are generating acid from the oxidation of iron sulfide minerals in the soil. Soils, which have not been exposed to air, are called “potential acid sulfate soils”. These soils have the potential for future oxidation of pyrite and the generation of acid. The pH of these soils in their undisturbed state may be neutral or slightly alkaline. However they generally pose the greatest environmental risk when disturbed. Actual and potential acid sulfate soils are often found in the same soil profile, with actual acid sulfate soils generally overlying potential acid sulfate soil horizons.

The majority of acid sulfate sediments were formed by natural processes under very restricted conditions in the Holocene geological period. The special conditions required the presence of iron-rich sediments from a river, sulfate from sea water, the presence of sulfate reducing bacteria and a plentiful supply of organic matter (usually mangroves). It should be noted that these conditions still exist at the bottom of coastal rivers and lakes with the formation of pyritic material when there are high levels of organics in the sediment.

The relatively restricted conditions under which acid sulfate soils are formed limit their formation to low lying parts of coastal floodplains, rivers and creeks. This will include areas with saline or brackish water such as deltas, coastal flats, back swamps and seasonal or permanent freshwater swamps that were formerly brackish. Due to flooding and stormwater erosion, these acid sulfate sediments may continue to be distributed through the sands of the estuarine flood plain region. Pyrite sediment may be found at any depth in the soil layer in suitable coastal sediments, usually beneath the water table.

1.4 The Environmental Impact of Acid Sulfate Soils

The oxidation of acid sulfate soils and pyritic hard rock produces acidic leachate, which affect the water quality in:

- bore-water;
- groundwater;
- drainage water; and,
- streams.

These acidic waters will not meet water quality criteria and will cause environmental impacts in five main areas:

- plant growth;
- sickness or death of aquatic life;
- release of heavy metals;
- animal and human health; and,
- corrosion and weakening of engineering structures.

1.5 Where are Acid Sulfate Soils Found?

The exact distribution of recent pyritic sediment around the Australian coast is unknown. However, pyritic sediment deposited during the Holocene epoch (<11000 years before present) is unlikely to be further inland than the present **coastal river tidal limit, or higher than 5 m above high water levels.**

The current hypothesis is that the source of pyritic material in coastal floodplains is "recent" Holocene deposits. It is known that Pleistocene age sediment is also in coastal floodplains at elevations below 3 m Australian Height Datum (AHD). Low sea levels 100,000 to 20,000 years ago have exposed these materials to air for a substantial period of time. The assumption is that any pyrite, which existed in Pleistocene sediment, will have long been completely oxidised.

The first reported findings of acid sulfate sediment in Australia were in the floodplain of the Macleay River in northern NSW in 1972. This was followed by descriptions of acid sulfate sediment on the floodplains of the Shoalhaven, Hawkesbury, Nambucca, Clarence, Richmond and Tweed Rivers of NSW, Botany Bay and in the Logan River in southern Queensland.

There have also been findings as far south as the Clyde River on the NSW South Coast, at Geroa, the Hunter, Myall and Manning Rivers and Byron Bay.

It is clear that all major coastal bays and estuaries in NSW have acid sulfate or potential acid sulfate sediment.

2.0 ACID SULFATE SOIL INVESTIGATION

2.1 Acid Sulfate Soil Assessment

The sampling protocol for this project was determined by:

- Review of the Property;
- Examination of the proposed construction activities, trenching and excavations;
- Consideration of the existing soil conditions (disturbed or undisturbed); and,
- Review of the ASSMAC Guideline requirements for sample density and analytical requirements.

Three (3) boreholes were excavated on the Site. One borehole was in the northern car park and the other two in the southern car park. Four (4) soil samples were collected from the boreholes with the locations and depths shown in **Table 2a**.

Refer to **Figure 2** – *Site Layout with Sampling Locations.*

Table 2a – Sample Location and Depth

Sample	Borehole	Depth (m)
BH1 - 3	1	3
BH2 - 6	2	6
BH2 - 6.8	2	6.8
BH3 - 1.5-1.9	3	1.5-1.9

2.1.1 Assessment Criteria

Standard approved methods have been developed for routine laboratory analysis of soil samples. The approved methods include:

- SPOCAS Suspension Peroxide Oxidation Combined Acidity and Sulfate.

The SPOCAS Method is in accordance with the *Acid Sulfate Soils Laboratory Methods Guidelines, ASSMAC, Wollongbar NSW.*

For assessment purposes, and for the development of effective management strategies, TOS results will need to be complemented with the SPOCAS method for a fuller understanding of the oxidisable sulphur content of the soil.

The criteria (based on oxidisable sulphur) which should trigger management action are grouped into three broad texture categories in **Table 2b**. For this study, the action criteria for the **Fine** texture action category were selected on the basis that the soil type most closely resembles the silty clays found in the study area. In order to assess the potential for acid generation the action levels applicable to a disturbance of less than 1000 tonnes has been used.

Levels of oxidisable sulphur (Spos%) within a soil or sediment can indicate the level of risk to the environment if the soil is disturbed. For all soils with oxidisable sulphur values greater than the action criteria (>0.06%) a management plan must be developed to manage the potential acid generation. As a general rule, the highest result (by either the sulphur or the acid trail) should be used as the action criteria. Existing acidity (TAA) needs to be included in the assessment.

The definition of Potential Acid Sulfate Soils (PASS) as defined in the Acid Sulfate Soil Assessment Guide produced by the NSW Acid Sulfate Soils Management Advisory Committee in August 1998 indicates that PASS soils have a pH of less than 4. The guidelines also stipulate that Actual Acid Sulfate Soils have a soil pH of less than 4.

Table 2b
Action Criteria 1-1000 tonnes disturbed

Texture	Approximate Clay Content	Sulphur Trail S_{pos}%	Acid Trail TPA Mol H^+/tonne
Coarse Texture Sands to Loamy Sands	<5.0%	0.03	18
Medium Texture Sandy Loams to Light Clays	5-40%	0.06	36
Fine Texture Medium to Heavy Clays and Silty Clays	>40%	0.1	62

Texture Range as describe by McDonald et al (1990)

For environmental purposes, **the highest result by either the sulphur or the acid trail** is generally used as the action criteria unless mitigating factors are established eg. The quantity, fineness and reactivity of neutralising material such as shell etc.

3.0 RESULTS

Four (4) soil samples were collected for analysis from the Site. The samples were submitted to the Sydney Environmental Soils Laboratory for SPOCAS testing.

Table 3a
Acid Sulfate Soil Analysis for Defined Soil Texture Categories

Sample ID	Depth (meters)	Texture	pH in kcl	Sulphur Trail Spos%	Acid Trail TPA Mol H+/tonne
BH1 - 3	3	Silty Clay	5.22	0.02	3.38
BH2 – 6	6	Fill: Gravelly Clay	8.48	0.02	-
BH2 – 6.8	6.8	Fill: Gravelly Clay	8.84	0.04	-
BH3 – 1.5-1.9	1.5-1.9	Silty Clay	3.98	0.01	135

Reported pH in **Table 3a** indicates that samples from Boreholes 1 and 3 were acidic, whilst samples from Borehole 2 were alkaline:

BH1 – 3 was below both the Sulphur Trail and Acid Trail TPA Action Criteria for fine texture soils with results of 0.02 Spos% and 3.38 Mol H+/tonne respectively. These results indicate nil actual and a very low potential acidity risk.

Both BH2 - 6 and BH2 – 6.8 came from fill material overlying natural shales and were alkaline (pH in kcl of 8.48 and 8.84 respectively). These samples were reported to pose nil actual and nil potential acidity risk.

The acid trail TPA for BH3 – 1.5-1.9 (135 Mol H+/tonne) however exceeded the Action Criteria for fine texture soils of 62 Mol H+/tonne indicating a very significant actual acidity risk and that an Acid Sulfate Management Plan is required

4.0 DISCUSSION

Considering the Site is at an elevation of between RL 4mAHD and RL 5.4mAHD, the close proximity of Homebush Bay and class 2 acid sulphate soils, Acid Sulphate Soils could potentially occur at the Site. The analysis of the samples indicated that natural soils in Borehole 1 can be considered to pose a low Potential Acidity risk. Ground water levels in Borehole 1 indicate that natural soils come from an anoxic environment, which would indicate soils will maintain the potential acidity risk if they are left undisturbed.

Laboratory analysis of soil from Borehole 2 indicate that the soil possesses nil actual and nil potential acidity risk. Analysis of natural soils in Borehole 3 indicated the soil should be considered to be Actual Acid Sulphate Soil. Soils from Borehole 3 were noted to be above the groundwater level resulting in an oxidising environment and the detected pH of less than 4.

Treatment of lime may be utilised to neutralise the actual acidity of the soils if the contact with the acid soils does not meet engineering criteria for concrete and steel structures. The laboratory recommended liming rate has been calculated at 1.96 and 10.1 kg/tonne for samples BH1 - 3 and BH3 – 1.5-1.9 respectively. The lime rate would neutralise the actual acidity and there is no potential for acid generation

5.0 CONCLUSION AND RECOMMENDATIONS

Laboratory analytical results indicate that there are areas of Actual Acid Sulphate Soils and areas of Potential Acid Sulphate Soils existing in the natural soils on the Site. Fill soils are noted to pose nil actual or potential acidity risk. Site observations indicate that the underlying soil profile consists of grey shale.

The detection of Actual Acid Sulphate Soils and the risk of potential acid sulphate soils indicate that an Acid Sulphate Soils Management Plan will be required to be produced for the Site. This plan will account for the management and monitoring of impacts on Site during both the construction and operation phase of the proposed development.

6.0 REFERENCES

Acid Sulfate Soil Manual – Acid Sulfate Soils Management Advisory Committee (ASSMAC) August 1998

Acid Sulfate Soils Assessment and Management - Environment Protection Authority, December 1995.

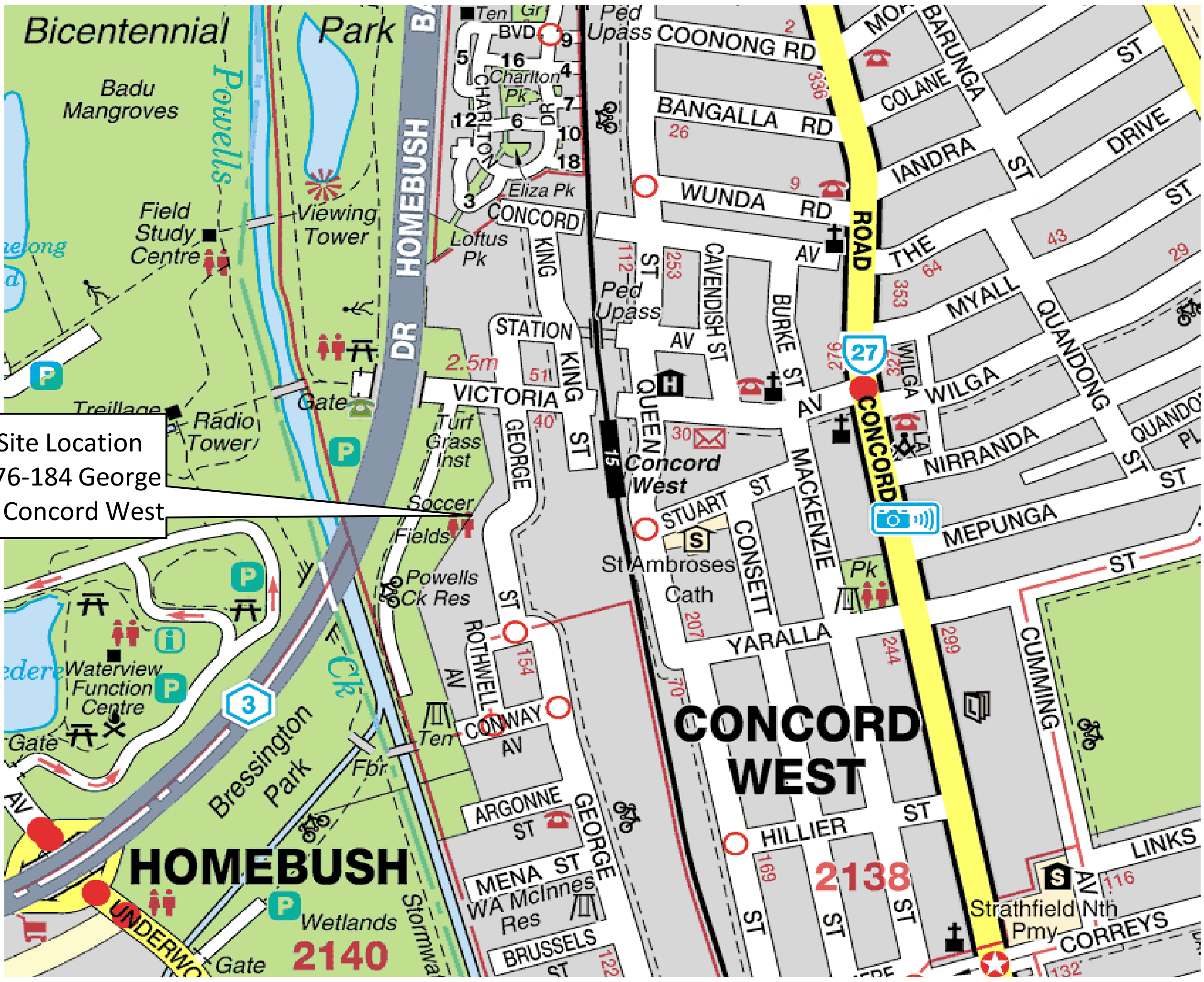
Department of Planning NSW website (iPlan) Acid Sulfate Soils

City of Canada Bay's Canada Bay Local Environmental Plan 2008 – Acid Sulfate Soil Soils Map Sheet ASS 004

Environment Protection Authority NSW, 2004: *Environmental Guidelines: Assessment, Classification & Management of Liquid and Non-Liquid Wastes,* EPA 99/21.

Figure 1

Site Location



DLA environmental Unit 2b/30 Leighton Place Hornsby, NSW 2077	**DESIGNED:** DLA	SITE LOCATION		
	COMPILED: AR	**CLIENT:**	Pinestreet Developments Pty Limited	**DRAWING:** 10/02/2012
	PROJ. No. DL2853	**LOCATION:**	176-184 George Street, Concord West 2134	**FIGURE:** 1

Figure 2

Site Layout with Sampling Location

DLA environmental	Site Layout with Sampling Locations			
	Title: 176-184 George St	Figure No: 2		Date: 10/2/12
	Newcastle Office Phone (02) 4949 3800 Fax (02) 4949 3811 Sydney Office Phone (02) 9476 1765 Fax (02) 9476 1557	Scale As shown	Sheet 1 of 1	Revision

Figure 3

City of Canada Bay Council Acid Sulfate Soil Map

Canada Bay Local Environmental Plan 2008

City of Canada Bay Council

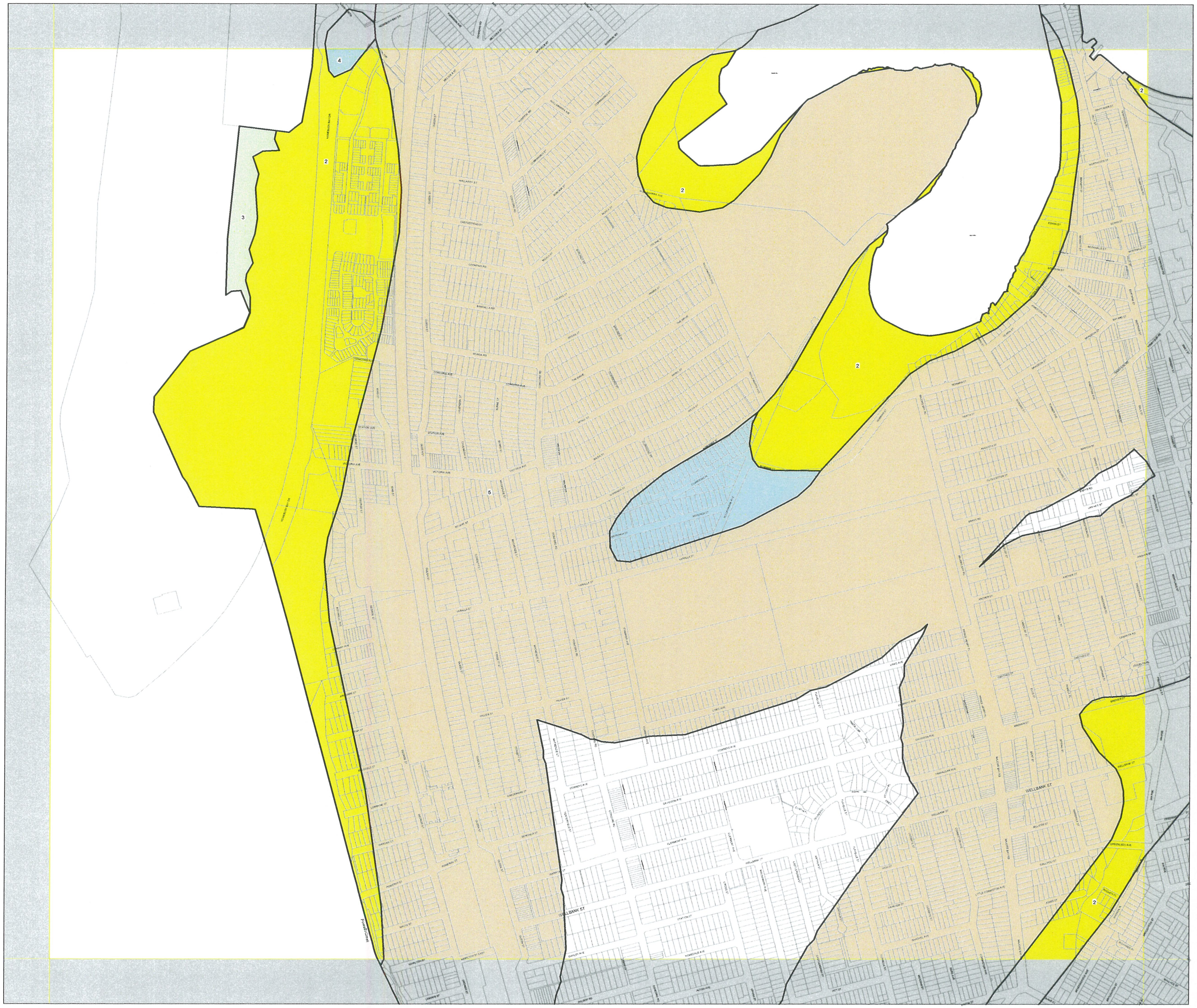
Acid Sulfate Soils Map - Sheet ASS 002

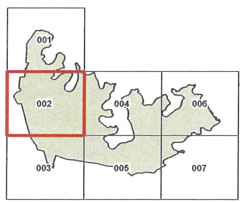
Acid Sulfate Soils

- 2 — Class 2
- 3 — Class 3
- 4 — Class 4
- 5 — Class 5

Cadastre

- Cadastre copyright Dept of Lands 20071207





N

0 200 400 Metres

Scale: 1: 10,000 @ A3

Projection: GDA 1994 Zone 56

Map identification number: 1520_COM_ASS_002_010_20071207

Appendix 1

NATA Certified Analytical Results

AUSTRALIA'S MOST TRUSTED EARTH SCIENCE SERVICES

SPOCAS

Sample Drop Off: 16 Chilvers Road, Thornleigh NSW 2120
Mailing Address: PO Box 357, Pennant Hills NSW 1715
Tel: 02 9980 6554
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Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 21303 **Sample N°: 1** **Date Received: 3/2/12** **Report Status:** ○ Draft ◉ **Final**

Client Name: **David Lane Associates (DLA**
Client Contact: **Anthony Richard**
Client Job N°: **DL2853**
Client Order N°:
Address: **"Ayrfield' Lot 18 Old North Rd NORTH ROTHBURY NSW 2335**

Project Name: **George St - Concord West**
Location: **176-184 George St - Concord West**
SESL Quote N°:
Sample Name: **BH1 -3m**
Description: **Soil**
Test Type: **sPOCAS**

Analysis	Unit	Result	Comment
pH kcl	pH units	5.22	Strong Acidity
TAA pH 6.5	moles H^+/t	11.5	
s-TAA pH 6.5	%w/w S	0.02	
pH Ox	pH unit	5.79	Medium Acidity
TPA pH 6.5	moles $H^{+/}$t	3.38	Insignificant Potential Acidity
s-TPA pH 6.5	%w/w S	0.01	
TSA pH 6.5	moles H^+/t	0.00	Nil Sulfidic Acidity
s-TSA pH 6.5	%w/w S	0.00	
ANC E	% $CaCO_3$		
a-ANC E	moles H^+/t		
s-ANC E	%w/w S		
S KCI	%w/w S	0.02	Insignificant Sulfidic Acidity
SP	%w/w	0.04	Minor Sulfidic Acidity
SPOS	%w/w	0.02	Insignificant Sulfidic Acidity
a-SPOS	moles H^+/t	14.7	
Ca KCI	%w/w	0.09	
Ca P	%w/w	0.09	
Ca A	%w/w	0.00	
Mg KCI	% w/w	0.07	
MgP	% w/w	0.07	
MgA	% w/w	0.00	
SRAS	% w/w	NR	
SHCI	% w/w S	0.03	
SNAS	% w/w S	0.02	
a-SNAS	molesH^+/t	9.67	
s-SNAS	% w/w S	0.02	
a-Net Acidity	molesH^+/t	26.2	
Liming Rate	kg $CaCO_3$/t	1.96	Low Treatment Level
a-Net Acidity without ANCE	molesH^+/t		
Liming Rate without ANCE	kg $CaCO_3$/t		

AS 4969 SPOCAS

For the purpose of acid sulphate soil assessment according to the Acid Sulfate Soil Manual (ASSMAC, 1998), this sample shows strong acidity and nil pH drop with nil sulfur generation after oxidation.

In conclusion SESL recommends that this soil poses **nil actual acidity risk and an insignificant potential acidity risk**. Liming of this material is required.

Consultant: Luke Jacovides

Authorised Signatory: Ryan Jacka

Method References:
Ahern CR, Blunden B and Stone Y (eds.) (1998). *Acid Sulphate Soils Laboratory Methods* Guidelines Published by the Acid Sulphate Soil Management Advisory committe, Wollongbar, NSW, Australia

Date of Report: 10/02/2012

END OF REPORT

SPOCAS

AUSTRALIA'S MOST TRUSTED EARTH SCIENCE SERVICES

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Batch N°: 21303 **Sample N°: 2** **Date Received: 3/2/12** **Report Status:** ○ Draft ◉ **Final**

Client Name: **David Lane Associates (DLA**
Client Contact: **Anthony Richard**
Client Job N°: **DL2853**
Client Order N°:
Address: **"Ayrfield' Lot 18 Old North Rd NORTH ROTHBURY NSW 2335**

Project Name: **George St - Concord West**
Location: **176-184 George St - Concord West**
SESL Quote N°:
Sample Name: **BH2 -6m**
Description: **Soil**
Test Type: **sPOCAS**

Analysis	Unit	Result	Comment
pH kcl	pH units	8.48	Moderate Alkalinity
TAA pH 6.5	moles H^+/t	0.00	
s-TAA pH 6.5	%w/w S	0.00	
pH Ox	pH unit	7.98	Slight Alkalinity
TPA pH 6.5	moles $H^{+/}$t		
s-TPA pH 6.5	%w/w S		
TSA pH 6.5	moles H^+/t		
s-TSA pH 6.5	%w/w S		
ANC E	% $CaCO_3$	0.46	
a-ANC E	moles H^+/t	0.00	
s-ANC E	%w/w S	0.00	
S KCI	%w/w S	0.02	Insignificant Sulfidic Acidity
SP	%w/w	0.04	Minor Sulfidic Acidity
SPOS	%w/w	0.02	Insignificant Sulfidic Acidity
a-SPOS	moles H^+/t	13.9	
Ca KCI	%w/w	0.19	
Ca P	%w/w	0.22	
Ca A	%w/w	0.03	
Mg KCI	% w/w	0.02	
MgP	% w/w	0.03	
MgA	% w/w	0.01	
SRAS	% w/w	NR	
SHCI	% w/w S	0.04	
SNAS	% w/w S	0.02	
a-SNAS	molesH^+/t	13.5	
s-SNAS	% w/w S	0.02	
a-Net Acidity	molesH^+/t	0.00	
Liming Rate	kg $CaCO_3$/t	0.00	Nil Treatment Level
a-Net Acidity without ANCE	molesH^+/t	0.00	
Liming Rate without ANCE	kg $CaCO_3$/t	0.00	

AS 4969 SPOCAS

For the purpose of acid sulphate soil assessment according to the Acid Sulfate Soil Manual (ASSMAC, 1998), this sample shows moderate alkalinity and a minor pH drop with insignificant sulfur generation after oxidation.

In conclusion SESL recommends that this soil poses **nil actual acidity risk and nil potential acidity risk**.

Consultant: Luke Jacovides

Authorised Signatory: Ryan Jacka

Method References:
Ahern CR, Blunden B and Stone Y (eds.) (1998). *Acid Sulphate Soils Laboratory Methods* Guidelines Published by the Acid Sulphate Soil Management Advisory committe, Wollongbar, NSW, Australia

Date of Report: 10/02/2012

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SPOCAS

Sample Drop Off: 16 Chilvers Road, Thornleigh NSW 2120
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Batch N°: 21303 **Sample N°: 3** **Date Received: 3/2/12** **Report Status:** ○ Draft ◉ **Final**

Client Name:	**David Lane Associates (DLA**	Project Name:	**George St - Concord West**
Client Contact:	**Anthony Richard**	Location:	**176-184 George St - Concord West**
Client Job N°:	**DL2853**	SESL Quote N°:	
Client Order N°:		Sample Name:	**BH2 -6.8m**
Address:	**"Ayrfield' Lot 18 Old North Rd NORTH ROTHBURY NSW 2335**	Description:	**Soil**
		Test Type:	**sPOCAS**

Analysis	Unit	Result	Comment
pH kcl	pH units	8.84	Strong Alkalinity
TAA pH 6.5	moles H^+/t	0.00	
s-TAA pH 6.5	%w/w S	0.00	
pH Ox	pH unit	8.36	Moderate Alkalinity
TPA pH 6.5	moles $H^{+/}$t		
s-TPA pH 6.5	%w/w S		
TSA pH 6.5	moles H^+/t		
s-TSA pH 6.5	%w/w S		
ANC E	% $CaCO_3$	0.77	
a-ANC E	moles H^+/t	0.00	
s-ANC E	%w/w S	0.00	
S KCl	%w/w S	0.02	Insignificant Sulfidic Acidity
SP	%w/w	0.07	Minor Sulfidic Acidity
SPOS	%w/w	0.04	Minor Sulfidic Acidity
a-SPOS	moles H^+/t	26.2	
Ca KCl	%w/w	0.21	
Ca P	%w/w	0.37	
Ca A	%w/w	0.16	
Mg KCl	% w/w	0.02	
MgP	% w/w	0.07	
MgA	% w/w	0.05	
SRAS	% w/w	NR	
SHCl	% w/w S	0.07	
SNAS	% w/w S	0.05	
a-SNAS	molesH^+/t	31.8	
s-SNAS	% w/w S	0.05	
a-Net Acidity	molesH^+/t	0.00	
Liming Rate	kg $CaCO_3$/t	0.00	Nil treatment level
a-Net Acidity without ANCE	molesH^+/t	0.00	
Liming Rate without ANCE	kg $CaCO_3$/t	0.00	

AS 4969 SPOCAS

For the purpose of acid sulphate soil assessment according to the Acid Sulfate Soil Manual (ASSMAC, 1998), this sample shows strong alkalinity and a minor pH drop with insignificant sulfur generation after oxidation.

In conclusion SESL recommends that this soil poses **nil actual acidity risk and nil potential acidity risk**.

Consultant: Luke Jacovides

Authorised Signatory: Ryan Jacka

Method References:
Ahern CR, Blunden B and Stone Y (eds.) (1998). *Acid Sulphate Soils Laboratory Methods* Guidelines Published by the Acid Sulphate Soil Management Advisory committe, Wollongbar, NSW, Australia

Date of Report: 10/02/2012

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SPOCAS

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Batch N°: 21303 **Sample N°: 4** **Date Received: 3/2/12** **Report Status:** ○ **Draft** ◉ **Final**

Client Name: **David Lane Associates (DLA**
Client Contact: **Anthony Richard**
Client Job N°: **DL2853**
Client Order N°:
Address: **"Ayrfield' Lot 18 Old North Rd NORTH ROTHBURY NSW 2335**

Project Name: **George St - Concord West**
Location: **176-184 George St - Concord West**
SESL Quote N°:
Sample Name: **BH3 -1.5-1.9m**
Description: **Soil**
Test Type: **sPOCAS**

Analysis	Unit	Result	Comment
pH kcl	pH units	3.98	Extreme Acidity
TAA pH 6.5	moles H^+/t	130	
s-TAA pH 6.5	%w/w S	0.21	
pH Ox	pH unit	5.00	Very Strong Acidity
TPA pH 6.5	moles $H^{+/}$t	135	Very Significant
s-TPA pH 6.5	%w/w S	0.22	
TSA pH 6.5	moles H^+/t	5.20	Insignificant Sulfidic Acidity
s-TSA pH 6.5	%w/w S	0.01	
ANC E	% $CaCO_3$		
a-ANC E	moles H^+/t		
s-ANC E	%w/w S		
S KCl	%w/w S	0.02	Insignificant Sulfidic Acidity
SP	%w/w	0.03	Minor Sulfidic Acidity
SPOS	%w/w	0.01	Nil Sulfidic Acidity
a-SPOS	moles H^+/t	4.35	
Ca KCl	%w/w	0.00	
Ca P	%w/w	0.00	
Ca A	%w/w	0.00	
Mg KCl	% w/w	0.03	
MgP	% w/w	0.03	
MgA	% w/w	0.00	
SRAS	% w/w	0.00	
SHCl	% w/w S	0.04	
SNAS	% w/w S	0.02	
a-SNAS	molesH^+/t	10.5	
s-SNAS	% w/w S	0.02	
a-Net Acidity	molesH^+/t	134.1	
Liming Rate	kg $CaCO_3$/t	10.1	Medium Treatment Level
a-Net Acidity without ANCE	molesH^+/t		
Liming Rate without ANCE	kg $CaCO_3$/t		

AS 4969 SPOCAS

For the purpose of acid sulphate soil assessment according to the Acid Sulfate Soil Manual (ASSMAC, 1998), this sample shows extreme acidity and nil pH drop with insignificant sulfur generation after oxidation.

In conclusion SESL recommends that this soil poses **a very significant actual acidity risk and a nil potential acidity risk**. Liming of this material is required.

Consultant: Luke Jacovides

Authorised Signatory: Ryan Jacka

Method References:
Ahern CR, Blunden B and Stone Y (eds.) (1998). *Acid Sulphate Soils Laboratory Methods* Guidelines Published by the Acid Sulphate Soil Management Advisory committe, Wollongbar, NSW, Australia

Date of Report: 10/02/2012

END OF REPORT