PLANNING PROPOSAL

AMENDMENT TO CANADA BAY LOCAL ENVIRONMENTAL PLAN 2013

THE CANADA BAY CLUB

BEVIN AVENUE

FIVE DOCK

NEXUS
Environmental Planning Pty Ltd
ABN 58 061 284 615

PLANNING PROPOSAL

AMENDMENT TO CANADA BAY LOCAL ENVIRONMENTAL PLAN 2013

THE CANADA BAY CLUB

BEVIN AVENUE

FIVE DOCK

3 May 2017

Prepared by:
Nexus Environmental Planning Pty Ltd
Suite 29, 103 Majors Bay Road
PO Box 212
CONCORD NSW 2137
Tel: (02) 9736 1313
Fax: (02) 9736 1306
Email: kennan@ozemail.com.au

B1851

Table of Contents

1. INTRODUCTION

Nexus Environmental Planning Pty Ltd has been requested by The Canada Bay Club to prepare a Planning Proposal to amend the Canada Bay Local Environmental Plan 2013 (**LEP 2013**) to permit car parking associated with the Canada Bay Club, Five Dock. The location of the Canada Bay Club is shown on **Figure 1**.

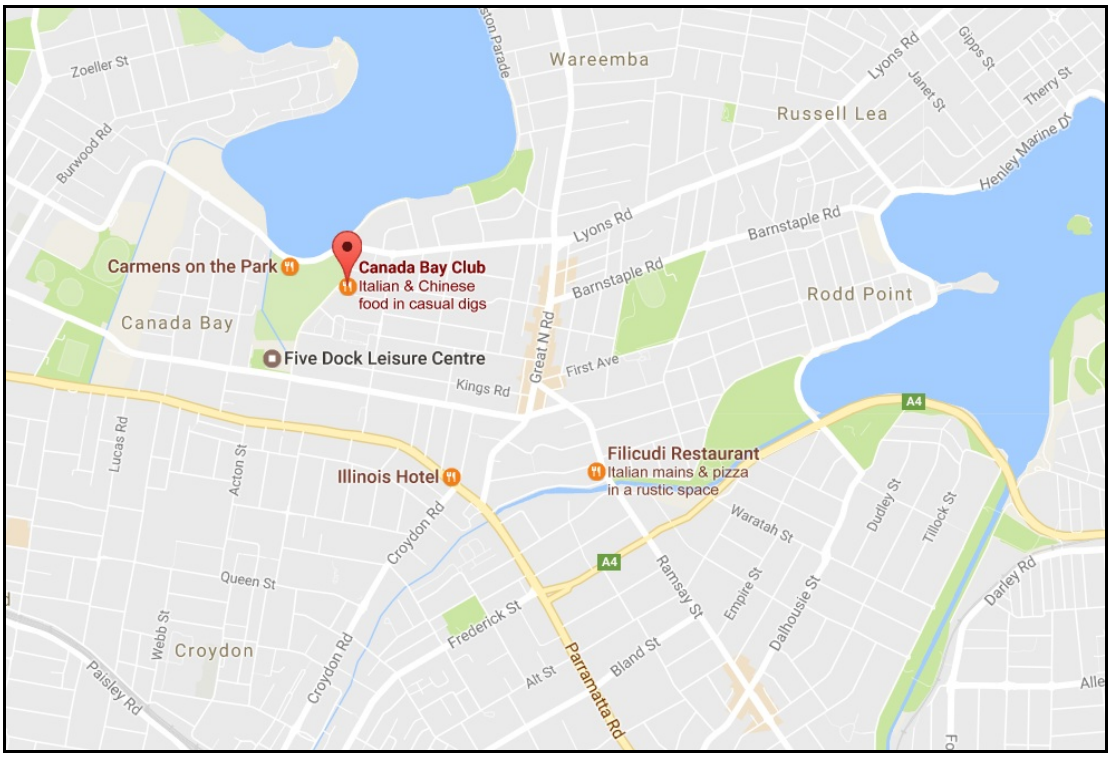

Figure 1: Location of the Canada Bay Club. © Google Maps

2. THE SITE OF THE PROPOSED REZONING

The Site of the proposed rezoning is legally defined as:

Lot 3, DP 527649
No.8 Bevin Avenue
FIVE DOCK

The Site is owned by the Western Suburbs Soccer, Sports and Community Club which is known as the Canada Bay Club. An extract from the title of the Site is at **Attachment 2**.

The Site is located on the northern side of Bevin Avenue to the east of the intersection of Bevin Avenue with William Street and to the west of the intersection of Bevin Avenue with Harris Road.

An extract from an aerial photograph of the Site is at **Figure 2**.

Figure 2: Extract from an aerial photograph showing the location of the Site. © SIX Maps

A cadastral map is at **Figure 3**.

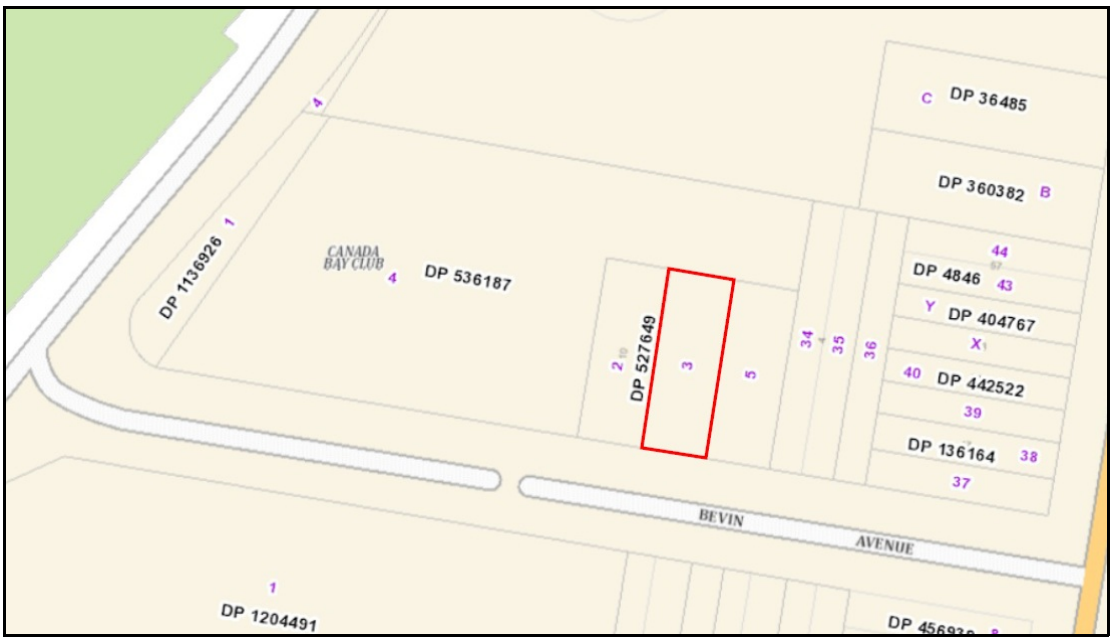

Figure 3: Cadastral map of the locality with the Site outlined in red. © SIX Maps

The Site is currently occupied by a part one and part two storey dwelling house.

A survey of the land owned by the Canada Bay Club including the Site has been undertaken by Summit Geomatic reduced copies of which are at **Attachment 1**. An extract from the survey plan is at **Figure 4**.

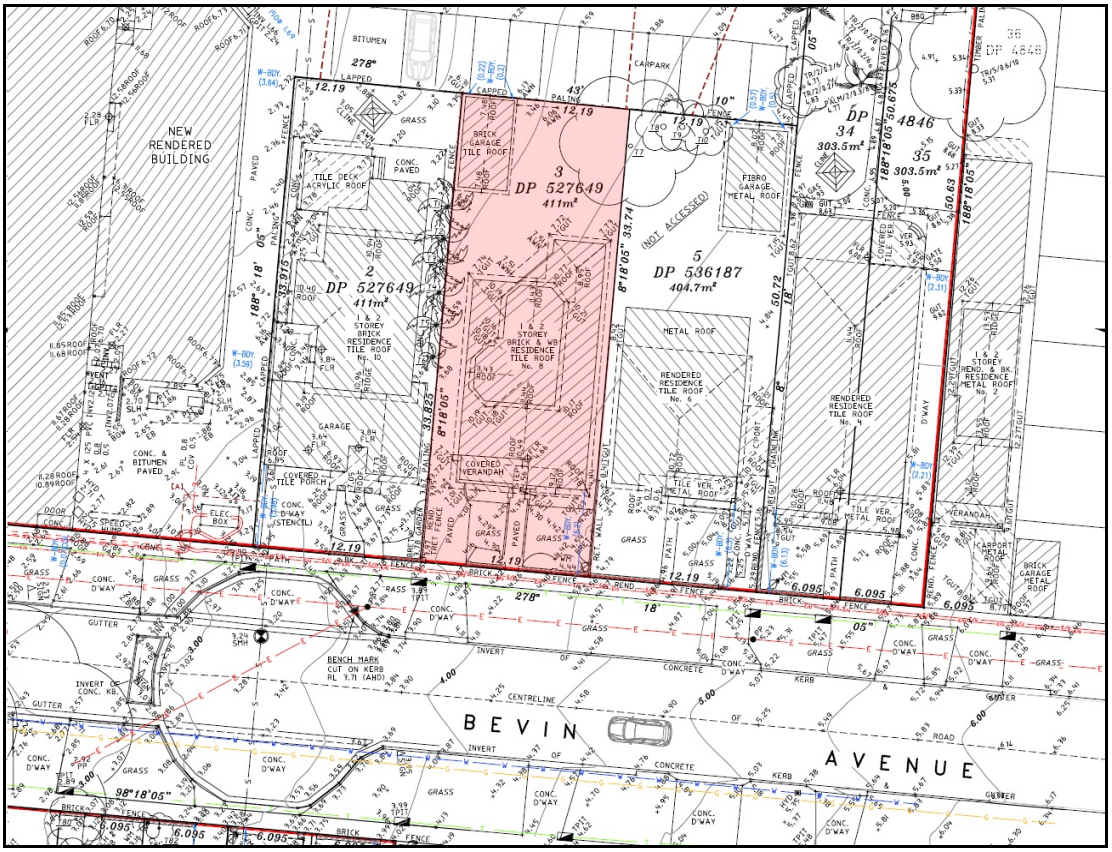

Figure 4: Extract from the survey of the Canada Bay Club land with the Site highlighted in red.

3. CURRENT ZONING OF THE SITE

The Site is zoned R2 Low Density Residential pursuant to LEP 2013. An extract from the LEP 2013 Map is at **Figure 5**.

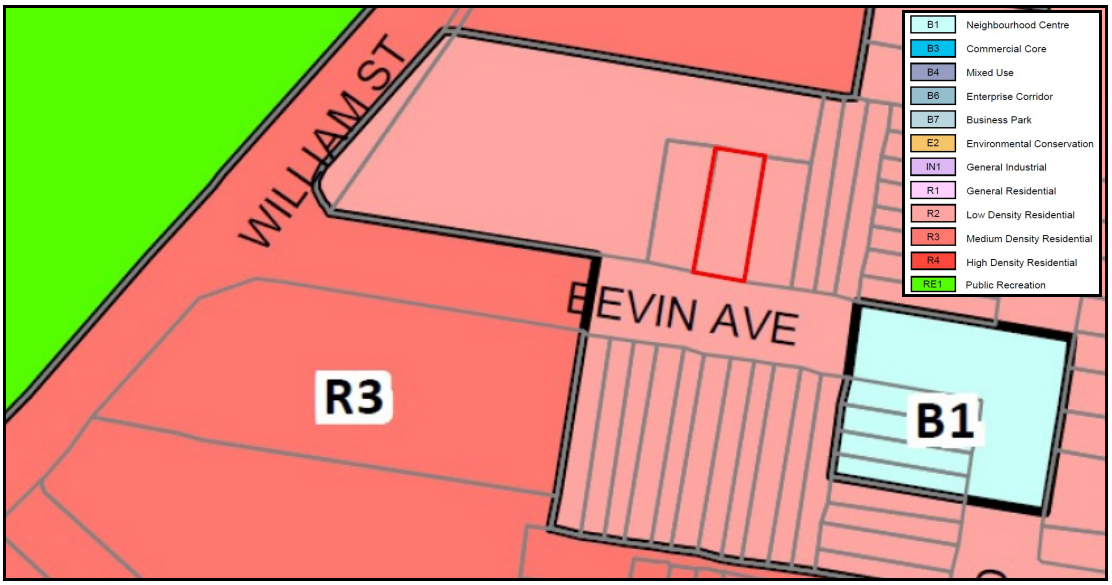

Figure 5: Extract from the LEP 2013 Map with the Site outlined in red.

4. PROPOSED REZONING

This Planning Proposal has been prepared in accordance with Section 55 of the Environmental Planning and Assessment Act 1979 and the Department of Planning Guide to Preparing Planning Controls (Department of Planning, 2012).

Clause 2.5 of LEP 2013 states:

> ***2.5 Additional permitted uses for particular land***
>
> *(1) Development on particular land that is described or referred to in Schedule 1 may be carried out:*
>
> *(a) with development consent, or*
>
> *(b) if the Schedule so provides—without development consent,*
>
> *In accordance with the conditions (if any) specified in that Schedule in relation to that development.*
>
> *(2) This clause has effect despite anything to the contrary in the Land Use Table or other provision of this Plan.*

The following clauses are contained in **Schedule 1** of LEP 2013:

> ***11 Use of certain land at Bevin Avenue, Five Dock***
>
> *(1) This clause applies to land at Bevin Avenue, Five Dock, being Lot 1, DP 860469.*
>
> *(2) Development for the following purposes is permitted with development consent if the use is associated with the adjacent Canada Bay Club:*
>
> *(a) car parks,*
>
> *(b) serviced apartments.*
>
> ***12 Use of certain land at Bevin Avenue, Five Dock***
>
> *(1) This clause applies to land at Bevin Avenue, Five Dock, being Lot 1, DP 1136926, Lot 4, DP 536187 and Lot 2, DP 527649.*
>
> *(2) Development for the purpose of a registered club is permitted with development consent.*

Lot 4, DP 536187 (Nos.12-18 Bevin Ave) and Lot 2, DP 527649 (No.10 Bevin Ave) are shown in the extract of the survey plan at **Figure 6**.

Lot 4, DP 536187 (Nos.12-18 Bevin Ave)	Lot 4 contains the existing Canada Bay Club building together with car parking associated with the Canada Bay Club.
Lot 2, DP 527649 (No.10 Bevin Ave)	Lot 2 contains a dwelling house.

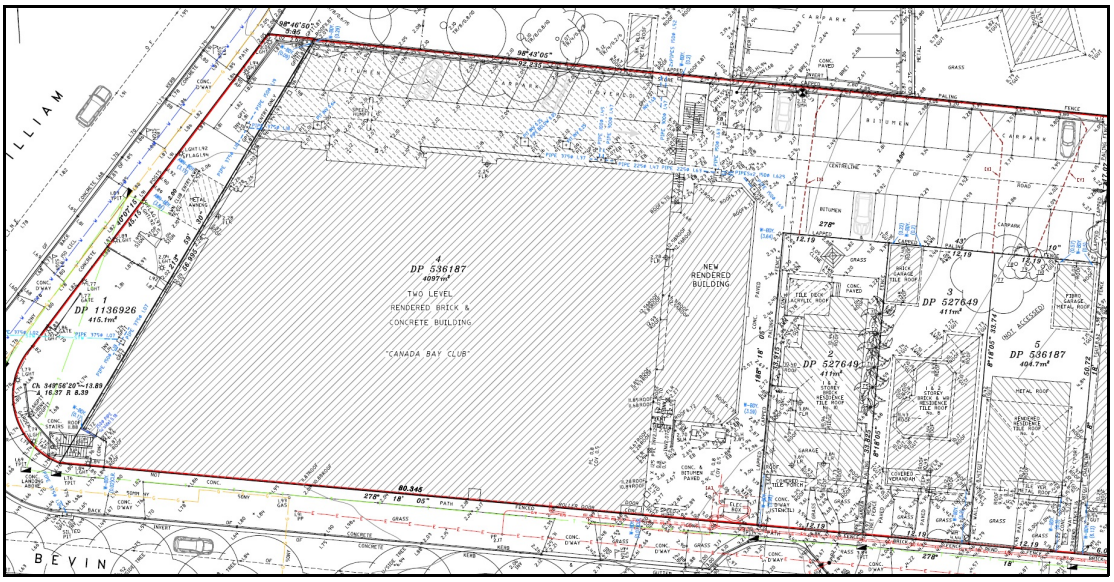

Figure 6: Extract from the survey at **Attachment 1**.

This Planning Proposal seeks a minor modification to LEP 2013, to allow car parking associated with the Canada Bay Club to be located on the Site. To enable this use, an amendment to Schedule 1 – Additional Permitted Uses of LEP 2013 is sought.

The proposed modification to **Schedule 1** of LEP 2013 would be as follows:

Use of certain land at Bevin Avenue, Five Dock

(1) This clause applies to land at Bevin Avenue, Five Dock, being Lot 2, DP 527649.

(2) Development for the purpose of car parking if the use is associated with the adjacent Canada Bay Club is permitted with development consent.

5. DEVELOPMENT FOLLOWING REZONING

Following the proposed modification to LEP 2013 it is proposed that the dwelling houses on Lots 2 & 3, DP 527649 (Nos.8 & 10 Bevin Ave) would be demolished and that land would be developed as car parking associated with the Canada Bay Club. This development would take the form of:

1. Demolish all development currently located on Nos. 8 and 10 Bevin Avenue.

2. Construction of an additional 40 off-street car parking spaces.

3. Construction of an additional 2 on-street car parking spaces in Bevin Avenue by way of reorganising the car parking to 90 degree parking rather than parallel parking.

4. Construct a new cul-de-sac at the head of Bevin Avenue.

5. Demolish the existing cul-de-sac head in Bevin Avenue and replace with grass verge and part of the entrance to the new off-street car parking. New kerb and guttering will be provided in this section of Bevin Avenue.

6. Construction of new sealed pavement to give effect to new on-street car parking.

7. Install rubber speed cushions in Bevin Avenue near the intersection of Bevin Avenue with William Street.

8. Construct appropriate traffic direction kerb at the intersection of Bevin Avenue with William Street.

A preliminary development plan of the proposed development following rezoning has been prepared by Lyle Marshall & Partners Pty Ltd, a copy of which is at **Attachment 3**.

An extract from the preliminary development plan is at **Figures 7**.

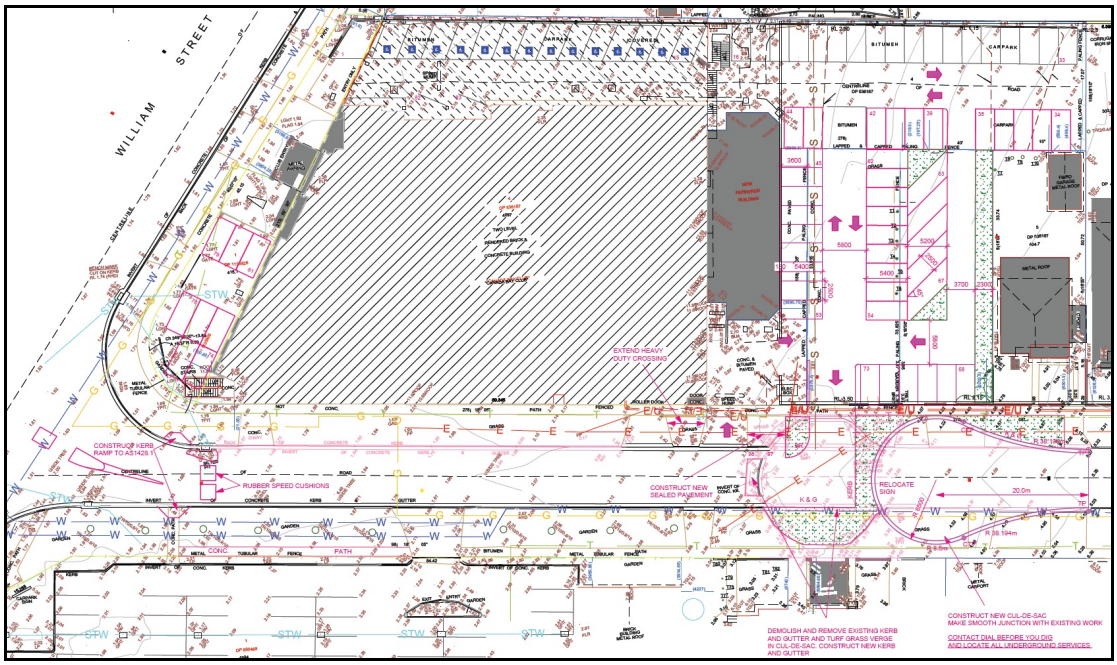

Figure 7: Extract from the preliminary development plan.

6. JUSTIFICATION

6.1 Section A - Need for the planning proposal

1. Is the planning proposal a result of any strategic study or report?

The planning proposal is not the result of any strategic study or report.

2. Is the planning proposal the best means of achieving the objectives or intended outcomes, or is there a better way?

The intended outcome is for car parking associated with the Canada Bay Club to be a permitted use on the Site. The planning proposal is considered to be the best means of achieving the intended outcome.

3. Is there a net community benefit?

The net community benefit is that the Site will be able to be used for much needed off-street car parking associated with the Canada Bay Club which will relieve existing pressure for car parking on the public road system in and around the Canada Bay Club which is, at many times during the day, at a premium.

6.2 Section B - Relationship to strategic planning framework

4. Is the planning proposal consistent with the objectives and actions contained within the applicable regional or sub-regional strategy (including the Sydney Metropolitan Strategy and exhibited draft strategies)?

A Plan for Growing Sydney, released in December 2014, is the NSW Government's plan for the future of the Sydney Metropolitan Area over the next 20 years. The Plan provides key directions and actions to guide Sydney's productivity, environmental management, and liveability - including the delivery of housing, employment, infrastructure and open space.

There are no specific State or regional strategic requirements which affect the Site.

5. Is the planning proposal consistent with the local council's Community Strategic Plan, or other local strategic plan?

There are no Community Strategic Plans or other local strategic plans relevant to the Site.

6. Is the planning proposal consistent with the applicable state environmental planning policies?

State Environmental Planning Policy No.55 - Remediation of Land

State Environmental Planning Policy No.55 - Remediation of Land (**SEPP 55**) aims:

> *.... to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment.*

Clause 7 of SEPP 55 states:

> *7. (1) A consent authority must not consent to the carrying out of any development on land unless:*
>
> *(a) it has considered whether the land is contaminated, and*
>
> *(b) if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and*
>
> *(c) if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.*

(2) Before determining an application for consent to carry out development that would involve a change of use on any of the land specified in subclause (4), the consent authority must consider a report specifying the findings of a preliminary investigation of the land concerned carried out in accordance with the contaminated land planning guidelines.

(3) The applicant for development consent must carry out the investigation required by subclause (2) and must provide a report on it to the consent authority. The consent authority may require the applicant to carry out, and provide a report on, a detailed investigation (as referred to in the contaminated land planning guidelines) if it considers that the findings of the preliminary investigation warrant such an investigation.

(4) The land concerned is:

(a) land that is within an investigation area,

(b) land on which development for a purpose referred to in Table 1 to the contaminated land planning guidelines is being, or is known to have been, carried out,

(c) to the extent to which it is proposed to carry out development on it for residential, educational, recreational or child care purposes, or for the purposes of a hospital land:

(i) in relation to which there is no knowledge (or incomplete knowledge) as to whether development for a purpose referred to in Table 1 to the contaminated land planning guidelines has been carried out, and

(ii) on which it would have been lawful to carry out such development during any period in respect of which there is no knowledge (or incomplete knowledge).

The Site has been used for a considerable time as residential development. The proposed development would be off-street car parking on that part of the Site which has been used for residential development.

It is considered unlikely that any contamination is present on the Site to warrant further investigation.

There are no other State Environmental Planning Policies which are relevant to the planning proposal.

7. Is the planning proposal consistent with applicable Ministerial Directions (s.117 directions)?

Clause 6.1 of LEP 2013 relates to Acid Sulfate Soils. **Sub-clause 6.1(1)** states:

(1) The objective of this clause is to ensure that development does not disturb, expose or drain acid sulfate soils and cause environmental damage.

Figure 8 is an extract from the LEP 2013 Acid Sulfate Soils map which shows that the Site is classified as Class 5.

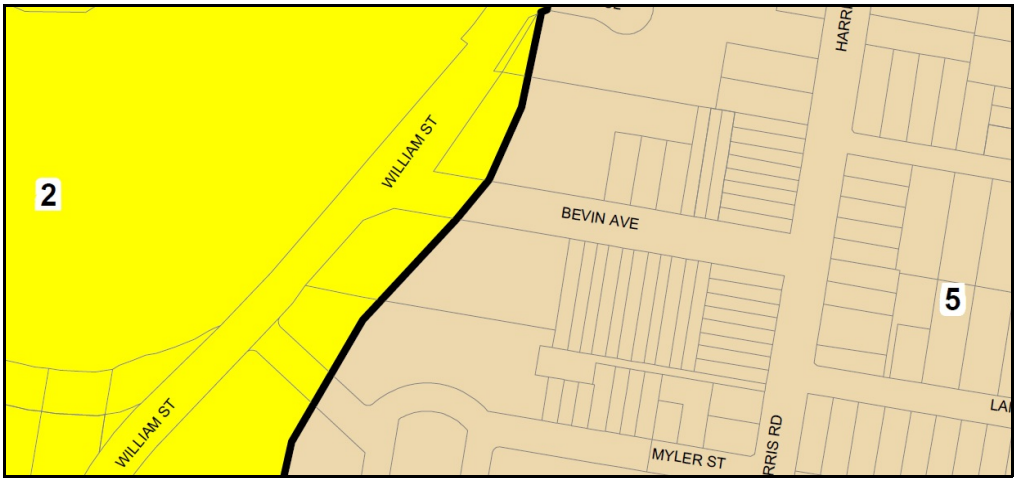

Figure 8: Extract from the LEP 2013 Acid Sulfate Soils Map.

S.117 Direction 4.1 deals with Acid Sulphate Soils and has the following objective:

> *(1) The objective of this direction is to avoid significant adverse environmental impacts from the use of land that has a probability of containing acid sulfate soils.*

The direction applies "*.... to all relevant planning authorities that are responsible for land having a probability of containing acid sulfate soils, as shown on Acid Sulfate Soils Planning Maps held by the Department of Planning*".

The direction applies "*... when a relevant planning authority prepares a planning proposal that will apply to land having a probability of containing acid sulfate soils as shown on the Acid Sulfate Soils Planning Maps*".

If the direction applies, the relevant planning authority "*.... must consider the Acid Sulfate Soils Planning Guidelines adopted by the Director-General of the Department of Planning when preparing a planning proposal that applies to any land identified on the Acid Sulfate Soils Planning Maps as having a probability of acid sulfate soils being present*".

Sub-clause 6 of the direction states:

> *(6) A relevant planning authority must not prepare a planning proposal that proposes an intensification of land uses on land identified as having a probability of containing acid sulfate soils on the Acid Sulfate Soils Planning Maps unless the relevant planning authority has considered an acid sulfate soils study assessing the appropriateness of the change of land use given the presence of acid sulfate soils. The relevant planning authority must provide a copy of any such study to the Director- General prior to undertaking community consultation in satisfaction of section 57 of the Act.*

An Acid Sulfate Soil Analysis has been prepared, a copy of which is at **Attachment 4**. The conclusion of that analysis is:

> *The POCAS results for the majority of samples identified acidic conditions greater than the certain action criteria, however these results are considered to be indicative of mildly acidic soils associated with organic/humic material rather*

than PASS as no significant concentrations of oxidisable sulfur were encountered in the samples. As such, there is considered to be a low potential for ASS to be disturbed during the proposed development. EIS therefore conclude that the risk of generating ASS conditions following disturbance of the fill/natural soils for the proposed development at the site is low and an ASSMP is not considered to be required for the proposed works.

There are no other s.117 Direction is Directions considered applicable to the Planning Proposal.

6.3 Section C - Environmental, social and economic impact

8. Is there any likelihood that critical habitat or threatened species, populations or ecological communities, or their habitats, will be adversely affected as a result of the proposal?

No critical habitat or threatened species, populations or ecological communities, or their habitats, will be adversely affected as a result of the planning proposal.

9. Are there any other likely environmental effects as a result of the planning proposal and how are they proposed to be managed?

Impacts to the natural and built environment

The proposed development following rezoning of the Site would have no adverse impact to the natural or built environment.

Environmental Risk

There is environmental risk associated with the demolition of the existing dwelling on the site. A Material Hazard Report has been prepared for each dwelling proposed to be demolished with one dwelling being identified as possibly containing asbestos material. The recommendations of that Material Hazard report should form a condition of any consent issued for any future development.

Social Impacts

The planning proposal and subsequent development of car parking associated with the Canada Bay Club would have a positive social impact in that the amenities available to Canada Bay Club members and their guests would be significantly enhanced. In addition, the proposed car park would relieve some of the existing pressure on public on-street car parking.

Economic Impact

There would be no significant economic impact resulting from the planning proposal.

7. CONCLUSION

It is proposed to modify the Canada Bay Local Environmental Plan 2013 by allowing development on No.8 Bevin Avenue for car parking associated with the adjoining Canada Bay Club.

It has been demonstrated that the planning proposal and subsequent development would have no adverse impact on the environment.

The planning proposal has planning merit and should be supported by the Council.

Attachment 1

Reduced copy of the Site Survey

Scale: 1:200 @ A1
Scale: 1:400 @ A3

2m 6m 10m
0 4m 8m 20m

SEE NOTES SHEET 1

Peter Nancarrow
Registered Surveyor Under The
Surveying and Spatial Information Act 2002.

M.G.A.
T.N.

MACKANESS CLOSE

WILLIAM STREET ROAD

BEVIN AVENUE

CENTRELINE OF ROAD

INVERT OF CONCRETE KERB

FENCE

GRASS

METAL TUBULAR FENCE

GATE

PATH

CONC. D'WAY

CONC. PAVED

BIN AREA

BALCONY

STAIRS

RIDGE

2 STOREY BRICK UNITS TILE ROOF

BITUMEN CARPARK

(COVERED)

SPEED HUMP

STORE

BK. BLD. ROOF

METAL ROOF

LAPPED ROOF

CONC. & BITUMEN PAVED

ELEC BOX

ROLLER DOOR

PALING FENCE

CONCRETE FENCE

TIMBER PALING FENCE

CORRUGATED IRON SHED

BRICK GARAGE TILE ROOF

FIBRO GARAGE METAL ROOF

3 STOREY BRICK UNITS TILE ROOF

RENDERED RESIDENCE TILE ROOF No. 6

RENDERED RESIDENCE TILE ROOF No. 4

1 & 2 STOREY BRICK & WB RESIDENCE TILE ROOF No. 8

1 & 2 STOREY BRICK RESIDENCE TILE ROOF No. 10

1 & 2 STOREY REND. & BK. RESIDENCE METAL ROOF No. 2

COVERED TILE PORCH

COVERED VERANDAH

TILE VER. METAL ROOF

METAL ROOF

BRICK GARAGE METAL ROOF

CARPORT METAL ROOF

TILE DECK ACRYLIC ROOF

BBQ

NEW RENDERED BUILDING

4
DP 536187
4097m²
TWO LEVEL
RENDERED BRICK &
CONCRETE BUILDING
"CANADA BAY CLUB"

1
DP 1136926
415.1m²

2
DP 532285
No. 4

2
DP 527649
411m²

3
DP 527649
411m²

5
DP 536187
404.7m²

6
DP 360382

36
DP 4846

34
303.5m²

35
303.5m²

98°46'50" 5.95

98°43'05" 92.235

278° 18' 05" 80.345

98° 43' 05" 6.095 6.095

278° 18' 05" 50.675

188° 18' 05" 50.63

188° 18' 05" 33.974

8° 18' 05" (NOT ACCESSED) 33.74

188° 18' 05" 33.975

8° 18' 05" 33.825

278° 18' 05" 50.72

Ch 349°56'20" 13.89
A 16.37 R 8.39

407° 15' 45.15

30' 59' 215° 66.905

Adjoins Sheet 2

Adjoins Sheet 4

SCHEDULE OF TREES

T1	PALM/2/0.3/6	9.34	
T2	PALM/2/0.3/6	9.42	
T3	PALM/2/0.3/6	9.47	
T4	PALM/2/0.3/6	9.56	
T5	PALM/2/0.3/4	9.61	
T6	PALM/1/0.3/3	9.65	
T7	TR/5/0.3/8		
T8	TR/2/0.4/6		
T9	TR/2/0.4/6		
T10	TR/2/0.4/6		

KEY DIAGRAM:

Revisions:

ISSUE	DATE	AMENDMENT	BY
F			
E	23/09/2016	Additional Detail Added Rear Of No.4 Bevin Ave. (Sheet 3)	PN.
D	12/03/2014	No's,4,6,8,10 Bevin Ave, No's, 9, 11 Bevin Ave, 'Info Added'	P.N.
C	22/08/2011	New Bldg, Easements & Detail Added (Shts 1,2,3)	A.H.

CLIENT:
Canada Bay Club
C/O: Lyle Marshall & Associates Pty Ltd.
Suite 8, 871 Pacific Highway
Chatswood, NSW 2067

LOT -	SURVEYOR:	DRWN BY: CHKD BY:
DP -	AH. / PM. / PN.	A.H. / S.S. P.N.
TITLE:	DATE OF SURVEY: 21/10/09,12/08/11,12/03/14,15/09/16	
L.G.A.: CANADA BAY	LEVEL DATUM: AHD	ORIGIN: SSM 79922
PARISH: CONCORD	ORIGIN RL: 2.133	SOURCE: SCIMS 2/10/2009
COUNTY: CUMBERLAND	CONTOUR INTERVAL: 0.5m	

PLAN OF DETAIL AND LEVELS
CANADA BAY CLUB
9-12 Bevin Avenue, Five Dock, NSW 2046

ORIENTATION: M.G.A. SCALE: 1:200 @A1 SCALE: 1:400 @A3

summit GEOMATIC
REGISTERED CONSULTING SURVEYORS
SUMMIT GEOMATIC PTY LTD
ABN: 71 092 947 601
PO BOX 7809, BAULKHAM HILLS B.C. NSW 2153
Ph. (02) 9836 3155 Fax (02) 9836 3177
Email: survey@summitgeo.com.au
http://www.summitgeo.com.au

JOB REF: 3243
REV No: F
SHEET 3 OF 6
A1

Attachment 2

Title documents for the Site

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 3/527649

SEARCH DATE	TIME	EDITION NO	DATE
13/12/2016	4:34 PM	5	19/8/2013

LAND

LOT 3 IN DEPOSITED PLAN 527649
AT FIVEDOCK
LOCAL GOVERNMENT AREA CANADA BAY
PARISH OF CONCORD COUNTY OF CUMBERLAND
TITLE DIAGRAM DP527649

FIRST SCHEDULE

WESTERN SUBURBS SOCCER, SPORTS & COMMUNITY CLUB LIMITED (T AH954645)

SECOND SCHEDULE (3 NOTIFICATIONS)

1 RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)
2 DP527649 EASEMENT FOR DRAINAGE APPURTENANT TO THE LAND ABOVE DESCRIBED
3 AH954646 MORTGAGE TO COMMONWEALTH BANK OF AUSTRALIA

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

PRINTED ON 13/12/2016

Attachment 3

Preliminary Development Plan

EXISTING PARKING SPACES

CLUB OFF-STREET	57 SPACES
TOTAL	57 SPACES

FUTURE PARKING

CLUB OFF-STREET NOs. 1 TO 83	83 SPACES
TOTAL	83 SPACES

ADDITIONAL SPACES — 26 SPACES

ISSUE	DATE	APPD	COMMENTS
B	07/06/16		CUL-DE-SAC RELOCATED
C	29/06/16		MINOR AMENDMENTS
D	31/10/16		CONC. FOOTPATH & PRAM RAMPS ADDED, PROPOSED
			CUL-DE-SAC RELOCATED, EXIST. DIS. PARKING MARKED
E	02/05/17		PARKING ON LOTS 34 & 35 DELETED, PARALLEL PARKING
			ON BEVIN AVE. REMOVED, 45 DEGREE PARKING ADDED

plot date : 02/05/17
file name :

LYLE MARSHALL & PARTNERS PTY. LTD.
CONSULTING ENGINEERS, TRANSPORTATION, ENVIRONMENTAL PLANNERS & ARCHITECTS
NOMINATED ARCHITECT : ERICA MARSHALL-MCCLELLAND : NO. 6513
LEVEL 2 SUITE 31
401 PACIFIC HIGHWAY
ARTARMON N.S.W 2064
The Association of Consulting Engineers Australia
phone: (02) 9436 0086
fax: (02) 9436 0082
email: lyle@lylemarshall.com.au
web: www.lylemarshallandassociates.info

CLIENT: **CANADA BAY CLUB**
4 WILLIAM STREET FIVE DOCK
PROPOSED EXTENSION OF CAR PARK AT NO 8 AND NO 10 BEVIN AVENUE, FIVE DOCK

SCALE	PASSED	DATE
1:250		02.05.17

DESIGN	LMA	JOB No.	SHEET No.	ISSUE
DRAWN	TT	2158-6-16	1E	P1
CHECKED	GLM	DATE FIRST ISSUED. 1.12.15	OF	

Attachment 4

Acid Sulfate Soils Analysis

ENVIRONMENTAL INVESTIGATION SERVICES

21 September 2016
Ref: E29677Klet-ASS

Canada Bay Club
Po Box 85
Five Dock NSW 2046

Attention: Mr Adam Lewis

PRELIMINARY ACID SULFATE SOIL ASSESSMENT
PROPOSED CARPARK
4, 8 & 10 BEVIN AVENUE, FIVE DOCK, NSW

1 INTRODUCTION

Canada Bay Club ('the client') commissioned Environmental Investigation Services (EIS)[1] to undertake a preliminary acid sulfate soil (ASS) assessment for the proposed car park at 4, 8 & 10 Bevin Avenue, Five Dock, NSW. The site is identified as Lot 2 in DP527649, Lot 3 in DP527649, Lot 34 in DP4846 and Lot 35 in DP4846. The site location is shown on Figure 1 and the investigation was confined to the proposed development area as shown on Figure 2.

The investigation was undertaken generally in accordance with an EIS proposal (Ref: EP43083K) of 4 August 2016 and written acceptance from Adam Lewis of Canada Bay Club by email of 9 August 2016. 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. 29677Prpt, dated 21 September 2016).

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.

1.1 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.

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

[2] Geotechnical consulting division of J&K

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

Postal Address: PO Box 976, North Ryde BC NSW 1670
Tel: 02 9888 5000 ● Fax: 9888 5004
EIS is a division of Jeffery and Katauskas Pty Ltd ● ABN 17 003 550 801

1.2 Proposed Development Details

EIS understand that the proposed development includes the demolition of existing site structures and the construction of an on grade car park. The proposed car park will be incorporated into the existing on grade carpark located to the north and west of the site. It is understood that following the future acquisition of number 6 Bevin Avenue that the proposed development will change to a three level car park which will require excavation of up to 3 metres.

2 SITE INFORMATION

2.1 Site Description

The site is located within undulating regional topography with the site located on the side of a west facing hillside which slopes towards Canada Bay. The site is located on the northern side of Bevin Avenue and approximately 50m west of the Bevin Avenue and Harris Road junction.

At the time of the investigation, the site comprised 3 properties (Number 4, Number 8 & Number 10 Bevin Avenue) & the existing asphaltic concrete (AC) carpark of the Canada Bay club.

A two storey brick house was located on both Number 8 and Number 10. A single level rendered house was located on Number 4. Located over the northern section of the site was the existing AC surfaced car park for the Canada Bay Club. The pavement surface appeared to be in fair to poor condition, with areas of rutting, crocodile cracking, delamination and AC patchwork.

Located to the east of the site was a 1 and 2 level brick and rendered house. Located to the north of the site was a 3 level brick building.

2.2 Regional Geology

The geological map of Sydney (1983[4]) indicates the site to be underlain by Ashfield Shale of the Wianamatta Group, which typically consists of black to dark grey shale and laminite. It is noted that the site is located close to the boundary of Hawkesbury Sandstone, which typically consists of medium to coarse grained quartz sandstone with minor shale and laminite lenses, Quaternary aged deposits of medium to fine-grained marine sands with podsols and man-made fill.

2.3 Canada Bay Council Local Environmental Plan (LEP) 2013

A review of the Canada Bay council LEP indicates that the site is located in an ASS risk Class 5 area The potential risks from ASS in Class 5 areas are deemed to be associated with works within 500m of adjacent Class 1,2,3,4 land which are likely to lower the water table below 1m AHD on the adjacent land (refer to appendices for further details on each risk class).

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

2.4 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 is not located within a risk area. The site is located approximately 50m east of 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.

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

[5] Department of Land and Water Conservation, (1997). *1:25,000 Acid Sulfate Soil Risk Map (Series 9130N3, Ed 2).*

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 has been adopted for this assessment. These criteria have been adopted as a conservative measure due to the fact that there were a range of soil types encountered at the site.

4 INVESTIGATION PROCEDURE

4.1 Subsurface Investigation and Soil Sampling Methods

Field work for this investigation was undertaken on 30 and 31 August 2016. Soil samples were collected from four locations in conjunction with the JK Geotechnics investigation, to a maximum borehole depth of 6.6m. Based on the proposed development details provided at the time of reporting, the number of sample locations and the depth of sampling meets the minimum requirements outlined in the ASS Manual 1998. The sampling locations are shown on the attached Figure 2.

The sample locations were drilled using a track mounted hydraulically operated drill rig equipped with spiral flight augers. Soil samples were obtained from a Standard Penetration Test (SPT) sampler or directly from the auger when conditions did not allow use of the SPT sampler.

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 COC procedures. Additional samples were frozen and stored pending further analysis.

4.2 Laboratory Analysis

One selected fill and three 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: 152793) attached in the appendices for further information.

5 RESULTS OF THE INVESTIGATION

5.1 Subsurface Conditions

The subsurface conditions encountered generally consisted of asphaltic concrete or concrete pavement to a maximum depth of 0.13m, underlain by fill material to a depth of approximately 0.4m, underlain by residual silty clay and sandstone bedrock to the termination depth of the boreholes. The fill material typically consisted of silty sand, silty clay, silty gravelly sand and sandy clay with inclusions of igneous gravel, slag, root fibres, concrete and brick fragments. Reference should be made to the borehole logs attached in the appendices for further details.

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 5-1: Summary of ASS Results

Analyte	Results Compared to ASS Guidelines
pH_{kcl} and pH_{ox}	The pH_{KCl} results ranged from 3.6 to 6.4. Prior to oxidation the pH values of two soil samples suspended in potassium chloride solution were below pH 5. The remaining two were above pH 5. Following oxidation, the pH_{ox} results for the samples ranged from 4.2 to 6.6. The pH of the samples typically dropped by between 0.1 to 1.2 units following oxidation. The pH of two samples increased following oxidation.

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

Analyte	Results Compared to ASS Guidelines
Acid Trail	• TAA results ranged from less than the practical quantitation limit (PQL) to 74mol H^+/tonne. Two of the results were above the action criterion of 18mol H^+/tonne; • TPA results ranged from less than the PQL to 74mol H^+/tonne. One of the results, BH4 (1.5-1.95m), was above the action criterion of 18mol H^+/tonne; and • TSA results were less than PQL.
Sulfur Trail	The S_{pos}% results ranged from less than the PQL to 0.02%. The S_{pos}% results in all of the samples analysed were below the action criterion of 0.03% as shown on Table A.
Liming Rate	The liming rate required for neutralisation ranged from 0.75 kg$CaCO_3$/tonne to 5.9 kg$CaCO_3$/tonne.

6 CONCLUSIONS

The sPOCAS results for the majority of samples identified acidic conditions greater than the certain action criteria, however these results are considered to be indicative of mildly acidic soils associated with organic/humic material rather than PASS as no significant concentrations of oxidisable sulfur were encountered in the samples. As such, there is considered to be a low potential for ASS to be disturbed during the proposed development. EIS therefore conclude that the risk of generating ASS conditions following disturbance of the fill/natural soils for the proposed development at the site is low and an ASSMP is not considered to be required for the proposed works.

7 LIMITATIONS

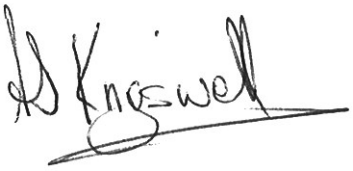
The report limitations are outlined below:

- 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;
- Copyright in this report is the property of EIS. EIS has used a degree of care, skill and diligence normally exercised by consulting professionals in similar circumstances and locality. No other warranty expressed or implied is made or intended. Subject to payment of all fees due for the investigation, the client alone shall have a licence to use this report;
- If the client, or any person, provides a copy of this report to any third party, such third party must not rely on this report except with the express written consent of EIS; and
- Any third party who seeks to rely on this report without the express written consent of EIS does so entirely at their own risk and to the fullest extent permitted by law, EIS accepts no liability whatsoever, in respect of any loss or damage suffered by any such third party.

If you have any questions concerning the contents of this letter please do not hesitate to contact us.

Kind Regards

Geoff Fletcher
Senior Environmental Scientist

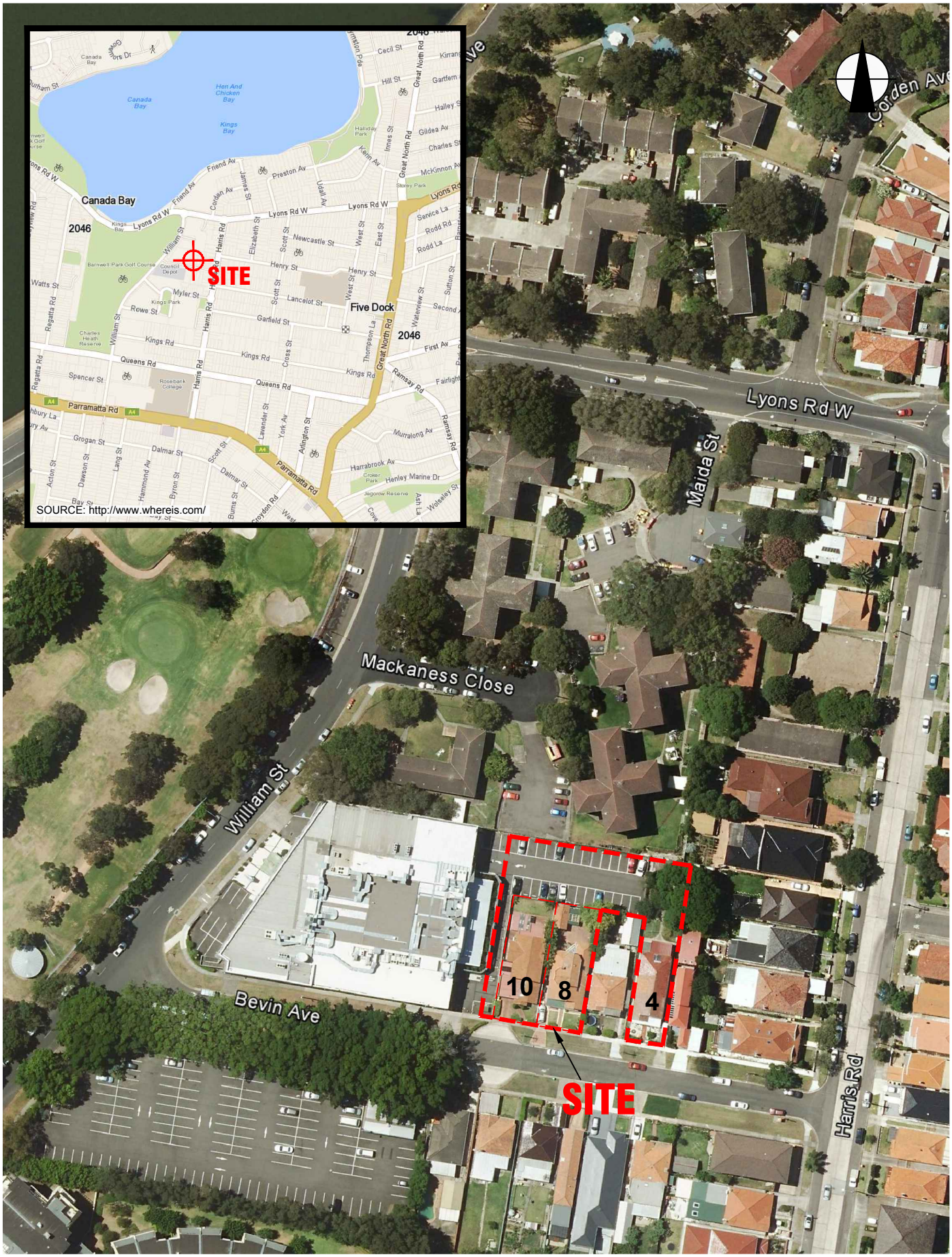


Adrian Kingswell
Principal

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
AERIAL IMAGE ©: 2015 GOOGLE INC.

This plan should be read in conjunction with the EIS report.

Title:	**SITE LOCATION PLAN**
Project:	4,8 & 10 BEVIN AVENUE FIVE DOCK, NSW
Report No:	E29677K
Figure No:	1

ENVIRONMENTAL INVESTIGATION SERVICES

EIS

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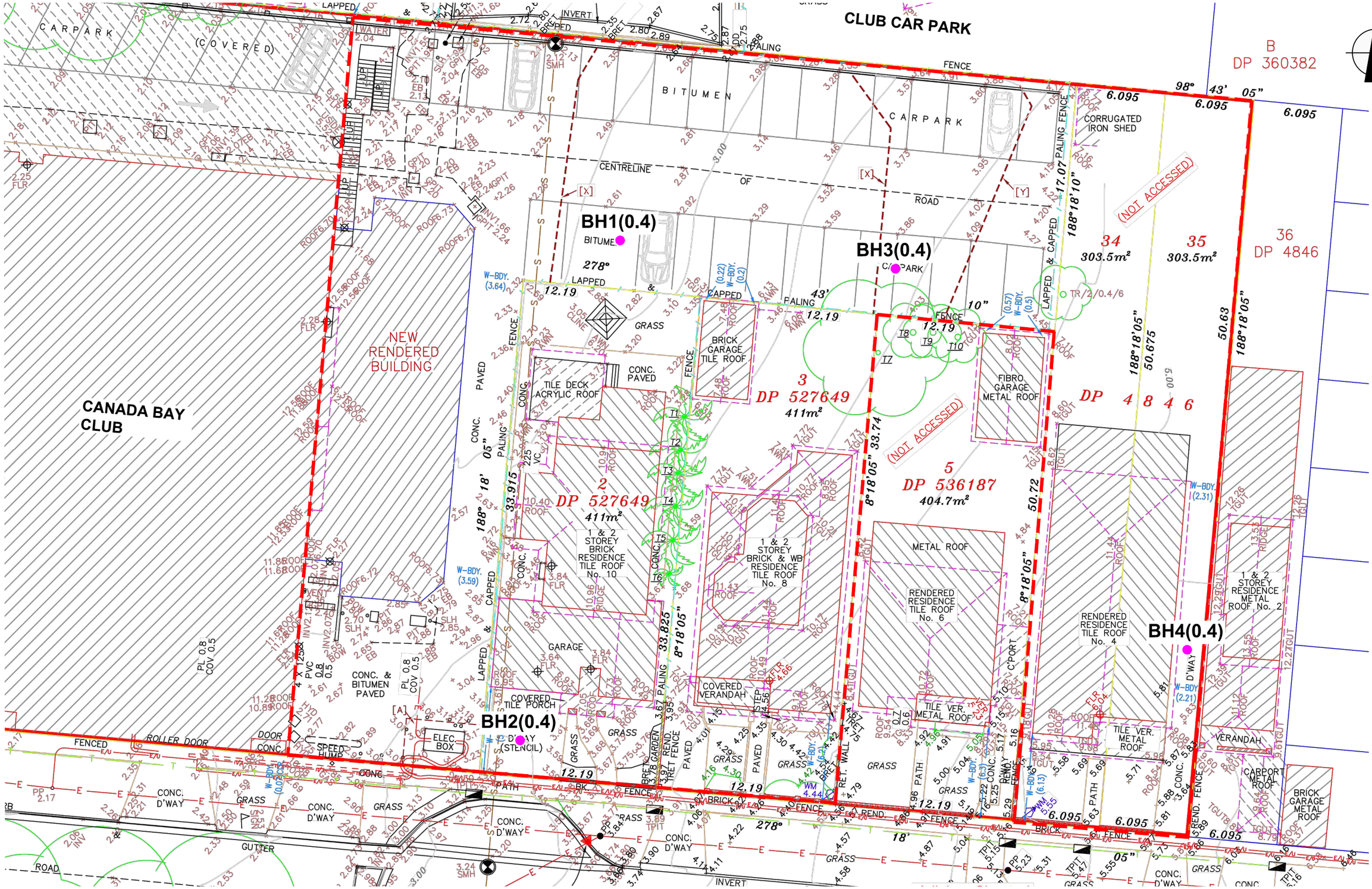

LEGEND

APPROXIMATE SITE BOUNDARY

BH (Fill Depth) BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m)

SCALE 0 2.5 5 7.5 10 12.5 METRES 1:250 @A3

This plan should be read in conjunction with the EIS report.

Title: **SAMPLE LOCATION PLAN**

Project: 4,8 & 10 BEVIN AVENUE FIVE DOCK, NSW

Report No: E29677K

Figure No: 2

ENVIRONMENTAL INVESTIGATION SERVICES

EIS

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REPORT TABLES

TABLE A

SUMMARY OF LABORATORY RESULTS - ACID SULFATE SOILS ANALYSIS (sPOCAS)

		Analysis	pH_{KCL}	TAA	pH_{ox}	TPA	TSA	S_{POS}	Liming Rate
				pH 6.5		pH 6.5	pH 6.5	%w/w	kg $CaCO_3$/tonne
Action Criteria[1]:		Coarse Textured Soil	pH 5.0	18molH+/ tonne	pH 5.0	18molH+/ tonne	18molH+/ tonne	0.03% w/w	0.03% w/w
Sample Reference	**Sample Depth (m)**	**Sample Description**							
BH1	0.5-0.95	Sandy Clay	5.4	6	4.2	LPQL	LPQL	0.006	0.75
BH2	0.15-0.25	Fill: silty sand	6.4	LPQL	6.6	LPQL	LPQL	0.02	1.2
BH3	0.5-0.95	Silty Clay	4.6	22	4.5	11	LPQL	0.008	2
BH4	1.5-1.95	Silty Clay	3.6	74	4.5	74	LPQL	LPQL	5.9
Total Number of Samples			4	4	4	4	4	4	4
Minimum Value			3.6	6	4.2	11	0	0.006	0.75
Maximum Value			6.4	74	6.6	74	0	0.02	5.9

Explanation:

[1] The Action criteria have been adopted from the Acid Sulfate Soil Manual (1998).

Values Exceeding Action Criteria **VALUE**

Abbreviations:

pH_{KCL} : pH of filtered 1:20, 1M KCL extract, shaken overnight

TAA pH 6.5 : Total Actual Acidity in 1M KCL extract titrated to pH6.5

pH_{ox} : pH filtered 1:20 1M KCl after peroxide digestion

TPA : Total Potential Acidity, 1M KCL peroxide digest titrated to pH6.5

TSA: Total Sulfide Acidity

S_{POS}: Peroxide oxidisable Sulfur (SP - SKCL)

Appendix A: Information in Acid Sulfate Soils

INFORMATION ON ACID SULFATE SOILS

Background

Acid Sulfate Soil (ASS) is formed from iron rich alluvial sediments and sulfate (found in seawater) in the presence of sulfate reducing bacteria and plentiful organic matter. These conditions are generally found in mangroves, salt marsh vegetation or tidal areas and at the bottom of coastal rivers and lakes. These soils include those that are producing acid (termed actual ASS) and those that can become acid producing (termed potential ASS or 'PASS'). PASS are naturally occurring soils and sediment that contain iron sulfides (pyrite) which, when exposed to oxygen generate sulfuric acid.

The ASS Management Advisory Committee (ASSMAC)

The NSW government in 1994 formed the ASSMAC to coordinate a response to ASS issues. In 1998 this group released the Acid Sulfate Soil Manual[7] providing best practice advice for planning, assessment, management, laboratory methods, drainage, groundwater and the preparation of ASS management plans (ASSMP).

In 1997 the Department of Land and Soil Conservation (now part of the Office of Environment and Heritage[8]) developed two series of maps with respect to ASS for use by council and technical staff implementing the ASS Manual 1998:

- ASS Planning Maps – issued to councils and government units; and
- ASS Risk Maps – issued to interested parties.

The ASS Planning Maps

The ASS planning maps provide an indication of the relative potential for disturbance of ASS to occur at locations within the council area. These maps do not provide an indication of the actual occurrence of ASS at a site or the likely severity of the conditions.

The maps are divided into five classes dependent upon the type of activities/works that if undertaken, may represent an environmental risk through the development of acidic conditions associated with ASS:

Table 1: Risk Classes

Risk Class	Description
Class 1	All works.
Class 2	All works below existing ground level and works by which the water table is likely to be lowered.

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

[8] http://www.environment.nsw.gov.au/acidsulfatesoil/index.htm

Risk Class	Description
Class 3	Works at depths beyond 1m below existing ground level or works by which the water table is likely to be lowered beyond 1m below existing ground level.
Class 4	Works at depths beyond 2m below existing ground level or works by which the water table is likely to be lowered beyond 2m below existing ground level.
Class 5	Works within 500m of adjacent Class 1,2,3,4 land which are likely to lower the water table below 1m AHD on the adjacent land.

The ASS Risk Maps

The ASS risk maps provide an indication of the probability of occurrence of PASS at a particular location based on interpretation from geological and soil landscape maps. The maps provide classes based on high probability, low probability, no known occurrence and areas of disturbed terrain (site specific assessment necessary) and the likely depth at which ASS are likely to be encountered.

Investigation and Laboratory Testing for ASS

The ASS Manual 1998 includes information on assessment of the likelihood of PASS, the need for an ASSMP, and the development of mitigation measures for a proposed development located in PASS risk areas.

The ASS Manual 1998 recommends a minimum of four sampling locations for a site with an area up to 1ha. 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.

Standard methods for the laboratory analysis of samples are presented in the Australian Standard AS4969-2008/09[9] (part 1 to 14). The principal analytical method is suspension Peroxide Oxidation Combined Acidity and Sulfur (sPOCAS).

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

The sPOCAS method specified in AS4969-2008/09 supersedes the POCAS method specified in the ASS Manual 1998. When S_{POS} (peroxide oxidisable sulfur) values are close to the action criteria confirmation of the result can be undertaken by the chromium reducible sulfur (S_{CR}) method.

The endpoint for the pH titration in AS4969-2008/09 is pH6.5 as opposed to pH5.5 adopted in the ASS Manual. Therefore the values for Total Actual Acidity (TAA), Total Sulfide Acidity (TSA) and Total Potential Acidity (TPA) will more conservative when analysed using the sPOCAS method specified in AS4969-2008/09.

Appendix B: Borehole Logs

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Borehole No. 1
1 / 2

BOREHOLE LOG

Client: CANADA BAY CLUB
Project: PROPOSED CAR PARK
Location: 4, 8 & 10 BEVIN AVENUE, FIVE DOCK, NSW

Job No.: 29677P **Method:** SPIRAL AUGER **R.L. Surface:** ~2.8 m
Date: 30/8/16 **Datum:** AHD
Plant Type: JK350 **Logged/Checked By:** M.S. & M.E./P.W.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING										ASPHALTIC CONCRETE: 80mm.t				
									-	FILL: Silty gravelly sand, fine to medium grained, dark grey, fine to medium grained igneous gravel.	D	-		ROADBASE
											MC~PL			
									CL	FILL: Silty clay, low to medium plasticity, dark brown, trace of fine grained igneous gravel, trace of fine grained igneous gravel, trace of root fibres.	MC>PL	St	200 140 180	RESIDUAL
					N = 3 1,1,2	2	1			SILTY CLAY: medium plasticity, brown and dark brown, trace of fine to medium grained sand.				
										as above, but grey and light brown.				
					N > 25 17,25/ 120mm REFUSAL	1	2		-	SANDSTONE: medium to coarse grained, light grey and red brown.	XW	EL		
											DW	VL - L		VERY LOW TO LOW 'TC' BIT RESISTANCE
										as above, but light grey.		M		MODERATE RESISTANCE
						0	3			REFER TO CORED BOREHOLE LOG				
						-1	4							
						-2	5							
						-3	6							
						-4								

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Borehole No. 1 2 / 2

CORED BOREHOLE LOG

Client: CANADA BAY CLUB
Project: PROPOSED CAR PARK
Location: 4, 8 & 10 BEVIN AVENUE, FIVE DOCK, NSW

Job No.: 29677P | **Core Size:** NMLC | **R.L. Surface:** ~2.8 m
Date: 30/8/16 | **Inclination:** VERTICAL | **Datum:** AHD
Plant Type: JK350 | **Bearing:** N/A | **Logged/Checked By:** M.S. & M.E./P.W.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION (Rock Type, grain characteristics, colour, structure, minor components.)	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ (EL 0.03, VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT SPACING (mm) (500, 300, 100, 50, 30, 10)	DEFECT DETAILS DESCRIPTION (Type, inclination, thickness, planarity, roughness, coating.) Specific / General
					START CORING AT 2.32m					
AFTER CORING ▼ 100% RETURN		0	3		SANDSTONE: medium to coarse grained, light grey and red brown, bedded at 0-10°.	DW	M			(2.62m) XWS, 0°, 10 mm.t
					as above, but yellow and red brown.					(2.91m) Cr, 5°, 15 mm.t (3.01m) Be, 0°, Un, R (3.14m) Cr, 0°, 5 mm.t
							L			(3.40m) CS, 0°, 40 mm.t
					CORE LOSS 0.22m					
10% RETURN		-1	4		SANDSTONE: medium to coarse grained, light grey and orange brown, bedded at 5-10°.	DW	L			(3.73m) XWS, 5°, 5 mm.t (4.11m) Be, 10°, P, S
					as above, but light grey, with dark grey laminae, bedded at 0-5°.		VL			(4.26m) Be, 5°, P, S, IS (4.48m) XWS, 0°, 10 mm.t
		-2	5			FR	M - H			(4.72m) CS, 0°, 20 mm.t (5.09m) Be, 0°, P, S
		-3	6		as above, but bedded at 10-20°.					(6.54m) XWS, 10°, 10 mm.t
		-4	7		END OF BOREHOLE AT 6.60 m					
		-5	8							
		-6								

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Borehole No. 2
1 / 2

BOREHOLE LOG

Client: CANADA BAY CLUB
Project: PROPOSED CAR PARK
Location: 4, 8 & 10 BEVIN AVENUE, FIVE DOCK, NSW

Job No.: 29677P **Method:** SPIRAL AUGER **R.L. Surface:** ~3.6 m
Date: 30/8/16 **Datum:** AHD
Plant Type: JK350 **Logged/Checked By:** M.S. & M.E./P.W.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING										CONCRETE: 130mm.t				
									-	FILL: Silty sand, fine to medium grained, dark grey and brown, with clay, trace of slag and root fibres.	D			
	■			■	N = 20 3,7,13	3			CH	SILTY CLAY: high plasticity, brown mottled red brown, trace of fine to coarse grained ironstone gravel, fine to medium grained sand and root fibres.	MC<PL	VSt - H	370 390 400	RESIDUAL
						1				as above, but light grey and red brown.				
									-	SANDSTONE: fine to medium grained, grey and red brown.	DW	M		LOW TO MODERATE 'TC' BIT RESISTANCE
						2								
							2			REFER TO CORED BOREHOLE LOG				
						1								
							3							
						0								
							4							
						-1								
							5							
						-2								
							6							
						-3								

JK_LIB_CURRENT - V8.00.GLB Log J & K AUGERHOLE - MASTER 29677P FIVE DOCK.GPJ <<DrawingFile>> 20/09/2016 15:34 Produced by gINT Professional, Developed by Datgel

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GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

Borehole No. 2
2 / 2

CORED BOREHOLE LOG

Client: CANADA BAY CLUB
Project: PROPOSED CAR PARK
Location: 4, 8 & 10 BEVIN AVENUE, FIVE DOCK, NSW

Job No.: 29677P | **Core Size:** NMLC | **R.L. Surface:** ~3.6 m
Date: 30/8/16 | **Inclination:** VERTICAL | **Datum:** AHD
Plant Type: JK350 | **Bearing:** N/A | **Logged/Checked By:** M.S. & M.E./P.W.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION (Rock Type, grain characteristics, colour, structure, minor components.)	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS: DEFECT SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Type, inclination, thickness, planarity, roughness, coating.) Specific / General
		2			START CORING AT 1.81m					
100% RETURN			2		SANDSTONE: fine to medium grained, brown, bedded at 10-15°.	SW	H			(2.22m) Be, 10°, Un, R (2.26m) Be, 10°, Un, R, IS
					CORE LOSS 0.32m					
ON COMPLETION OF CORING		1			SANDSTONE: fine to medium grained, light grey and red brown.	XW	EL			
			3		as above, but light grey and grey laminae, bedded at 5-10°.	SW	M			(2.90m) Cr, 10°, 40 mm.t (3.45m) Be, 10°, P, R
0% RETURN		0			as above, but light brown.					
			4		as above, but light grey.					
		-1			as above, but light grey mottled red brown, with dark grey laminae, bedded at 10°.		H			(4.82m) Be, 10°, P, R (4.99m) CS, 0°, 20 mm.t
			5			DW	L VL M			
					END OF BOREHOLE AT 5.35 m					
		-2	6							
		-3	7							
		-4								

JK_LIB_CURRENT - V8.00.GLB Log J & K CORED BOREHOLE - MASTER 29677P FIVE DOCK.GPJ <<DrawingFile>> 20/09/2016 15:34 Produced by gINT Professional. Developed by Datgel

JK Geotechnics
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

Borehole No. 3
1 / 2

BOREHOLE LOG

Client: CANADA BAY CLUB
Project: PROPOSED CAR PARK
Location: 4, 8 & 10 BEVIN AVENUE, FIVE DOCK, NSW

Job No.: 29677P **Method:** SPIRAL AUGER **R.L. Surface:** ~3.9 m
Date: 31/8/16 **Datum:** AHD
Plant Type: JK308 **Logged/Checked By:** M.S. & M.E./P.W.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING										ASPHALTIC CONCRETE: 100mm.t				
									-	FILL: Silty gravelly sand, fine to medium grained, dark grey, fine grained igneous gravel, with clay.	D			ROADBASE
					N = 8 2,4,4	3	1		CL-CH	SILTY CLAY: medium to high plasticity, brown mottled red brown, with iron indurated bands and fine to coarse grained sand.	MC~PL	VSt	350 290 380	RESIDUAL
									-	SANDSTONE: medium to coarse grained, grey and brown, with M strength iron indurated bands.	DW	M - H		MODERATE TO HIGH 'TC' BIT RESISTANCE
											XW	EL		
						2	2				DW	M		MODERATE RESISTANCE
						1	3			REFER TO CORED BOREHOLE LOG				
						0	4							
						-1	5							
						-2	6							
						-3								

JK Geotechnics
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

Borehole No. 3
2 / 2

CORED BOREHOLE LOG

Client: CANADA BAY CLUB
Project: PROPOSED CAR PARK
Location: 4, 8 & 10 BEVIN AVENUE, FIVE DOCK, NSW

Job No.: 29677P | **Core Size:** NMLC | **R.L. Surface:** ~3.9 m
Date: 31/8/16 | **Inclination:** VERTICAL | **Datum:** AHD
Plant Type: JK308 | **Bearing:** N/A | **Logged/Checked By:** M.S. & M.E./P.W.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ (EL -0.03, VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	DEFECT SPACING (mm) (500, 300, 100, 50, 30, 10)	DEFECT DETAILS DESCRIPTION Type, inclination, thickness, planarity, roughness, coating. Specific / General
		2	2		START CORING AT 2.13m					
▼ ON COMPLETION OF CORING 100% RETURN		1	3		SANDSTONE: medium to coarse grained, orange brown, bedded at 10-20°.	SW	H			(2.23m) Cr, 0°, 60 mm.t (2.32m) Be, 15°, P, S (2.35m) Be, 15°, P, S (2.45m) Cr, 0°
					as above, but red brown.		M			(3.07m) XWS, 10°, 60 mm.t
					CORE LOSS 0.45m					(3.34m) XWS, 10°, 20 mm.t
		0	4		SANDSTONE: medium to coarse grained, red brown and orange grey, bedded at 10-20°.	SW	H			(3.88m) Be
0% RETURN					CORE LOSS 0.09m					(4.41m) Be, 0°, Un, R, IS
		-1	5		SANDSTONE: medium to coarse grained, orange brown, bedded at 10-20°.	SW	M			(4.49m) J, 45°, Un, R (4.61m) Be, 15°, P, S (5.03m) XWS, 0°, 20 mm.t
		-2	6		as above, but light grey, with dark grey laminae.	FR	H			(5.72m) XWS, 15°, 50 mm.t (5.82m) CS, 0°, 40 mm.t (6.27m) Cr, 20°, 10 mm.t (6.37m) Cr, 0°, 60 mm.t
		-3	7		END OF BOREHOLE AT 6.53 m					
		-4								

JK Geotechnics
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

Borehole No. 4
1 / 2

BOREHOLE LOG

Client: CANADA BAY CLUB
Project: PROPOSED CAR PARK
Location: 4, 8 & 10 BEVIN AVENUE, FIVE DOCK, NSW

Job No.: 29677P **Method:** SPIRAL AUGER **R.L. Surface:** ~5.8 m
Date: 31/8/16 **Datum:** AHD
Plant Type: JK308 **Logged/Checked By:** M.S. & M.E./P.W.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING									-	CONCRETE: 50mm.t				
										FILL: Sandy clay, low to medium plasticity, dark brown, fine to coarse grained sand, with fine grained igneous gravel, concrete and brick fragments and silt fines.	MC<PL			
	■			■	N = 8 4,4,4	5	1		CH	SILTY CLAY: high plasticity, brown and red brown, with fine to coarse grained ironstone gravel.	MC<PL	VSt	330 280 370	RESIDUAL
										as above, but grey mottled brown and red brown.				
	■			■	N = 10 4,4,6	4	2						270 290 370	
										SANDSTONE: brown to red brown, with M strength iron indurated bands	XW - DW	EL - L		VERY LOW TO LOW 'TC' BIT RESISTANCE
						3	3			REFER TO CORED BOREHOLE LOG				MODERATE RESISTANCE
						2	4							
						1	5							
						0	6							
						-1								

JK_LIB_CURRENT - V8.00.GLB Log J & K AUGERHOLE - MASTER 29677P FIVE DOCK.GPJ <<DrawingFile>> 20/09/2016 15:34 Produced by gINT Professional, Developed by Datgel

JK Geotechnics
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

Borehole No. 4
2 / 2

CORED BOREHOLE LOG

Client: CANADA BAY CLUB
Project: PROPOSED CAR PARK
Location: 4, 8 & 10 BEVIN AVENUE, FIVE DOCK, NSW

Job No.: 29677P | **Core Size:** NMLC | **R.L. Surface:** ~5.8 m
Date: 31/8/16 | **Inclination:** VERTICAL | **Datum:** AHD
Plant Type: JK308 | **Bearing:** N/A | **Logged/Checked By:** M.S. & M.E./P.W.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION (Rock Type, grain characteristics, colour, structure, minor components.)	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Type, inclination, thickness, planarity, roughness, coating.) Specific / General
					START CORING AT 2.68m					
100% RETURN		3	3		SANDSTONE: fine grained, red brown, with M strength iron indurated bands.	DW	H			
					CORE LOSS 0.25m	MC>PL	VSt			
					SILTY CLAY: high plasticity, light grey, with H strength iron indurated sandstone bands.	DW	H			(3.20m) HP; 200,250,300kPa
		2	4		SANDSTONE: medium to coarse grained, brown and red brown, cross bedded at 10-15°.					(3.57m) XWS, 15°, 10 mm.t (3.69m) Be, 10°, Un, R, CLAY INFILL, 5mm.t (4.06m) Be, 15°, P, R, IS (4.26m) Be, 10°, P, S (4.37m) Be, 20°, P, CLAY INFILL, 2mm.t (4.41m) Be, 10°, P, R, IS (4.55m) Be, 10°, Un, R, IS
		1	5		as above, but light grey, with grey laminae.	SW	M - H			(5.11m) Be, 5°, P, R (5.48m) CS, 10°
		0	6		END OF BOREHOLE AT 5.68 m					
		-1	7							
		-2	8							
		-3								

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EXPLANATORY NOTES – ENVIRONMENTAL LOGS

INTRODUCTION

These notes have been provided to supplement the environmental report with regards to drilling and field logging. Not all notes are necessarily relevant to all reports. Where geotechnical borehole logs are utilised for environmental purpose, reference should also be made to the explanatory notes included in the geotechnical report. Environmental logs are not suitable for geotechnical purposes.

The ground is a product of continuing natural and manmade processes and therefore exhibits a variety of characteristics and properties which vary from place to place and can change with time. Environmental studies involve gathering and assimilating limited facts about these characteristics and properties in order to understand the ground on a particular site under certain conditions. These conditions are directly relevant only to the ground at the place where, and time when, the investigation was carried out.

DESCRIPTION AND CLASSIFICATION METHODS

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726, the SAA Site Investigation Code. In general, descriptions cover the following properties – soil or rock type, colour, structure, strength or density, and inclusions. Identification and classification of soil and rock involves judgement and the Company infers accuracy only to the extent that is common in current geotechnical practice.

Soil types are described according to the predominating particle size and behaviour as set out in the attached Unified Soil Classification Table qualified by the grading of other particles present (e.g. sandy clay) as set out below (note that unless stated in the report, the soil classification is based on a qualitative field assessment, not laboratory testing):

Soil Classification	Particle Size
Clay	less than 0.002mm
Silt	0.002 to 0.075mm
Sand	0.075 to 2mm
Gravel	2 to 60mm

Non-cohesive soils are classified on the basis of relative density, generally from the results of Standard Penetration Test (SPT) as below:

Relative Density	SPT 'N' Value (blows/300mm)
Very loose	less than 4
Loose	4 – 10
Medium dense	10 – 30
Dense	30 – 50
Very Dense	greater than 50

Cohesive soils are classified on the basis of strength (consistency) either by use of hand penetrometer, laboratory testing or engineering examination. The strength terms are defined as shown in the following table:

Classification	Unconfined Compressive Strength kPa
Very Soft	less than 25
Soft	25 – 50
Firm	50 – 100
Stiff	100 – 200
Very Stiff	200 – 400
Hard	Greater than 400
Friable	Strength not attainable – soil crumbles

Rock types are classified by their geological names, together with descriptive terms regarding weathering, strength, defects, etc. Where relevant, further information regarding rock classification is given in the text of the report. In the Sydney Basin, 'Shale' is used to describe thinly bedded to laminated siltstone.

DRILLING OR EXCAVATION METHODS

The following is a brief summary of drilling and excavation methods currently adopted by the Company, and some comments on their use and application. All except test pits and hand auger drilling require the use of a mechanical drilling rig.

Test Pits: These are normally excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils if it is safe to descend into the pit. The depth of penetration is limited to approximately 3m for a backhoe and up to 6m for an excavator. Limitations of test pits include problems associated with disturbance and difficulty of reinstatement; and the consequent effects on nearby structures. Care must be taken if construction is to be carried out near test pit locations to either properly re-compact the backfill during construction, or to design and construct the structure so as not to be adversely affected by poorly compacted backfill at the test pit location.

Hand Auger Drilling: A borehole of 50mm to 100mm diameter is advanced by manually operated equipment. Premature refusal of the hand augers can occur on a variety of materials such as fill, hard clay, gravel or ironstone, and does not necessarily indicate rock level.

Continuous Spiral Flight Augers: The borehole is advanced using 75mm to 115mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling and in-situ testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface by the flights or may be collected after withdrawal of the auger flights, but they can be very disturbed and layers may become mixed. Information from the auger sampling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability due to mixing or softening of samples by groundwater, or uncertainties as to the original depth of the samples. Augering below the groundwater table is of even lesser reliability than augering above the water table.

Rock Augering: Use can be made of a Tungsten Carbide (TC) bit for auger drilling into rock to indicate rock quality and continuity by variation in drilling resistance and from examination of recovered rock fragments. This method of investigation is quick and relatively inexpensive but provides only an indication of the likely rock strength and predicted values may be in error by a strength order. Where rock strengths may have a significant impact on construction feasibility or costs, then further investigation by means of cored boreholes may be warranted.

Wash Boring: The borehole is usually advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from "feel" and rate of penetration.

Mud Stabilised Drilling: Either Wash Boring or Continuous Core Drilling can use drilling mud as a circulating fluid to stabilise the borehole. The term 'mud' encompasses a range of products ranging from bentonite to polymers such as Revert or Biogel. The mud tends to mask the cuttings and reliable identification is only possible from intermittent intact sampling (e.g. from SPT and U50 samples) or from rock coring, etc.

Continuous Core Drilling: A continuous core sample is obtained using a diamond tipped core barrel. Provided full core recovery is achieved (which is not always possible in very low strength rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation. In rocks, an NMLC triple tube core barrel, which gives a core of about 50mm diameter, is usually used with water flush. The length of core recovered is compared to the length drilled and any length not recovered is shown as CORE LOSS. The locations of losses are determined on site by the supervising engineer; where the location is uncertain, the loss is placed at the top end of the drill run.

Standard Penetration Tests: Standard Penetration Tests (SPT) are used mainly in non-cohesive soils, but can also be used in cohesive soils as a means of indicating density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" – Test F3.1.

The test is carried out in a borehole by driving a 50mm diameter split sample tube with a tapered shoe, under the impact of a 63kg hammer with a free fall of 760mm. It is normal for the tube to be driven in three successive 150mm increments and the 'N' value is taken as the number of blows for the last 300mm. In dense sands, very hard clays or weak rock, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form:

- In the case where full penetration is obtained with successive blow counts for each 150mm of, say, 4, 6 and 7 blows, as: N = 13 (4, 6, 7)
- In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm, as: N>30 (15, 30/40mm)

The results of the test can be related empirically to the engineering properties of the soil. Occasionally, the drop hammer is used to drive 50mm diameter thin walled sample tubes (U50) in clays. In such circumstances, the test results are shown on the borehole logs in brackets.

A modification to the SPT test is where the same driving system is used with a solid 60 tipped steel cone of the same diameter as the SPT hollow sampler. The solid cone can be continuously driven for some distance in soft clays or loose sands, or may be used where damage would otherwise occur to the SPT. The results of this Solid Cone Penetration Test (SCPT) are shown as "Nc" on the borehole logs, together with the number of blows per 150mm penetration.

LOGS

The borehole or test pit logs presented herein are an interpretation of the subsurface conditions, and their reliability will depend to some extent on the frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will enable the most reliable assessment, but is not always practicable or possible to justify on economic grounds. In any case, the boreholes or test pits represent only a very small sample of the total subsurface conditions.

The attached explanatory notes define the terms and symbols used in preparation of the logs.

Interpretation of the information shown on the logs, and its application to design and construction, should therefore take into account the spacing of boreholes or test pits, the method of drilling or excavation, the frequency of sampling and testing and the possibility of other than "straight line"

variations between the boreholes or test pits. Subsurface conditions between boreholes or test pits may vary significantly from conditions encountered at the borehole or test pit locations.

GROUNDWATER

Where groundwater levels are measured in boreholes, there are several potential problems:

- Although groundwater may be present, in low permeability soils it may enter the hole slowly or perhaps not at all during the time it is left open;
- A localised perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes and may not be the same at the time of construction; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must be washed out of the hole or 'reverted' chemically if water observations are to be made.

More reliable measurements can be made by installing standpipes which are read after stabilising at intervals ranging from several days to perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from perched water tables or surface water.

FILL

The presence of fill materials can often be determined only by the inclusion of foreign objects (e.g. bricks, concrete, plastic, slag/ash, steel etc) or by distinctly unusual colour, texture or fabric. Identification of the extent of fill materials will also depend on investigation methods and frequency. Where natural soils similar to those at the site are used for fill, it may be difficult with limited testing and sampling to reliably determine the extent of the fill.

The presence of fill materials is usually regarded with caution as the possible variation in density, strength and material type is much greater than with natural soil deposits. If the volume and quality of fill is of importance to a project, then frequent test pit excavations are preferable to boreholes

LABORATORY TESTING

Laboratory testing has not been undertaken to confirm the soil classifications and rocks strengths indicated on the environmental logs unless noted in the report.

SITE ANOMALIES

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, EIS should be notified immediately.

GRAPHIC LOG SYMBOLS FOR SOIL AND ROCKS

SOIL


FILL


TOPSOIL


CLAY (CL, CH)


SILT (ML, MH)


SAND (SP, SW)


GRAVEL (GP, GW)


SANDY CLAY (CL, CH)


SILTY CLAY (CL, CH)


CLAYEY SAND (SC)


SILTY SAND (SM)


GRAVELLY CLAY (CL, CH)


CLAYEY GRAVEL (GC)


SANDY SILT (ML)


PEAT AND ORGANIC SOILS

ROCK


CONGLOMERATE


SANDSTONE


SHALE


SILTSTONE, MUDSTONE, CLAYSTONE


LIMESTONE


PHYLLITE, SCHIST


TUFF


GRANITE, GABBRO


DOLERITE, DIORITE


BASALT, ANDESITE


QUARTZITE

DEFECTS AND INCLUSIONS


CLAY SEAM


SHEARED OR CRUSHED SEAM


BRECCIATED OR SHATTERED SEAM/ZONE


IRONSTONE GRAVEL


ORGANIC MATERIAL

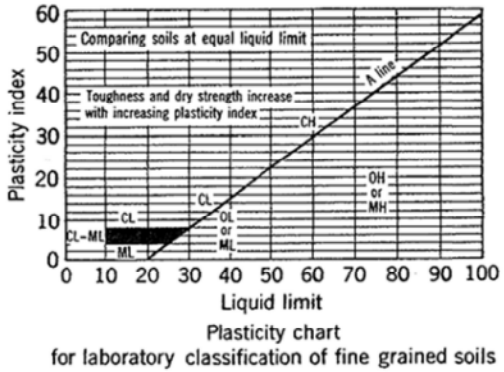
OTHER MATERIALS


CONCRETE


BITUMINOUS CONCRETE, COAL


COLLUVIUM

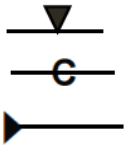
Field Identification Procedures (Excluding particles larger than 75 μm and basing fractions on estimated weights)						Group Symbols [a]	Typical Names	Information Required for Describing Soils	Laboratory Classification Criteria
Coarse-grained soils More than half of material is *larger* than 75 μm sieve size[b] (The 75 μm sieve size is about the smallest particle visible to naked eye)	Gravels More than half of coarse fraction is larger than 4 mm sieve size	Clean gravels (little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes			*GW*	Well graded gravels, gravel-sand mixtures, little or no fines	Give typical name; indicate approximate percentages of sand and gravel; maximum size; angularity, surface condition, and hardness of the coarse grains; local or geologic name and other pertinent descriptive information; and symbols in parentheses For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics Example: *Silty sand*, gravelly; about 20% hard, angular gravel particles 12 mm maximum size; rounded and subangular sand grains coarse to fine, about 15% non-plastic fines with low dry strength; well compacted and moist in place; alluvial sand; (*SM*)	Use grain size curve in identifying the fractions as given under field identification Determine percentages of gravel and sand from grain size curve Depending on percentage of fines (fraction smaller than 75 μm sieve size) coarse grained soils are classified as follows: Less than 5% *GW, GP, SW, SP* More than 12% *GM, GC, SM, SC* 5% to 12% *Borderline* cases requiring use of dual symbols $C_U = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3 Not meeting all gradation requirements for *GW* Atterberg limits below "A" line, or *PI* less than 4 — Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols Atterberg limits above "A" line, with *PI* greater than 7
			Predominantly one size or a range of sizes with some intermediate sizes missing			*GP*	Poorly graded gravels, gravel-sand mixtures, little or no fines		
		Gravels with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures see *ML* below)			*GM*	Silty gravels, poorly graded gravel-sand-silt mixtures		
			Plastic fines (for identification procedures, see *CL* below)			*GC*	Clayey gravels, poorly graded gravel-sand-clay mixtures		
	Sands More than half of coarse fraction is smaller than 4 mm sieve size	Clean sands (little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes			*SW*	Well graded sands, gravelly sands, little or no fines		$C_U = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3 Not meeting all gradation requirements for *SW* Atterberg limits below "A" line or *PI* less than 5 — Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols Atterberg limits below "A" line with *PI* greater than 7
			Predominantly one size or a range of sizes with some intermediate sizes missing			*SP*	Poorly graded sands, gravelly sands, little or no fines		
		Sands with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures, see *ML* below)			*SM*	Silty sands, poorly graded sand-silt mixtures		
			Plastic fines (for identification procedures, see *CL* below)			*SC*	Clayey sands, poorly graded sand-clay mixtures		
Fine-grained soils More than half of material is *smaller* than 75 μm sieve size	Identification Procedures on Fraction Smaller than 380 μm Sieve Size		Dry Strength (crushing characteristics)	Dilatancy (reaction to shaking)	Toughness (consistency near plastic limit)				
	Silts and clays liquid limit less than 50		None to slight	Quick to slow	None	*ML*	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	Give typical name; indicate degree and character of plasticity, amount and maximum size of coarse grains; colour in wet condition, odour if any, local or geologic name, and other pertinent descriptive information, and symbol in parentheses For undisturbed soils add information on structure, stratification, consistency in undisturbed and remoulded states, moisture and drainage conditions Example: *Clayey silt*, brown; slightly plastic; small percentage of fine sand; numerous vertical root holes; firm and dry in place; loess; (*ML*)	
			Medium to high	None to very slow	Medium	*CL*	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
			Slight to medium	Slow	Slight	*OL*	Organic silts and organic silt-clays of low plasticity		
	Silts and clays liquid limit greater than 50		Slight to medium	Slow to none	Slight to medium	*MH*	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
			High to very high	None	High	*CH*	Inorganic clays of high plasticity, fat clays		
			Medium to high	None to very slow	Slight to medium	*OH*	Organic clays of medium to high plasticity		
Highly Organic Soils			Readily identified by colour, odour, spongy feel and frequently by fibrous texture			*Pt*	Peat and other highly organic soils		



Plasticity chart
for laboratory classification of fine grained soils

Note: 1 Soils possessing characteristics of two groups are designated by combinations of group symbols (eg. GW-GC, well graded gravel-sand mixture with clay fines).
2 Soils with liquid limits of the order of 35 to 50 may be visually classified as being of medium plasticity.

LOG SYMBOLS

LOG COLUMN	SYMBOL	DEFINITION
Groundwater Record		Standing water level. Time delay following completion of drilling may be shown. Extent of borehole collapse shortly after drilling. Groundwater seepage into borehole or excavation noted during drilling or excavation.
Samples	ES U50 DB DS ASB ASS SAL	Soil sample taken over depth indicated, for environmental analysis. Undisturbed 50mm diameter tube sample taken over depth indicated. Bulk disturbed sample taken over depth indicated. Small disturbed bag sample taken over depth indicated. Soil sample taken over depth indicated, for asbestos screening. Soil sample taken over depth indicated, for acid sulfate soil analysis. Soil sample taken over depth indicated, for salinity analysis.
Field Tests	N = 17 4, 7, 10	Standard Penetration Test (SPT) performed between depths indicated by lines. Individual show blows per 150mm penetration. 'R' as noted below.
	N_c = 5 7 3 R	Solid Cone Penetration Test (SCPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration for 60 degree solid cone driven by SPT hammer. 'R' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	VNS = 25 PID = 100	Vane shear reading in kPa of Undrained Shear Strength. Photoionisation detector reading in ppm (Soil sample heads pace test).
Moisture (Cohesive Soils) (Cohesionless)	MC > PL MC ≈ PL MC < PL D M W	Moisture content estimated to be greater than plastic limit. Moisture content estimated to be approximately equal to plastic limit. Moisture content estimated to be less than plastic limit. DRY – Runs freely through fingers. MOIST – Does not run freely but no free water visible on soil surface. WET – Free water visible on soil surface.
Strength (Consistency) Cohesive Soils	VS S F St VSt H ( )	VERY SOFT – Unconfined compressive strength less than 25kPa SOFT – Unconfined compressive strength 25-5 0kPa FIRM – Unconfined compressive strength 50-1 00kPa STIFF – Unconfined compressive strength 100- 200kPa VERY STIFF – Unconfined compressive strength 200- 400kPa HARD – Unconfined compressive strength greater than 400kPa Bracketed symbol indicates estimated consistency based o n tactile examination or other tests.
Density Index/ Relative Density (Cohesionless Soils)	VL L MD D VD ( )	**Density Index (ID) Range (%)** / **SPT ' N' Value Range (Blows/300mm)** Very Loose <15 / 0-4 Loose 15-35 / 4-10 Medium Dense 35-65 / 10-30 Dense 65-85 / 30-50 Very Dense >85 / >50 Bracketed symbol indicates estimated density based on ease of drilling or other tests.
Hand Penetrometer Readings	300 250	Numbers indicate individual test results in kPa on representative undisturbed material unless noted otherwise
Remarks	'V' bit 'TC' bit T_{60}	Hardened steel 'V' shaped bit. Tungsten carbide wing bit. Penetration of auger string in mm under static load of rig applied by drill head hydraulics without rotation of augers.

LOG SYMBOLS CONTINUED

ROCK STRENGTH

Rock strength is defined by the Point Load Strength Index (Is 50) and refers to the strength of the rock substance in the bedding. The test procedure is described by the International Journal of Rock Mechanics, Mining and Geomechanics Abstract Volume 22, No 2, 1985.

TERM	SYMBOL	Is (50) MPa	FIELD GUIDE
Extremely Low:	EL	0.03	Easily remoulded by hand to a material with soil properties.
Very Low:	VL	0.1	May be crumbled in the hand. Sandstone is "sugary" and friable.
Low:	L	0.3	A piece of core 150 mm long x 50mm dia. may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.
Medium Strength:	M	1	A piece of core 150 mm long x 50mm dia. can be broken by hand with difficulty. Readily scored with knife.
High:	H	3	A piece of core 150 mm long x 50mm dia. core cannot be broken by hand, can be slightly scratched or scored with knife; rock rings under hammer.
Very High:	VH	10	A piece of core 150 mm long x 50mm dia. may be broken with hand-held pick after more than one blow. Cannot be scratched with pen knife; rock rings under hammer.
Extremely High:	EH		A piece of core 150 mm long x 50mm dia. is very difficult to break with h and-held hammer . Rings when struck with a hammer.

ROCK STRENGTH

ABBREVIATION	DESCRIPTION	NOTES
Be	Bedding Plane Parting	Defect orientations measured relative to the normal to (i.e. relative to horizontal for vertical holes)
CS	Clay Seam	
J	Joint	
P	Planar	
Un	Undulating	
S	Smooth	
R	Rough	
IS	Iron stained	
XWS	Extremely Weathered Seam	
Cr	Crushed Seam	
60t	Thickness of defect in millimetres	

Appendix C: Laboratory Report and Chain of Custody Documentation

SAMPLE AND CHAIN OF CUSTODY FORM

TO:		FROM:
ENVIROLAB SERVICES PTY LTD	EIS Job Number: E29677K	ENVIRONMENTAL INVESTIGATION SERVICES
12 ASHLEY STREET		REAR OF 115 WICKS ROAD
CHATSWOOD NSW 2067	Date Results Required: STANDARD	MACQUARIE PARK, NSW 2113
P: (02) 99106200		P: 02-9888 5000 F: 02-9888 5001
F: (02) 99106201	Page: 1 of 1	Attention: Geoff Fletcher
Attention: Aileen		

Location: Five Dock

Sampler: MS

Sample Preserved in Esky on Ice

Tests Required

Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	Sample Description	sPOCAS	pH (1:5 water)
30/8/16	1	BH1	0.1-0.2	P	Fill		
	2		0.5-0.95		Fill	X	
	3		1.5-1.77		Sandstone		
	4	BH2	0.15-0.25		Fill	X	
	5		0.5-0.95		Silty clay		
31/8/16	6	BH3	0.15-0.25		Fill		
	7		0.5-0.95		Silty clay	X	
	8	BH4	0.1-0.2		Fill		
	9		0.5-0.95		Silty Clay		
	10		1.5-1.95			X	

ENVIROLAB GROUP

Environ... Service...
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No. 152793

Date Received: 01.09.2016

Time Received: 17:00

Received by: JAC

Temp: Cool/Ambient

Cooling: Ice/Icepack

Security: Intact/Broken/None

Remarks (comments/detection limits required):

Sample Containers:
G - 250mg Glass Jar
A - Ziplock Asbestos Bag
P - Plastic Bag

Relinquished By:	Date:	Time:	Received By:	Date:
[signature]	1/9/16	14:45	James	01.09

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

SAMPLE RECEIPT ADVICE

Client Details	
Client	Environmental Investigation Services
Attention	Geoff Fletcher

Sample Login Details	
Your Reference	E29677K, Five Dock
Envirolab Reference	**152793**
Date Sample Received	01/09/2016
Date Instructions Received	01/09/2016
Date Results Expected to be Reported	**08/09/2016**

Sample Condition	
Samples received in appropriate condition for analysis	YES
No. of Samples Provided	10 Soils
Turnaround Time Requested	Standard
Temperature on receipt (°C)	0.0
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments
Samples will be held for 1 month for water samples and 2 months for soil samples from date of receipt of samples

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	Phone: 02 9910 6200
Fax: 02 9910 6201	Fax: 02 9910 6201
Email: ahie@envirolabservices.com.au	Email: jhurst@envirolabservices.com.au

Sample and Testing Details on following page

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

Sample Id	*sPOCAS*	*On Hold*
BH1- 0.1-0.2		✓
BH1-0.5-0.95	✓	
BH1-1.-1.77		✓
BH2-0.15-0.25	✓	
BH2-0.5-0.95		✓
BH3-0.15-0.25		✓
BH3-0.5-0.95	✓	
BH4-0.1-0.2		✓
BH4-0.5-0.95		✓
BH4-1.5-1.95	✓	

12 Ashley Street, Chatswood, NSW 2067
tel: +61 2 9910 6200

email: sydney@envirolab.com.au
envirolab.com.au

Envirolab Services Pty Ltd - Sydney | ABN 37 112 535 645

CERTIFICATE OF ANALYSIS 152793

Client:

Environmental Investigation Services
PO Box 976
North Ryde BC
NSW 1670

Attention: Geoff Fletcher

Sample log in details:

Your Reference:	**E29677K, Five Dock**
No. of samples:	10 Soils
Date samples received / completed instructions received	01/09/2016 / 01/09/2016

Analysis Details:

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	8/09/16 / 8/09/16
Date of Preliminary Report:	Not Issued

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025 - Testing **Tests not covered by NATA are denoted with *.**

Results Approved By:

David Springer
General Manager

sPOCAS Our Reference: Your Reference	UNITS ----------	152793-2 BH1	152793-4 BH2	152793-7 BH3	152793-10 BH4
	-				
Depth	----------	0.5-0.95	0.15-0.25	0.5-0.95	1.5-1.95
Date Sampled		30/08/2016	30/08/2016	31/08/2016	31/08/2016
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	05/09/2016	05/09/2016	05/09/2016	05/09/2016
Date analysed	-	05/09/2016	05/09/2016	05/09/2016	05/09/2016
pH $_{kcl}$	pH units	5.4	6.4	4.6	3.6
TAA pH 6.5	moles H^+/t	6	<5	22	74
s-TAA pH 6.5	%w/w S	0.01	<0.01	0.04	0.12
pH $_{Ox}$	pH units	4.2	6.6	4.5	4.5
TPA pH 6.5	moles H^+/t	<5	<5	11	74
s-TPA pH 6.5	%w/w S	<0.01	<0.01	0.02	0.12
TSA pH 6.5	moles H^+/t	<5	<5	<5	<5
s-TSA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01
ANC$_E$	% $CaCO_3$	<0.05	0.36	<0.05	<0.05
a-ANC$_E$	moles H^+/t	NA	71	NA	NA
s-ANC$_E$	%w/w S	<0.05	0.11	<0.05	<0.05
S$_{KCl}$	%w/w S	<0.005	0.03	0.02	0.02
S$_P$	%w/w	0.007	0.05	0.02	0.03
S$_{POS}$	%w/w	0.006	0.02	0.008	<0.005
a-S$_{POS}$	moles H^+/t	<5	15	<5	<5
Ca$_{KCl}$	%w/w	0.10	0.24	0.09	0.11
Ca$_P$	%w/w	0.1	0.23	0.09	0.01
Ca$_A$	%w/w	<0.005	<0.005	<0.005	<0.005
Mg$_{KCl}$	%w/w	0.023	0.011	0.021	0.049
Mg$_P$	%w/w	0.020	0.010	0.023	0.047
Mg$_A$	%w/w	<0.005	<0.005	<0.005	<0.005
S$_{HCl}$	%w/w S	[NT]	[NT]	[NT]	0.030
S$_{NAS}$	%w/w S	[NT]	[NT]	[NT]	0.005
a-S$_{NAS}$	moles H^+/t	[NT]	[NT]	[NT]	<5
s-S$_{NAS}$	%w/w S	[NT]	[NT]	[NT]	<0.01
Fineness Factor	-	1.5	1.5	1.5	1.5
a-Net Acidity	moles H^+/t	10	15	27	79
Liming rate	kg $CaCO_3$/t	0.75	1.2	2.0	5.9

Method ID	Methodology Summary
Inorg-064	sPOCAS determined using titrimetric and ICP-AES techniques. Based on Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004.

QUALITY CONTROL sPOCAS	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			05/09/2016	152793-2	05/09/2016 || 05/09/2016	LCS-1	05/09/2016
Date analysed	-			05/09/2016	152793-2	05/09/2016 || 05/09/2016	LCS-1	05/09/2016
pH $_{kcl}$	pH units		Inorg-064	[NT]	152793-2	5.4 || 5.3 || RPD: 2	LCS-1	93%
TAA pH 6.5	moles H^+/t	5	Inorg-064	<5	152793-2	6 || 6 || RPD: 0	LCS-1	125%
s-TAA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	152793-2	0.01 || 0.01 || RPD: 0	[NR]	[NR]
pH $_{Ox}$	pH units		Inorg-064	[NT]	152793-2	4.2 || 4.3 || RPD: 2	LCS-1	97%
TPA pH 6.5	moles H^+/t	5	Inorg-064	<5	152793-2	<5 || <5	LCS-1	81%
s-TPA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	152793-2	<0.01 || <0.01	[NR]	[NR]
TSA pH 6.5	moles H^+/t	5	Inorg-064	<5	152793-2	<5 || <5	[NR]	[NR]
s-TSA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	152793-2	<0.01 || <0.01	[NR]	[NR]
ANC_E	% $CaCO_3$	0.05	Inorg-064	<0.05	152793-2	<0.05 || <0.05	[NR]	[NR]
a-ANC_E	moles H^+/t	5	Inorg-064	<5	152793-2	NA || NA	[NR]	[NR]
s-ANC_E	%w/w S	0.05	Inorg-064	<0.05	152793-2	<0.05 || <0.05	[NR]	[NR]
S_{KCl}	%w/w S	0.005	Inorg-064	<0.005	152793-2	<0.005 || <0.005	[NR]	[NR]
S_P	%w/w	0.005	Inorg-064	<0.005	152793-2	0.007 || 0.007 || RPD: 0	[NR]	[NR]
S_{POS}	%w/w	0.005	Inorg-064	<0.005	152793-2	0.006 || <0.005	[NR]	[NR]
a-S_{POS}	moles H^+/t	5	Inorg-064	<5	152793-2	<5 || <5	[NR]	[NR]
Ca_{KCl}	%w/w	0.005	Inorg-064	<0.005	152793-2	0.10 || 0.09 || RPD: 11	[NR]	[NR]
Ca_P	%w/w	0.005	Inorg-064	<0.005	152793-2	0.1 || 0.10 || RPD: 0	[NR]	[NR]
Ca_A	%w/w	0.005	Inorg-064	<0.005	152793-2	<0.005 || 0.007	[NR]	[NR]
Mg_{KCl}	%w/w	0.005	Inorg-064	<0.005	152793-2	0.023 || 0.022 || RPD: 4	[NR]	[NR]
Mg_P	%w/w	0.005	Inorg-064	<0.005	152793-2	0.020 || 0.024 || RPD: 18	[NR]	[NR]
Mg_A	%w/w	0.005	Inorg-064	<0.005	152793-2	<0.005 || <0.005	[NR]	[NR]
S_{HCl}	%w/w S	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
S_{NAS}	%w/w S	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
a-S_{NAS}	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	[NR]	[NR]
s-S_{NAS}	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NR]	[NR]
Fineness Factor	-	1.5	Inorg-064	<1.5	152793-2	1.5 || 1.5 || RPD: 0	[NR]	[NR]
a-Net Acidity	moles H^+/t	10	Inorg-064	<10	152793-2	10 || <10	[NR]	[NR]
Liming rate	kg $CaCO_3$/t	0.75	Inorg-064	<0.75	152793-2	0.75 || <0.75	[NR]	[NR]

QUALITY CONTROL sPOCAS	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
a-Net Acidity without ANCE	moles H^+/t	10	Inorg-064	<10	[NT]	[NT]	[NR]	[NR]
Liming rate without ANCE	kg $CaCO_3$/t	0.75	Inorg-064	<0.75	[NT]	[NT]	[NR]	[NR]

Report Comments:

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NR: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.